
**Specification for
Sampling procedures and charts for inspection
by variables for percent defective**

Spécification des procédures d'échantillonnage et diagrammes d'inspection
par variables et repérage du pourcentage défectueux

Spezifikation für Probeentnahmeverfahren und Tabellen für die Kontrolle
durch Variable für Fehlerprozentkarten

Contents

	Page		Page
Foreword	2	III-C. Single sampling plans for reduced inspection (master table): 'σ' method	21
Cooperating organizations	Back cover	IV. Values of f for maximum standard deviation (MSD): 's' method	22
Specification		V. Tables of operating characteristics for sample size code letters B to P	23
Section one. General		<i>Diagrams</i>	
1. Scope and field of application	3	A. Sample sizes to meet quality at 95 % and 10 % risk	37
2. Definitions and symbols	3	S. 's' method: the acceptance curves D to P	38
3. The acceptable quality level (AQL)	5	SIGMA 'σ' method: the acceptance curves C to P	50
4. Switching rules for normal, tightened and reduced inspection	5	Appendices	
5. Relationship of BS 6002 to BS 6001	5	A. Procedure for obtaining 's'	63
6. Non-continuous production	6	B. Statistical theory	65
Section two. Choice of sampling plan		C. The 'R' method for assessing the acceptability of a lot	72
7. Planning	6	<i>Tables</i>	
8. Choice between variables and attributes	6	RI. Code letters and sample sizes: 'R' method	76
9. Choice of method	6	RII-A. Normal inspection for plans based on variability unknown (master table): 'R' method	77
10. Choice of inspection level and AQL	6	RII-B. Tightened inspection for plans based on variability unknown (master table): 'R' method	78
11. Choice of sampling plan	7	RII-C. Reduced inspection for plans based on variability unknown (master table): 'R' method	79
Section three. Operation of a variables sampling plan		RIV. Values of F for maximum average range (MAR): 'R' method	80
12. Essential preliminaries	7	<i>Diagrams</i>	
13. Standard procedure for the 's' method	7	R. 'R' method: acceptance curves D to P	81
14. Standard procedure for the 'σ' method	9	D. Bibliography.	93
15. Procedure during continuing inspection	11	Figures	
16. Normality and outliers	11	1. Graphical method for single specification limits	8
17. Records	11	2. 's' method: acceptance curve for sample size 10	10
18. Operation of the switching rules	13	3. 'σ' method: acceptance curve for code letter L	12
19. Discontinuing inspection	13	4. Normal distribution	65
20. Acceptance curves for tightened and reduced inspection	13	5. Standardized normal distribution	65
21. Switching to the 'σ' method	13	6. Fraction defective for constant $\sigma = 1$ and different values of the mean in relation to a fixed lower specification limit	66
Section four. Tables and diagrams		7 to 14. <i>Untitled.</i>	67-72
<i>Tables</i>		15. Graphical method for single or separate specification limits	74
I-A. Sample size code letters: inspection levels	14	16. 'R' method: acceptance curve for sample size 25	75
I-B. Sample size code letters: sample sizes for normal inspection	15		
II-A. Single sampling plans for normal inspection (master table): 's' method	16		
II-B. Single sampling plans for tightened inspection (master table): 's' method	17		
II-C. Single sampling plans for reduced inspection (master table): 's' method	18		
III-A. Single sampling plans for normal inspection (master table): 'σ' method	19		
III-B. Single sampling plans for tightened inspection (master table): 'σ' method	20		

Foreword

This British Standard is complementary to BS 6000 and BS 6001 since it provides alternative methods of sampling inspection indexed in terms of 'acceptable quality level' (AQL). It should be noted, however, that the variables sampling plans given in this standard can be more economical in that they require relatively smaller sample sizes (for a particular value of AQL) since more effective use can be made of data from the sample results if the measurements can be assumed to follow the normal distribution.

The content of this standard has been based on provisional agreements reached within the ABCA (USA, UK, Canada, Australia) Standardization Group and ISO Technical Committee 69, Application of statistical methods, for the revision of US Military Standard 414* and the development of ISO/DIS 3951. The procedure used is based on the one given in MIL-STD 414, known as Form 1, which is applicable when separate specification limits have to be met. The alternative procedure, known as Form 2, has not been incorporated in this standard; instead, a graphical method is given that provides an acceptance criterion which is applicable especially when a combined specification limit has to be met, but which can also be used in any variables sampling scheme.

The standard has four sections: the first two sections deal principally with the field of application, relationship with BS 6001 and the selection of a suitable sampling plan. Sections three and four provide detailed operational instructions, tables and diagrams. Provided that an AQL value has already been specified (for a particular product characteristic) then the latter sections may be used separately.

Appendices have also been provided to deal with the calculation of the estimated standard deviation (s), basic statistical theory and the use of the 'R' (range) method, an optional alternative to using the 's' method.

Although variables sampling schemes have been little used in industry in general to-date, it is anticipated that with the advent of modern and relatively inexpensive calculating machines (facilitating the direct calculation of both the mean and standard deviation) variables sampling schemes will be used to a much greater extent in the future.

The publication of this standard thus enables AQLs to be specified for various product characteristics with reference to both BS 6001 and BS 6002. Consequently users may choose either the simpler attributes scheme or a more economical variables scheme (in terms of sample size), or a combination of both with respect to a particular product, e.g. dimensional or 'simple' functional requirements might be assessed in accordance with BS 6001, but destructive or 'expensive' test requirements assessed in accordance with BS 6002, since maximum advantage can be taken of the quantitative information provided by the test results (say from fatigue or tensile tests on raw materials or reliability tests on equipment and complete systems).

The UK was primarily responsible for the development work on this standard within both ABCA and ISO. In this respect acknowledgement is made to the Ministry of Defence Quality Assurance Directorate (Weapons) Woolwich, and in particular the work of the late Cdr. J C Gascoigne on modifications aimed at achieving maximum compatibility with the attributes sampling schemes as regards basic procedures and operating characteristics.

BS 6002 has been published in advance of the ISO standard in view of the urgency of the requirement for its use within UK industry. However, it is not anticipated that there will be any fundamental differences between BS 6002 and the finally published ISO 3951.

*MIL-STD-414 (ANSI Z1.9) Sampling procedures and tables for inspection by variables for percent defective

British Standard Specification for

Sampling procedures and charts for inspection by variables for percent defective

Section one. General

1. Scope and field of application

1.1 Scope

1.1.1 This British Standard specifies sampling plans and procedures for inspection by variables and is complementary to BS 6001. When specified by the responsible authority both this standard and BS 6001 may be referred to in a product or process specification, contract, inspection instructions, or other relevant documents and the provisions set forth therein shall apply. The 'responsible authority' shall be designated in one of the above documents.

1.1.2 The object of the methods laid down in this standard is to ensure that lots of an acceptable quality have a high probability of acceptance and that the probability of rejection of inferior lots is as high as possible.

1.1.3 In common with BS 6001, the percentage of non-conforming products, or the *percent defective*, in the lots is used to define the quality of these lots and of the production process in question.

NOTES. *References.* The titles of the standards publications referred to in this standard are listed on the inside back cover. A bibliography of other documents used in the preparation of this standard is given in appendix D.

1.2 **Field of application.** This standard is primarily designed for use under the following conditions:

- (a) where the inspection procedure is to be applied to a *continuous series of lots* of discrete products all supplied by one producer using one production process; if there are different producers the standard should be applied to each one separately;
- (b) where only a single *quality characteristic* (x) of these products is taken into consideration, which is *measurable on a continuous scale*; if several such characteristics are of importance the standard should be applied to each separately;
- (c) where the quality characteristic (x) is distributed over the items in a lot according to a *normal distribution*, or a close approximation to the normal distribution.
- (d) where contract or standard defines an *upper specification limit* (U) a *lower specification limit* (L) or both; a product is qualified as *non-conforming* or *defective* when its measured quality characteristic (x) satisfies one of the following inequalities:

- (1) $x > U$
- (2) $x < L$
- (3) either $x > U$ or $x < L$

Inequalities (1) and (2) are cases with a *single specification limit*, and inequality (3) is a case with *double specification limits*. In this last situation, a further distinction is made between separate or combined double limits according to whether the acceptable quality level (AQL) is applied to each limit separately or to both limits combined (see clause 3).

2. Definitions and symbols

2.1 **Definitions.** For the purposes of this British Standard the definitions given in BS 4778 for general quality assurance terminology, BS 5532 for general statistics terminology and BS 6001 for sampling inspection apply. The following additional terms also apply.

2.1.1 **inspection by variables.** A method that consists of measuring a quantitative characteristic for each item of a population or of a sample taken from this population.

2.1.2 **acceptance sampling by variables.** An acceptance procedure wherein a specified characteristic is measured and by calculating the degree of conformance of the items in a sample, establishing statistically the acceptability of the lot.

2.1.3 **acceptable quality level (AQL).** The maximum percent defective that, for the purposes of sampling inspection, can be considered satisfactory as a process average.

NOTE. See clause 3.

2.1.4 **limiting quality.** In a sampling plan, a quality level that corresponds to a specified and relatively low probability of acceptance (in this standard, 10 %).

NOTE. See 1.1.1.

2.1.5 **defective.** Any item that does not conform to the specification.

NOTE. See 1.2(d).

2.1.6 **'s' method.** A method of assessing the acceptability of a lot by using the estimate of the standard deviation of the lot based on measurements of all the items in a sample.

NOTE. See clause 13.

2.1.7 **'σ' method.** A method of assessing the acceptability of a lot using previous knowledge of its standard deviation.

NOTE. See clause 14.

2.1.8 **'R' method.** A method of assessing the acceptability of a lot by using an estimate of the standard deviation of the lot based on the average range of the measurements of the items in subgroups of a sample.

NOTE. See appendix C.

2.1.9 **specification limit.** The specified maximum or minimum acceptable value of the characteristic.

NOTE. See 1.2(d).

2.1.10 lower specification limit. The specified *minimum* acceptable value of the characteristic.

NOTE. See 1.2(d).

2.1.11 upper specification limit. The specified *maximum* acceptable value of the characteristic.

NOTE. See 1.2(d).

2.1.12 single specification limit. The term used when one limit only is specified.

NOTE. See 1.2(d).

2.1.13 separate double specification limits. The term used when both upper and lower limits are specified and separate AQLs are applied to each limit individually.

NOTE. See 3.3.

2.1.14 combined double specification limit. The term used when both upper and lower limits are specified and an AQL is given which applies to the combined percent defective at both the limits.

NOTE. See 3.3.

2.1.15 acceptability constant. A constant dependent on the specified value of the acceptable quality level and the sample size.

2.1.16 quality statistic. A function of the specification limit, the mean and the standard deviation of the lot.

NOTE. See B.3.

2.1.17 quality statistic. A function of the specification limit, the sample mean and the estimate of the standard deviation of the lot.

NOTE. A lot is sentenced on the result of comparing the quality statistic with the acceptability constant (see B.6i).

2.1.18 lower quality statistic. A function of the lower specification limit, the sample mean and the estimate of the standard deviation of the lot.

NOTE. A lot is sentenced on the result of comparing the lower quality statistic with the acceptability constant (see 13.2).

2.1.19 upper quality statistic. A function of the upper specification limit, the sample mean and the estimate of the standard deviation of the lot.

NOTE. A lot is sentenced on the result of comparing the upper quality statistic with the acceptability constant (see 13.2).

2.1.20 maximum average range (MAR). Under given conditions, the largest acceptable average range.

NOTE. See appendix C.

2.1.21 maximum standard deviation (MSD). Under given conditions, the largest acceptable standard deviation.

NOTE. See 13.4 and B.5.2.

2.1.22 switching rules. Rules that govern the decision to increase or decrease the severity of inspection.

NOTE. See clause 18.

2.2 Symbols. For the purposes of this British Standard, the following symbols apply.

f a factor, given in table IV, that relates the maximum standard deviation to the difference between *U* and *L*.

K the (general) acceptability constant.

k_s the acceptability constant when using the 's' method.

k_σ the acceptability constant when using the 'σ' method.

k_R the acceptability constant when using the 'R' method.

L lower specification limit. (As a suffix to a variable denotes its value at *L*.)

n the number of units in a sample.

N the number of units in a lot.

P the cumulative probability function.

P_a the probability of acceptance, i.e. the percent of lots expected to be accepted.

p the estimate of the total percent or fraction defective.
 $p = P_U + P_L$

P_L the estimate of fraction defective below *L*.

P_U the estimate of fraction defective above *U*.

q the quality parameter: equal to *z_U* or $-z_L$.

Q the quality statistic.

Q_L the lower quality statistic.

Q_U the upper quality statistic.

s the estimate from the sample of the standard deviation of the lot.

$$s = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}} \quad (\text{see also appendix A})$$

U the upper specification limit. (As a suffix to a variable denotes its value at *U*.)

x the measured value of a characteristic in the sample.

$\bar{x}$ the mean value of *x* for the sample of *n* items.

z the standardized variate

$$z = \frac{x - \mu}{\sigma}$$

z_L the value of *z* at the lower specification limit.

$$z_L = \frac{L - \mu}{\sigma}$$

z_U the value of *z* at the upper specification limit.

$$z_U = \frac{U - \mu}{\sigma}$$

μ the mean of the lot.

σ the standard deviation of the process (or of a lot).

Σ 'the sum of' (e.g. Σx = the sum of the *x* values).

$\sum_{i=1}^n x_i$ the sum of all the *x* values when *i* takes integral value from 1 to *n*.

$>$ 'greater than' (e.g. $a > b$ means *a* is greater than *b*).

$\geq$ 'greater than or equal to' (e.g. $a \geq b$ means *a* is greater than or equal to *b*).

$<$ 'less than' (e.g. $a < b$ means *a* is less than *b*).

$\leq$ 'less than or equal to' (e.g. $a \leq b$ means *a* is less than or equal to *b*).

3. The acceptable quality level (AQL)

3.1 Definition. The maximum percent defective that, for the purposes of sampling inspection, can be considered satisfactory as a process average.

3.2 Use. The AQL, together with the sample size code letter, is used to index the sampling plans provided herein.

3.3 Specifying AQLs. The AQL to be used can be designated in the product specification, contract, or by the responsible authority. Where both upper and lower specification limits are given, separate AQLs can be specified for the individual limits, which are then known as *separate double specification limits*. Alternatively, an overall AQL can be specified which applies to the combined percent defective at both the upper and lower limits; this is then known as a *combined double specification limit*.

3.4 Preferred AQLs. The values of AQLs given in this standard are preferred AQLs. If, for any product, a non-preferred AQL is specified, then this standard is not applicable (see 11.2).

3.5 Caution. From the definition of the AQL in 3.1, it follows that the desired protection can be obtained only when a continuous series of lots is provided for inspection.

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

4. Switching rules for normal, tightened and reduced inspection

4.1 In order to discourage the process average exceeding the AQL, this standard prescribes a switch to *tightened inspection* when inspection results indicate that the process average exceeds the AQL, and to stopping sampling inspection altogether when tightened inspection does not in time stimulate the producer to improve his production process.

4.2 Hence, tightened inspection and the *stopping rule* are integral, and therefore obligatory procedures of this standard if the protection implied by the AQL is to be maintained.

4.3 This standard also provides the possibility of switching to *reduced inspection* when inspection results indicate that the process average is stable and reliable at a level below the AQL. This practice is, however, optional (at the discretion of the responsible authority).

4.4 When there is sufficient evidence from the control charts (see BS 1313 and BS 2564) that the variability is in statistical control consideration may be given to switching to the ' σ ' method. If this appears advantageous the consistent value of s should be taken as σ .

4.5 When it has been necessary to discontinue sampling inspection, tightened inspection shall not be resumed until action is taken by the producer to improve the quality of the submitted product.

4.6 Details of the operation of the switching rules are given in clause 18.

5. Relationship of BS 6002 to BS 6001

5.1 Similarities

(a) This standard is complementary to BS 6001, the two standards sharing common philosophy and, as far as possible, their procedures and vocabulary are the same.

(b) Both use the AQL to index the sampling plans and the preferred values used in this standard are identical with those given in BS 6001 for the same range of values (i.e. from 0.1 % to 10 %).

(c) The same method is employed for selecting a sample and determining its size, i.e. sample size code letters are derived in terms of lot size and inspection level, with inspection level II being preferred in default of other instructions.

(d) The switching rules are technically equivalent.

(e) The definition of critical, major and minor defects remains unchanged, but the concept is less useful as characteristics cannot be grouped together for sentencing in inspection by variables (see 1.2). They can be useful, however, when specifying the AQL for the various characteristics.

5.2 Differences

(a) *Determination of acceptability.* The acceptability of an attributes sampling plan, taken from BS 6001, is determined by the number of defectives found in the sample; the acceptability criterion in inspection by variables is based on estimates of the location and variability of the distributed measurements of a lot, in relation to the specification limits. That is, in terms of the mean and standard deviation. In this standard three possible ways of estimating the standard deviation are considered: the ' s ' method, the ' σ ' method and the ' R ' method (see appendix C).

The acceptability can be calculated from a formula in the case of single specification limits (see 13.2), but is more easily established by plotting the estimated mean and standard deviation on an acceptance diagram (see figures 1 and 2) and noting whether the point lies within the accept zone.

(b) *Normality.* In BS 6001 there is no requirement relating to the distribution of the characteristics, but in this standard it is necessary to the efficient operation of a plan that the measurements be normally distributed.

(c) *Operating characteristic curves.* While an individual variables plan can be devised whose operating characteristic (OC) curve corresponds closely to that of a given attributes plan, it would not be possible to make all the OC curves in this standard identical with the corresponding OC curves in BS 6001 which are indexed with the same code letter and AQL, as the sample size for a given code letter would then have to increase with the AQL; this would be undesirable for the practical application of this sampling scheme.

(d) *Probability of acceptance at the AQL.* The probability that a lot, whose quality is precisely at the AQL, will be accepted increases with the sample size and follows a similar, but not identical, sliding scale to that used in BS 6001.

(e) *Sample sizes.* The variables sample sizes corresponding to given code letters are usually smaller than the attributes sample sizes for the same letters.

(f) *Double sampling plans.* No double sampling plans are given in this standard.

(g) *Average outgoing quality limit (AOQL).* Since it is anticipated that variables plans will be used mainly with destructive testing, where 100 % inspection and rectification of rejected lots is not possible, the AOQL concept cannot be applied and therefore these tables have not been included in this standard.

6. Non-continuous production

6.1 The sampling scheme contained in this standard was not designed to be applied under circumstances different from those specified in 1.2, for example to an isolated lot or a limited number of lots, where tightened inspection and the stopping rule cannot be applied.

6.2 Under such conditions the concept of an AQL as a maximum for the process average of accepted lots no longer holds, and the AQL can no longer be interpreted as a measure for the degree of protection of the consumer against receiving lots of poor average quality. The AQL then indicates only the percent defective that has a high probability of acceptance and acts as an index to a sampling plan.

6.3 The degree of protection of the consumer provided by the individual sampling plans of this standard can, however, be judged from their OC curves as given in charts B to P and tables V-B-1 to V-P-1, and these should be consulted in choosing a sampling plan.

Diagram A will assist in finding a suitable curve.

The intersection of a vertical line through the acceptable value of the limiting quality and a horizontal line through the acceptable quality with a 95 % probability of acceptance (approximately equal to the AQL) will lie on, or under, a sloping line indexed with the sample size code letter of a standard plan which meets the specified requirements approximately.

Section two. Choice of sampling plan

7. Planning

The choice of the most suitable variables plan, if one exists, requires experience, judgement and some knowledge of both statistics and the product to be inspected.

This section of the standard is intended to suggest to those responsible for specifying sampling plans the considerations that should be borne in mind when deciding whether a variables plan would be suitable and the choices to be made when selecting an appropriate standard plan.

8. Choice between variables and attributes

The first question to consider is whether it is desirable to inspect by variables rather than by attributes.

The following points should be taken into account.

(a) In terms of economics, it is necessary to compare the total cost of the relatively simple inspection of a larger number of items by an attributes scheme with the generally more elaborate procedure required by a variables scheme, which is usually more expensive in time and money per item.

(b) In terms of the knowledge gained, the advantage lies with inspection by variables as the more precise information obtained indicates how good the product is; earlier warning will be given if the quality is slipping.

(c) An attributes scheme can be more readily understood and accepted, e.g. it may at first be difficult to accept that, when inspecting by variables, a lot can be rejected on measurements taken of a sample that does not contain any defectives (see example in 13.4).

(d) A comparison of the size of the samples required for the same AQL from standard plans for inspection by attributes (i.e. from BS 6001 and the standard plans in this standard) is given in table I-B. It will be seen that the smallest samples are required by the ' σ ' method, used when the standard deviation of the lot is known.

(e) Inspection by variables is appropriate particularly in conjunction with the use of control charts for variables.

(f) Variables sampling has a substantial advantage when the inspection process is expensive, e.g. in the case of destructive testing.

(g) A variables scheme becomes less suitable as the number of measurements to be taken on one item increases, since each characteristic has to be considered separately. It may be advantageous to apply 'attributes' to the majority of the characteristics and 'variables' to one or two of the more important requirements, e.g. proof load tests, safety and reliability requirements.

(h) The use of this standard is applicable only when there is reason to believe that the distribution of the variable is normal. In case of any doubt, the responsible authority should be consulted.

NOTE. Tests for departure from normality are dealt with in section two of BS 2846 : Part 4 : 1976 which provides examples of graphical methods that can be used to verify that the distribution of the data is sufficiently normal to justify the use of sampling by variables. However, more comprehensive documentation on this subject is currently in course of preparation which will additionally give guidance on various numerical tests which may also be used. Subsequently, it is envisaged that 'tests for departure from normality' will form the subject of a separate standard.

9. Choice of method

If it is decided to apply inspection by variables, the next question is which method should be used. The ' s ', the ' R ' or the ' σ ' method?

Table I-B shows that the ' σ ' method is most economical in sample size, but before this method can be employed the value of σ has to be established.

In terms of sample size, the ' s ' method has a slight advantage over the ' R ' method, but the calculation of s does involve more computation; the extent and difficulty of this is more apparent than real, especially if an electronic calculator is available. Methods of calculating s are given in appendix A.

The ' R ' method (given in appendix C) is simple to calculate, but requires a somewhat larger sample size for the same AQL.

Initially it will be necessary to begin with the ' s ' or ' R ' method, but if the quality is satisfactory, the standard switching rules will permit the responsible authority to commence reduced inspection and to use a smaller sample size.

The question then is, if the variance is under control and lots continue to be accepted, will it be economical to change to the ' σ ' method? It should be noted that the size of the sample will not necessarily be smaller if the AQL is large. It will still be necessary to calculate s for record purposes and to keep the control charts up-to-date (see clause 17), but the acceptance criteria become simpler (see 14.2 and 14.3).

10. Choice of inspection level and AQL

In standard sampling plans, the inspection level determines the size of the sample to be taken and hence, in conjunction with the AQL, governs the severity of the inspection. The appropriate OC curve given in table V shows the extent of the risk that is involved in such a plan.

The choice of the inspection level and the AQL is governed by a number of factors, but is mainly a balance between the total cost of inspection and the consequences of defective items passing into service.

The normal practice is to use inspection level II unless special circumstances indicate that another level is more appropriate.

11. Choice of sampling plan

11.1 Standard plans. The standard procedure can be used only when the production of lots is continuous.

The standard procedure, with its semi-automatic steps from lot size to sample size, using inspection level II and beginning with the 's' method, has been found in practice to produce workable sampling plans, but it assumes that the order of priority is first the AQL, second the sample size and last the limiting quality.

The acceptability of this system is due to the fact that the consumer is protected by the switching rules (see clause 18), which quickly increase the severity of inspection and finally terminate it if the quality of the process is worse than the AQL.

NOTE. It should also be remembered that the limiting quality is the quality which if offered for inspection would have a 10 % probability of acceptance; the actual risk taken by the consumer therefore also depends on the probability of goods of this low quality being offered for inspection.

However, if, in certain circumstances, the limiting quality has a higher priority than the sample size (for instance when only a limited number of lots are being produced), a suitable plan in this standard may be selected by using diagram A. The intersection of a vertical line through the acceptable value of the limiting quality and a horizontal line through the acceptable quality with a 95 % probability of acceptance (approximately equal to the AQL) will lie on, or under, a sloping line indexed with the sample size code letter of a standard plan that meets the specified requirements. This should be verified by inspecting the OC curve given in table V for this code letter and the AQL.

If the lines intersect at a point above the line marked R (see diagram A) this implies that a sample of over 1000 would be necessary and the specification cannot be met by the plans in the standard.

11.2 Special plans. If standard plans are not acceptable, it will be necessary to devise a special plan. The choice is then to decide which combination of AQL, limiting quality and sample size is most suitable, remembering that these are not independent, for, when any two have been chosen, the third follows.

NOTE. This choice is not completely unfettered: the 'non-central t' tables D10 have been computed only for a limited, though generally adequate, range of variables and the fact that the size of the sample is necessarily a whole number imposes some constraints. If a special scheme is necessary it should be devised only with the assistance of a statistician experienced in quality control.

Section three. Operation of a variables sampling plan

12. Essential preliminaries

Before starting inspection by variables check:

- (a) that the distribution is considered to be normal and that production is considered to be continuous.
- (b) whether the 's' (or 'R') method is to be used initially or whether the variance is stable and the 'σ' method is to be used. (In the latter case establish the value of σ.)

(c) that the inspection level to be used for this plan has been designated; if none has been given inspection level II shall be used.

(d) that the AQL for this plan has been designated and that it is one of the preferred AQLs for use with this standard; if it is not, the tables in this standard are not applicable (see 11.2 for special plans).

(e) if a double specification limit has to be met, whether the limits are separate or combined.

13. Standard procedure for the 's' method

NOTE. For the 'R' method see appendix C.

13.1 Obtaining a plan. The procedure for obtaining a plan is as follows

- (a) with the inspection level given (normally this will be inspection level II) and with the lot size, obtain the sample size code letter using table I-A;
- (b) with the sample size code letter and the AQL enter table II-A and obtain the sample size (*n*) and acceptability constant (*k_s*).
- (c) taking a random sample of this size, measure the characteristic (*x*) in each item and then calculate $\bar{x}$, the sample mean, and *s*, the estimated standard deviation (see appendix A). If $\bar{x}$ is outside the specification limit, the lot is rejected without calculating *s*. It may, however, be necessary to calculate *s* for record purposes.

13.2 Acceptability criteria for single or separate specification limits. If single or separate specification limits are given, calculate the quality statistics

$$Q_U = \frac{U - \bar{x}}{s} \quad \text{and/or} \quad Q_L = \frac{\bar{x} - L}{s} \quad \text{as appropriate,}$$

and then compare with *Q_U* and/or *Q_L* with the acceptability constants (*k_{sU}* and/or *k_{sL}*) obtained from table II-A for normal inspection. If the appropriate quality statistic is greater than or equal to the acceptability constant, accept the lot; if less, reject.

Thus if only the upper specification limit *U* is given:

- accept if $Q_U \geq k_s$
- reject if $Q_U < k_s$

Or, if only the lower specification limit *L* is given:

- accept if $Q_L \geq k_s$
- reject if $Q_L < k_s$

When both *U* and *L* are given:

- accept if both $Q_L \geq k_{sL}$ and $Q_U \geq k_{sU}$
- reject if either $Q_L < k_{sL}$ or $Q_U < k_{sU}$

Example

The maximum temperature of operation for a certain device is specified as 60 °C. Production is inspected in lots of 100 items. Inspection level II, normal inspection with AQL = 2.5 % is to be used. From table I-A, the sample size code letter is F; from table II-A it is seen that a sample size of 10 is required and that the acceptability constant *k_s* is 1.41. Suppose the measurements are as follows: 53 °C, 57 °C, 49 °C, 58 °C, 59 °C, 54 °C, 58 °C, 56 °C, 55 °C, 50 °C. Compliance with the acceptability criterion is to be determined.

Information needed	Value obtained
Sample size: n	10
Sample mean $\bar{x}$: $\Sigma x/n$	54.9
Standard deviation s : $\sqrt{\Sigma(x - \bar{x})^2 / (n - 1)}$ (see A.2)	3.414
Specification limit (upper): U	60
$Q_U = (U - \bar{x})/s$	1.494
Acceptability constant: k_s (see table II-A)	1.41
Acceptability criterion: compare Q_U with k_s	$1.494 > 1.41$
The lot meets the acceptability criterion since Q_U is greater than k_s .	

13.3 Graphical method for single specification limits.

When a graphical criterion is desired, draw the line

$$\bar{x} = U - k_s s \text{ (for an upper limit) and/or}$$

$$\bar{x} = L + k_s s \text{ (for a lower limit),}$$

as appropriate, on graph paper with $\bar{x}$ as the vertical axis and s as the horizontal axis. Using the values of s and $\bar{x}$ calculated from the measurements obtained from a sample (see appendix A for the calculation of s), plot the point $s, \bar{x}$ on the graph. If this point lies in the accept zone, accept the lot; if outside, reject it.

Example

Using the figures given in the example in 13.2 mark the point $U = 60$ on the $\bar{x}$ (vertical) axis and draw a line through this point with a slope $-k_s$ (as $k_s = 1.41$; this means that the line will pass through points $s = 1, \bar{x} = 58.59$; $s = 2, \bar{x} = 57.18$; $s = 3, \bar{x} = 55.77$; etc. Select a suitable point and draw a straight line through it and $s = 0, \bar{x} = 60$ (i.e. U). The accept zone is then the area under this line. The calculated values of s and $\bar{x}$ are 3.414 and 54.9. Plotting the point $s, \bar{x}$ it will be seen from figure 1 that it lies just inside the accept zone and that the lot is acceptable.

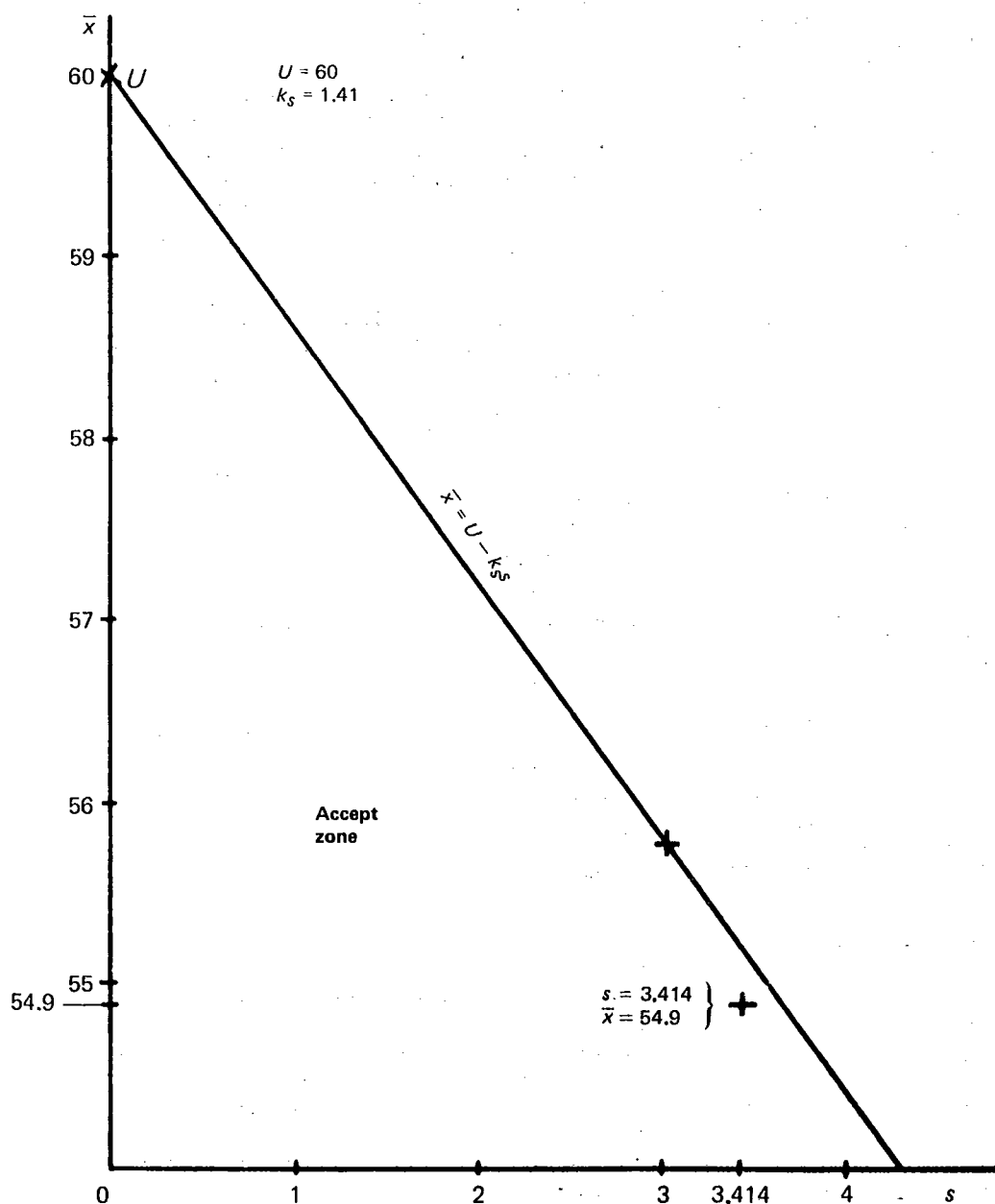


Figure 1. Graphical method for single specification limits

13.4 Acceptability criterion for a combined double specification limit. If a combined upper and lower specification limit has been given, it will be necessary to use graphical methods, unless s is greater than the value of the MSD obtained from table IV, when the lot shall be rejected at once.

From the chart in the 'S' series, which is labelled with the sample size code letter, select the acceptance curve with the AQL specified for the sampling plan. For the greater convenience of the inspector this curve should then be copied (or traced) on to graph paper and the scale adjusted so that s and $\bar{x}$ can be plotted directly (i.e. the upper limit is given instead of 1.0 and the lower limit instead of 0 on the $\bar{x}$ scale).

The values of s and $\bar{x}$ found from the sample are plotted on this working chart and if the point lies outside the accept zone, reject the lot, otherwise accept.

If it is not convenient to adjust the scales, calculate the values of $s/U - L$ and $\bar{x} - L/U - L$ and plot a point representing these values on the appropriate chart from the 'S' series (or a copy of it). If the point lies outside the accept zone defined by the curve for the specified AQL, reject the lot, otherwise accept.

Example

The minimum temperature of operation for a certain device is specified as 60.0 °C. The maximum temperature is 70.0 °C. Production is in inspection lots of 96 items. Inspection level II, normal inspection, with AQL = 1.5 % is to be used. From table I-A, the sample size code letter is F; from table I-B it is seen that a sample size of 10 is required and from table IV that the value of f for the MSD is 0.276. Suppose the measurements obtained are as follows: 63.5 °C, 62.0 °C, 65.2 °C, 61.7 °C, 69.0 °C, 67.1 °C, 60.0 °C, 66.4 °C, 62.8 °C, 68.0 °C. Compliance with the acceptability criterion is to be determined.

Information needed	Value obtained
Sample size: n	10
Sample mean $\bar{x}$: $\Sigma x/n$	64.57
Standard deviation s : $\sqrt{\Sigma(x - \bar{x})^2 / (n - 1)}$ (see A.2)	3.01
Standardized mean: $(\bar{x} - L)/(U - L)$	0.457
Standardized standard deviation: $s/(U - L)$	0.301
Standardized MSD (from table IV)	0.276

The appropriate acceptance curve is taken from diagram S-F.

If, as in figure 2, the scales have been adjusted to the real measurements, plot the point $s = 3.01$, $\bar{x} = 64.57$. This lies outside the acceptance curve and the lot is rejected.

It could have been rejected as soon as it was seen that s was greater than the MSD.

If the scales of the acceptance chart were not adjusted, the following additional calculations are required.

Standardized mean:
 $(\bar{x} - L)/(U - L) = (64.57 - 60)/(70 - 60) = 0.457$

Standardized s :
 $s/(U - L) = 3.01/(70 - 60) = 0.301$

and the point (0.301, 0.457) is plotted on figure 2.

As this point lies outside the curve for AQL = 1.5 %, the lot is rejected.

NOTE. This lot is rejected even though all tested items in the sample were within specification limits.

14. Standard procedure for the 'σ' method

14.1 Obtaining a plan. The 'σ' method is to be used only when there is valid evidence on which the estimated standard deviation of the process may be considered to be a known constant σ .

From table I-A obtain the sample size code letter, then, for normal inspection, from table III-A with this code letter and the specified AQL, obtain the sample size (n) and acceptability constant (k_σ).

Take a random sample of this size, measure the characteristic under inspection (x) for all items of the sample and calculate the mean ($\bar{x}$).

14.2 Acceptability criteria for single or separate specification limits. It is possible to obtain an acceptability criterion by following the procedure given for the 's' method, by substituting σ (the given value of the standard deviation of the process) for the s derived for the individual samples and comparing the calculated value of Q with the value of the acceptability constant (k_σ) obtained from table III-A.

However, if $(U - \bar{x})/\sigma \geq k_{\sigma U}$, the acceptance criterion for an upper specification is written as $\bar{x} \leq U - k_{\sigma U}\sigma$. Since U , $k_{\sigma U}$ and σ are all known in advance, the value of $\bar{x}_U = U - k_{\sigma U}\sigma$ should be determined before inspection begins, the acceptance criteria for an upper specification limit then becomes:

accept if $\bar{x} \leq \bar{x}_U = U - k_{\sigma U}\sigma$,
reject if $\bar{x} > \bar{x}_U = U - k_{\sigma U}\sigma$.

Similarly for a lower specification limit:

accept if $\bar{x} \geq \bar{x}_L = L + k_{\sigma L}\sigma$,
reject if $\bar{x} < \bar{x}_L = L + k_{\sigma L}\sigma$.

When both limits are given:

accept if both $\bar{x} \leq \bar{x}_U$ and $\bar{x} \geq \bar{x}_L$,
reject if either $\bar{x} > \bar{x}_U$ or $\bar{x} < \bar{x}_L$.

Example

The specified minimum yield point for certain steel castings is 400 N/mm². A lot of 500 items is submitted for inspection. Inspection level II, normal inspection, with AQL = 1.5 % is to be used. The value of σ is known to be 21 N/mm². From table I-A, it is seen that the code letter is I and from table III-A that for an AQL of 1.5 % the sample size (n) is 10 and the acceptability constant (k_σ) is 1.70. Suppose the yield points of the sample specimens are as follows:

431, 417, 469, 407, 452,
427, 421, 476, 400, 445.

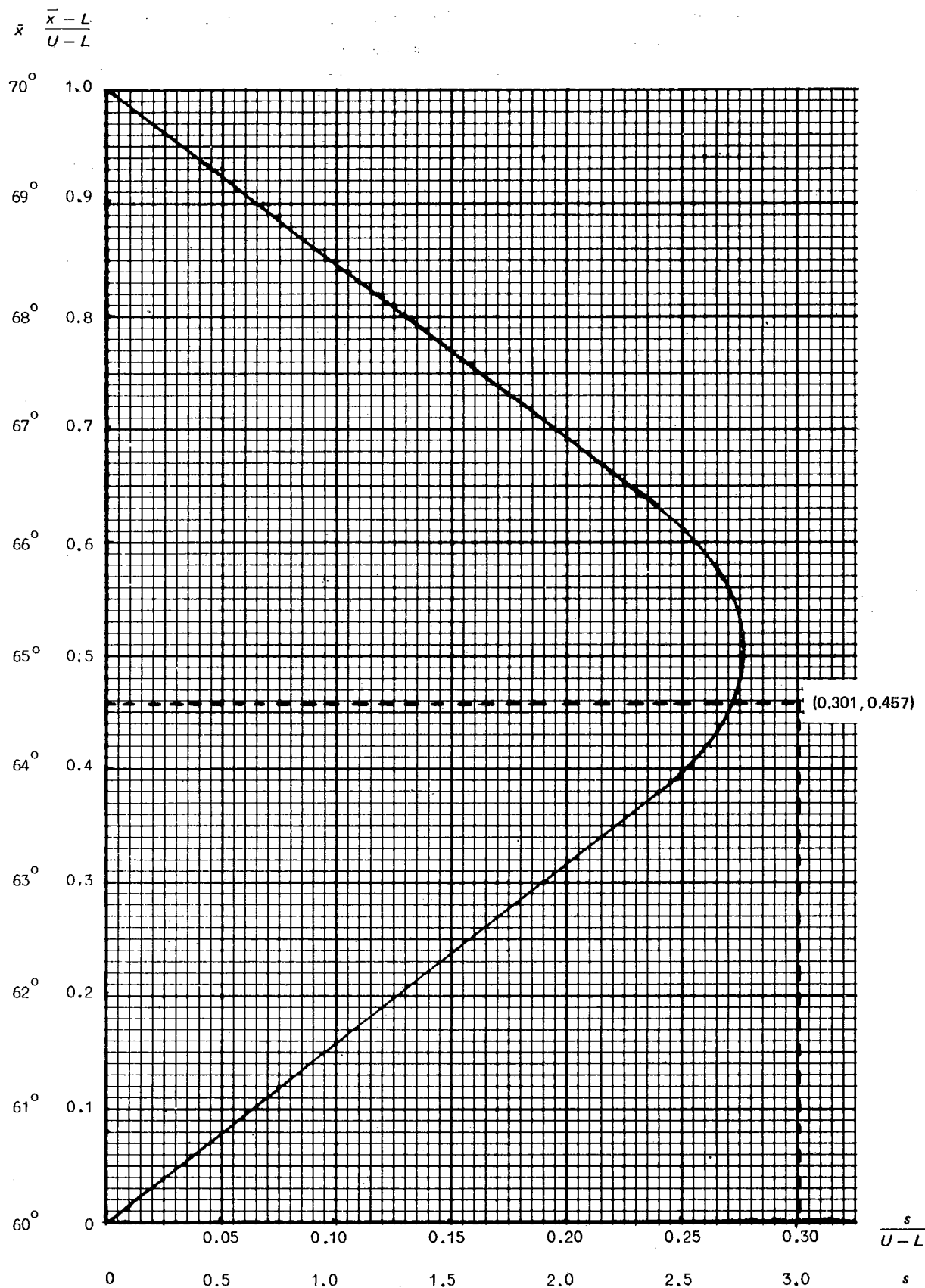
Compliance with the acceptability criterion is to be determined.

Information needed	Value obtained
Acceptability constant: k_σ	1.70
Known σ :	21
Product: $k_\sigma \sigma$	35.70
Specification limit: L	400
Sum: $L + k_\sigma \sigma$	435.70
Sum of measurements: Σx	4345
Sample size: n	10
Sample mean: $\bar{x}$	434.5

Acceptability criterion: Is $\bar{x} \geq \bar{x}_L$?

The lot does not meet the acceptability criterion and is not to be accepted.

BS 6002 : 1979

Figure 2. 's' method: acceptance curve for sample size 10, $n = 10$, AQL = 1.5 %, MSD = 0.276

14.3 Acceptability criterion for a combined double specification limit. Using the lot size and given inspection level, find the sample size code letter from table I-A and the sample size from table I-B using the code letter and the AQL.

From the chart indexed with the code letter in the SIGMA series select the acceptance curve for the AQL given for this plan.

Calculate the value $\sigma/(U - L)$ and draw a vertical line through this point cutting the acceptance curve.

Measure the values of $\bar{x}/(U - L)$ at which this line intersects the acceptance curve. These give the highest and lowest acceptance values of the mean $\bar{x}_U$ and $\bar{x}_L$ respectively (see figure 3).

NOTE 1. If the line does not intercept the acceptance curve the process can never be acceptable and sampling inspection is pointless.

NOTE 2. If the line intercepts the straight line portions of the acceptance curve this is equivalent to two separate specification limits and the acceptance criteria are those given in 14.2.

In accordance with 14.1 take a sample of the appropriate size and obtain the mean of the characteristic under inspection.

The acceptance criterion is:

accept if the mean lies between the highest and lowest acceptable values of the mean (i.e. if $\bar{x}_L \leq \bar{x} \leq \bar{x}_U$); otherwise reject.

Example

The specification for electrical resistance of a certain electrical component is $520 \pm 50 \Omega$. Production is at a rate of 3500 items per inspection lot. Inspection level II, normal inspection, with AQL = 1 % is to be used.

The value of σ is known to be 21.0. From table I-A the sample size code letter is L; from table I-B it is seen that a sample size of 25 is required. Suppose the values of the sample resistances are as follows:

515, 491, 479, 507, 543, 521, 536, 483, 509, 514,
507, 484, 526, 552, 499, 530, 512, 492, 521, 467,
489, 513, 535, 501, 529.

Information needed	Value obtained
Sample size: n	25
Upper specification limit: U	570
Lower specification limit: L	470
Known σ :	21.0
Standardized $\sigma : \sigma/(U - L) = 21.0/100$	0.21
Standardized limiting values from acceptance chart (see figure 3):	
maximum $\frac{\bar{x} - L}{U - L} = 0.576$	minimum $\frac{\bar{x}_L - L}{U - L} = 0.424$
$\bar{x}_U = 57.6 + 470$	$\bar{x}_L = 42.4 + 470$
limits of $\bar{x}$	
$\bar{x}_U = 527.6$	$\bar{x}_L = 512.4$
Sum of measurements:	12.755
Mean of measurements:	510.2
Since $\bar{x}$ at 510.2 lies outside the acceptance limits for $\bar{x}$ of 527.6 and 512.4 the lot is not acceptable.	

NOTE. All the calculations other than the sum and mean of measurements should be completed before sampling begins. If σ had been known to be 25, the vertical line through its standardized value (i.e. $\sigma/(U - L) = 0.25$) would not intercept the acceptance curve for an AQL = 1 % and sampling inspection would not have taken place.

If σ had been 15, the acceptable limits for $\bar{x}$ could be obtained either from the chart or by calculation, since the intercept is on the straight line portion of the curve.

From table III-A

$$k_\sigma = 1.97$$

$$k_\sigma \sigma = 29.6$$

$$\bar{x}_U = U - k_\sigma \sigma = 540.4$$

$$\bar{x}_L = L + k_\sigma \sigma = 499.6$$

and in that case the lot, whose mean was 510.2, would be acceptable.

15. Procedure during continuing inspection

As a variables sampling inspection plan can only operate efficiently if:

- (a) the characteristic being inspected is normally distributed;
- (b) records are kept;
- (c) the switching rules are obeyed;

it is necessary to ensure that these requirements are being met.

16. Normality and outliers

16.1 Normality. Normality should have been checked by the responsible authority before sampling begins, but in cases of doubt a statistician should advise whether the distribution appears suitable for sampling by variables or whether use should be made of the graphical tests for normality given in BS 2846 : Part 4.

16.2 Outliers. An outlier or an outlying observation is one that appears to deviate markedly from other members of the sample in which it occurs. A single outlier, even when it lies within specification limits, can produce an increase in variability that far outweighs changes in the mean and can consequently lead to rejection of the lot. When an outlying observation is suspected, a test for outliers should precede and be made independently of a decision on acceptability of a lot. (See, for example, BS 5497 : Part 1.) When outliers are detected, the disposition of the lot should be a matter for negotiation between the purchaser and the supplier.

17. Records

17.1 Control charts. One of the advantages of inspection by variables is that trends in the quality of the product can be detected and warning given before an unacceptable standard is reached, but this is only possible if adequate records are kept.

For all three methods ('s', 'R' and 'σ') records should be kept of the values of $\bar{x}$ and s , or $\bar{R}$ if appropriate, preferably in the form of control charts.

NOTE. For guidance on the use and construction of control charts for variables see BS 2564.

Records are particularly important when using the 'σ' method in order to verify that the values of s obtained from the samples fall within the limits of the prescribed value of σ .

When a combined double specification limit has been laid down, the value of the MSD, given in table IV (or MAR given in table R-IV), should be plotted on the s (or R) control chart, as an indication of an unacceptable value.

NOTE. Control charts are used to detect trends. The ultimate decision as to the acceptability of an individual lot is governed by the procedure given in clauses 13 and 14 of this standard.

BS 6002 : 1979

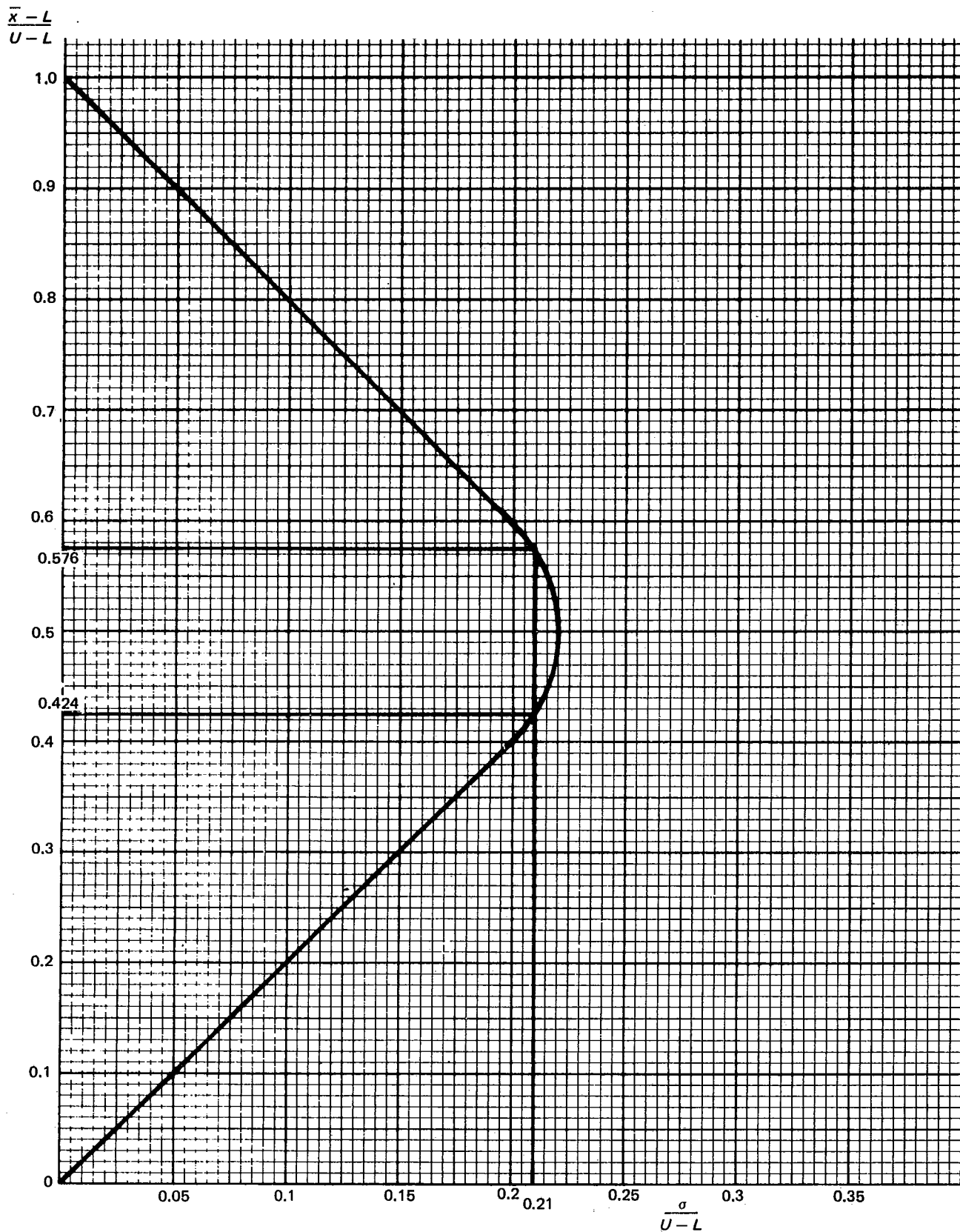


Figure 3. 'σ' method: acceptance curve for code letter L, AQL = 1.0 %

17.2 Rejected lots. Particular care shall be taken to record all rejected lots and to see that the switching rules are implemented. Any lot not accepted by the sampling plan shall not be resubmitted either in whole or in part without the permission of the responsible authority.

18. Operation of the switching rules

The standard switching rules are as follows.

(a) *Normal inspection* shall be used at the start of inspection (unless otherwise specified) and shall continue to be used during the course of inspection until tightened inspection becomes necessary or reduced inspection is allowed.

(b) *Tightened inspection* shall be instituted when two lots on original normal inspection are rejected within any five or less successive lots.

NOTE. Tightened inspection is achieved by increasing the value of the acceptability constant. The values are tabulated in table II-B for the 's' method (table R-II-B for the 'R' method) and table III-B for the 'σ' method. In the 's' and 'R' methods there is no change in the size of the sample unless the sample size is so small that the tables indicate, with a downward arrow, that an increase of sample size is necessary.

(c) *Tightened inspection* shall be relaxed when five successive lots on original inspection have been accepted on tightened inspection.

(d) *Reduced inspection* can be instituted after 10 successive lots have been accepted under normal inspection, provided that:

- (1) these lots would have been acceptable if the AQL had been one step tighter;

NOTE: If a value for k_s for this tighter AQL is not given in table II-A, a sufficiently accurate acceptance curve may be extrapolated by eye from the appropriate diagram in the S series.

- (2) production is in statistical control;

- (3) it is considered desirable by the responsible authority.

NOTE. Reduced inspection is conducted on a much smaller sample than normal inspection and the value of the acceptability constant is also decreased. The values of n and k_s (or k_σ) for reduced inspection are given in table II-C for the 's' method and table III-C for the 'σ' method.

(e) *Reduced inspection* shall cease and normal inspection shall be reinstated if any of the following occur on original inspection:

- (1) a lot is rejected;
- (2) production becomes irregular or delayed;
- (3) other conditions warrant that normal inspection be instituted.

19. Discontinuing inspection

If tightened inspection has had to be maintained continuously for over 10 successive lots, sampling inspection shall be discontinued pending action by the producer to improve the quality of the submitted product.

20. Acceptance curves for tightened and reduced inspection

Separate acceptance curves have not been produced for tightened or reduced inspection, so when combined double specification limits have to be met under tightened or reduced inspection it is necessary to find the curve among those given for use in normal inspection that has the required sample size and acceptability constant.

When switching to tightened inspection it will always be the curve just inside that being used in normal inspection (i.e. that with the next lower preferred AQL). When switching to reduced inspection it is necessary to find the values of the sample size and acceptability constant from table II-C or table III-C for the 's' and 'σ' methods respectively and then to refer back to table II-A (or table III-A) to find the normal inspection plan giving these values (i.e. code letter and AQL).

The code letter and AQL then determine the acceptance curve to be used.

Example

If, in normal inspection, the sample size code letter is I and the AQL = 0.25 % when using the 's' method, from table II-A, $n = 25$ and $k_s = 2.26$. On switching to reduced inspection, from table II-C, $n = 10$ and $k_s = 1.98$. Referring back to table II-A, $n = 10$ and $k_s = 1.98$ is found to correspond to a sample size code letter F and AQL of 0.40. The acceptance curve given for these values in diagram S-F should, accordingly, be used.

21. Switching to the 'σ' method

If it appears that the value of s (or $\bar{R}$) is in control, the root mean square value of s (or $\bar{R}/c$, see appendix C) may be presumed to be σ , the 'known' standard deviation of the process, and the 'σ' method may be adopted. In order to verify that the variability remains under control the value of s should still be calculated and plotted on a control chart.

NOTE. This switch should not be undertaken without the permission of the responsible authority.

Section four. Tables and diagrams

Tables

- I-A. Sample size code letters: inspection levels
 I-B. Sample size code letters: sample sizes for normal inspection
 II-A. Single sampling plans for normal inspection: 's' method
 II-B. Single sampling plans for tightened inspection: 's' method
 II-C. Single sampling plans for reduced inspection: 's' method
 III-A. Single sampling plans for normal inspection: 'σ' method
 III-B. Single sampling plans for tightened inspection: 'σ' method
 III-C. Single sampling plans for reduced inspection: 'σ' method
 IV. Values of f for maximum standard deviation (MSD): 's' method
 V. Tables of operating characteristics for sample size code letters B to P

Diagrams

- A. Samples sizes to meet quality at 95 % and 10 % risk
 S. 's' method: the acceptance curves
 SIGMA. 'σ' method: the acceptance curves

Table I-A. Sample size code letters: inspection levels (see clause 10)

Lot size	Special inspection levels		General inspection levels		
	S-3	S-4	I	II	III
2 to 8					C
9 to 15					D
16 to 25			B	C	E
26 to 50			C	D	F
51 to 90			D	E	G
91 to 150		B	E	F	H
151 to 280		C	F	G	I
281 to 500		D	G	H/I*	J
501 to 1 200	B	E	H	J	K
1 201 to 3 200	C	F	I	K	L
3 201 to 10 000	D	G	J	L	M
10 001 to 35 000	E	H	K	M	N
35 001 to 150 000	F	I	L	N	P
150 001 to 500 000	G	J	M	P	
500 001 and over	H	K	N		

* Use H for lot size 281 to 400 and I for lot size 401 to 500.

NOTE 1. The code letters and inspection levels in this standard correspond to those given in BS 6001; they are *not* identical with those given in MIL STD 414.

NOTE 2. Symbol



There is no suitable sampling plan in this area; use the first sampling plan below or above the arrow. This refers to both the sample size and acceptability constant k_s (or k_d).

Table I-B. Sample size code letters: sample sizes for normal inspection (see clauses 8 and 9)

Code letter	's' method	'σ' method											Equivalent attributes sample	
	Acceptable quality level													
	All	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10.0	Code letter	Sample size
B	3												B	3
C	4												C	5
D	5												D	8
E	7												E	13
F	10		3	3	3	4	4	4	5	5	6	7	F	20
G	15	4	4	4	5	5	6	6	7	8	9	11	G	32
H	20	5	5	6	6	7	7	8	9	10	12	14	H	50
I	25	6	6	7	8	8	9	10	11	13	15	17	—	—
J	35	8	9	9	10	11	12	14	15	18	20	24	J	80
K	50	11	12	13	14	16	17	19	22	25	29	33	K	125
L	75	16	17	19	21	23	25	28	32	36	42	49	L	200
M	100	22	23	25	27	30	33	36	42	48	55	64	M	315
N	150	31	34	37	40	44	49	54	61	70	82	95	N	500
P	200	42	45	49	54	59	65	71	81	93	109	127	P	800

NOTE 1. All AQL values are in percent defective.

NOTE 2. The code letters and inspection levels in this standard correspond to those given in BS 6001; they are *not* identical with those given in MIL STD 414.

NOTE 3. Symbol

There is no suitable sampling plan in this area; use the first sampling plan below the arrow. This refers to both the sample size and acceptability constant k_s (or k_d).

Table II-A. Single sampling plans for normal inspection (master table): 's' method (see 13.1)

Sample size code letter	Sample size	Acceptable quality levels (normal inspection)										
		0.10	0.15	0.25	0.40	0.65	1.00	1.50	2.50	4.00	6.50	10.00
		k_s	k_s	k_s	k_s	k_s	k_s	k_s	k_s	k_s	k_s	k_s
B	3	↓	↓	↓	↓	↓	↓	↓	1.12	0.958	0.765	0.566
C	4	↓	↓	↓	↓	↓	1.45	1.34	1.17	1.01	0.814	0.617
D	5	↓	↓	↓	↓	1.65	1.53	1.40	1.24	1.07	0.874	0.675
E	7	↓	↓	2.00	1.88	1.75	1.62	1.50	1.33	1.15	0.955	0.755
F	10	↓	2.24	2.11	1.98	1.84	1.72	1.58	1.41	1.23	1.03	0.828
G	15	2.42	2.32	2.20	2.06	1.91	1.79	1.65	1.47	1.30	1.09	0.886
H	20	2.47	2.36	2.24	2.11	1.96	1.82	1.69	1.51	1.33	1.12	0.917
I	25	2.50	2.40	2.26	2.14	1.98	1.85	1.72	1.53	1.35	1.14	0.936
J	35	2.54	2.45	2.31	2.18	2.03	1.89	1.76	1.57	1.39	1.18	0.969
K	50	2.60	2.50	2.35	2.22	2.08	1.93	1.80	1.61	1.42	1.21	1.00
L	75	2.66	2.55	2.41	2.27	2.12	1.98	1.84	1.65	1.46	1.24	1.03
M	100	2.69	2.58	2.43	2.29	2.14	2.00	1.86	1.67	1.48	1.26	1.05
N	150	2.73	2.61	2.47	2.33	2.18	2.03	1.89	1.70	1.51	1.29	1.07
P	200	2.73	2.62	2.47	2.33	2.18	2.04	1.89	1.70	1.51	1.29	1.07

NOTE 1. All AQL values are in percent defective.

NOTE 2. The code letters and inspection levels in this standard correspond to those given in BS 6001; they are *not* identical with those given in MIL STD 414.

NOTE 3. Symbols



There is no suitable sampling plan in this area; use the first sampling plan below the arrow. This refers to both the sample size and acceptability constant k_s (or k_d).



The plan given in this area gives a high degree of security but at the expense of a large sample. At the discretion of the responsible authority the next plan above the arrow may be used.



The heavy lines indicate the boundary of the equivalent attribute sampling plans in BS 6001.

Table II-B. Single sampling plans for tightened inspection (master table): 's' method (see clauses 4 and 18)

Sample size code letter	Sample size	Acceptable quality levels (tightened inspection)										
		0.10	0.15	0.25	0.40	0.65	1.00	1.50	2.50	4.00	6.50	10.00
		k_s	k_s	k_s	k_s	k_s	k_s	k_s	k_s	k_s	k_s	k_s
B	3	↓	↓	↓	↓	↓	↓	↓	↓	1.12	0.958	0.765
C	4	↓	↓	↓	↓	↓	↓	1.45	1.34	1.17	1.01	0.814
D	5	↓	↓	↓	↓	↓	1.65	1.53	1.40	1.24	1.07	0.874
E	7	↓	↓	↓	2.00	1.88	1.75	1.62	1.50	1.33	1.15	0.955
F	10	↓	↓	2.24	2.11	1.98	1.84	1.72	1.58	1.41	1.23	1.03
G	15	2.53	2.42	2.32	2.20	2.06	1.91	1.79	1.65	1.47	1.30	1.09
H	20	2.58	2.47	2.36	2.24	2.11	1.96	1.82	1.69	1.51	1.33	1.12
I	25	2.61	2.50	2.40	2.26	2.14	1.98	1.85	1.72	1.53	1.35	1.14
J	35	2.65	2.54	2.45	2.31	2.18	2.03	1.89	1.76	1.57	1.39	1.18
K	50	2.71	2.60	2.50	2.35	2.22	2.08	1.93	1.80	1.61	1.42	1.21
L	75	2.77	2.66	2.55	2.41	2.27	2.12	1.98	1.84	1.65	1.46	1.24
M	100	2.80	2.69	2.58	2.43	2.29	2.14	2.00	1.86	1.67	1.48	1.26
N	150	2.84	2.73	2.61	2.47	2.33	2.18	2.03	1.89	1.70	1.51	1.29
P	200	2.85	2.73	2.62	2.47	2.33	2.18	2.04	1.89	1.70	1.51	1.29

NOTE 1. All AQL values are in percent defective.

NOTE 2. The code letters and inspection levels in this standard correspond to those given in BS 6001; they are *not* identical with those given in MIL STD 414.

NOTE 3. Symbols

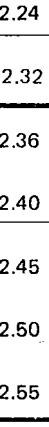
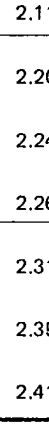
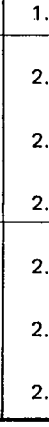
There is no suitable sampling plan in this area; use the first sampling plan below the arrow. This refers to both the sample size and acceptability constant k_s (or k_d).

The plan given in this area gives a high degree of security but at the expense of a large sample. At the discretion of the responsible authority the next plan above the arrow may be used.



The heavy lines indicate the boundary of the equivalent attribute sampling plans in BS 6001.

Table II-C. Single sampling plans for reduced inspection (master table): 's' method (see clauses 4 and 18)

Sample size code letter	Sample size	Acceptable quality levels										
		0.10	0.15	0.25	0.40	0.65	1.00	1.50	2.50	4.00	6.50	10.00
		k_s	k_s	k_s	k_s	k_s	k_s	k_s	k_s	k_s	k_s	k_s
B	3							1.12	0.958	0.765	0.566	0.341
C	3							1.12	0.958	0.765	0.566	0.341
D	3							1.12	0.958	0.765	0.566	0.341
E	3							1.12	0.958	0.765	0.566	0.341
F	4							1.12	0.958	0.765	0.566	0.341
G	5				1.65	1.53	1.40	1.24	1.07	0.874	0.675	0.455
H	7				1.65	1.53	1.40	1.24	1.07	0.874	0.675	0.455
I	10				1.65	1.53	1.40	1.24	1.07	0.874	0.675	0.455
J	15	2.32	2.20	2.06	1.91	1.79	1.65	1.47	1.30	1.09	0.886	0.664
K	20	2.36	2.24	2.11	1.96	1.82	1.69	1.51	1.33	1.12	0.917	0.695
L	25	2.40	2.26	2.14	1.98	1.85	1.72	1.53	1.35	1.14	0.936	0.712
M	35	2.45	2.31	2.18	2.03	1.89	1.76	1.57	1.39	1.18	0.969	0.745
N	50	2.50	2.35	2.22	2.08	1.93	1.80	1.61	1.42	1.21	1.00	0.774
P	75	2.55	2.41	2.27	2.12	1.98	1.84	1.65	1.46	1.24	1.03	0.804

NOTE 1. All AQL values are in percent defective.

NOTE 2. The code letters and inspection levels in this standard correspond to those given in BS 6001; they are *not* identical with those given in MIL STD 414.

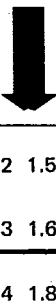
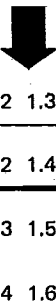
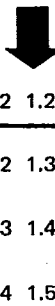
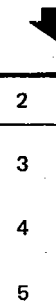
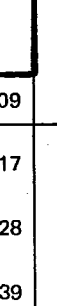
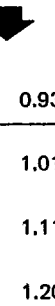
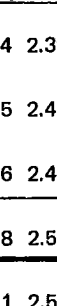
NOTE 3. Symbols

There is no suitable sampling plan in this area; use the first sampling plan below the arrow. This refers to both the sample size and acceptability constant k_s (or k_o).

The plan given in this area gives a high degree of security but at the expense of a large sample. At the discretion of the responsible authority the next plan above the arrow may be used.



The heavy lines indicate the boundary of the equivalent attribute sampling plans in BS 6001.

Code letter	Acceptable quality levels																																											
	0.10		0.15		0.25		0.40		0.65		1.00		1.50		2.50		4.00		6.50		10.00																							
	<i>n</i>	<i>k_σ</i>	<i>n</i>	<i>k_σ</i>	<i>n</i>	<i>k_σ</i>	<i>n</i>	<i>k_σ</i>	<i>n</i>	<i>k_σ</i>	<i>n</i>	<i>k_σ</i>	<i>n</i>	<i>k_σ</i>	<i>n</i>	<i>k_σ</i>	<i>n</i>	<i>k_σ</i>	<i>n</i>	<i>k_σ</i>	<i>n</i>	<i>k_σ</i>																						
B																																												
C																							2 1.36		2 1.25		2 1.09		2 0.936		3 0.755		3 0.573											
D																							2 1.58		2 1.42		2 1.33		3 1.17		3 1.01		4 0.641											
E																							2 1.94		2 1.81		3 1.69		3 1.56		3 1.44		4 1.28		4 1.11		5 0.919		5 0.728					
F			3 2.19		3 2.07		3 1.91		4 1.80		4 1.69		4 1.53		5 1.39		5 1.20		6 0.991		7 0.797																							
G																							4 2.39		4 2.30		4 2.14		5 2.05		5 1.88		6 1.78		6 1.62		7 1.45		8 1.28		9 1.07		11 0.877	
H																							5 2.46		5 2.34		6 2.23		6 2.08		7 1.95		7 1.80		8 1.68		9 1.49		10 1.31		12 1.11		14 0.906	
I																							6 2.49		6 2.37		7 2.25		8 2.13		8 1.96		9 1.83		10 1.70		11 1.51		13 1.34		15 1.13		17 0.924	
J	8 2.54		9 2.45		9 2.29		10 2.16		11 2.01		12 1.88		14 1.75		15 1.56		18 1.38		20 1.17		24 0.964																							
K	11 2.59		12 2.49		13 2.35		14 2.21		16 2.07		17 1.93		19 1.79		22 1.61		25 1.42		29 1.21		33 0.995																							
L	16 2.65		17 2.54		19 2.41		21 2.27		23 2.12		25 1.97		28 1.84		32 1.65		36 1.46		42 1.24		49 1.03																							
M	22 2.69		23 2.57		25 2.43		27 2.29		30 2.14		33 2.00		36 1.86		42 1.67		48 1.48		55 1.26		64 1.05																							
N	31 2.72		34 2.62		37 2.47		40 2.33		44 2.17		49 2.03		54 1.89		61 1.69		70 1.51		82 1.29		95 1.07																							
P	42 2.73		45 2.62		49 2.48		54 2.34		59 2.18		65 2.04		71 1.89		81 1.70		93 1.51		109 1.29		127 1.07																							

The heavy lines indicate the boundary of the equivalent attribute sampling plans in BS 6001.

Table III-B. Single sampling plans for tightened inspection (master table): ' σ ' method (see clauses 4 and 18)

Code letter	Acceptable quality levels											
	0.10	0.15	0.25	0.40	0.65	1.00	1.50	2.50	4.00	6.50	10.00	
	n k_{σ}	n k_{σ}	n k_{σ}	n k_{σ}	n k_{σ}	n k_{σ}	n k_{σ}	n k_{σ}	n k_{σ}	n k_{σ}	n k_{σ}	
B	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	
C	↓	↓	↓	↓	↓	↓	2 1.36	2 1.25	2 1.09	2 0.936	3 0.755	
D	↓	↓	↓	↓	↓	2 1.58	2 1.42	2 1.33	3 1.17	3 1.01	3 0.825	
E	↓	↓	↓	2 1.94	2 1.81	3 1.69	3 1.56	3 1.44	4 1.28	4 1.11	5 0.919	
F	↓	↓	3 2.19	3 2.07	3 1.91	4 1.80	4 1.69	4 1.53	5 1.39	5 1.20	6 0.991	
G	3 2.49	4 2.39	4 2.30	4 2.14	5 2.05	5 1.88	6 1.78	6 1.62	7 1.45	8 1.28	9 1.07	
H	4 2.55	5 2.46	5 2.34	6 2.23	6 2.08	7 1.95	7 1.80	8 1.68	9 1.49	10 1.31	12 1.11	
I	6 2.59	6 2.49	6 2.37	7 2.25	8 2.13	8 1.96	9 1.83	10 1.70	11 1.51	13 1.34	15 1.13	
J	7 2.63	8 2.54	9 2.45	9 2.29	10 2.16	11 2.01	12 1.83	14 1.75	15 1.56	18 1.38	20 1.17	
K	11 2.72	11 2.59	12 2.49	13 2.35	14 2.21	16 2.07	17 1.93	19 1.79	22 1.61	25 1.42	29 1.21	
L	15 2.77	16 2.65	17 2.54	19 2.41	21 2.27	23 2.12	25 1.97	28 1.84	32 1.65	36 1.46	42 1.24	
M	20 2.80	22 2.69	23 2.57	25 2.43	27 2.29	30 2.14	33 2.00	36 1.86	42 1.67	48 1.48	55 1.26	
N	30 2.84	31 2.72	34 2.62	37 2.47	40 2.33	44 2.17	49 2.03	54 1.89	61 1.69	70 1.51	82 1.29	
P	40 2.85	42 2.73	45 2.62	49 2.48	54 2.34	59 2.18	65 2.04	71 1.89	81 1.70	93 1.51	109 1.29	

NOTE 1. All AQL values are in percent defective.

NOTE 2. The code letters and inspection levels in this standard correspond to those given in BS 6001; they are *not* identical with those given in MIL STD 414.

NOTE 3. Symbols

There is no suitable sampling plan in this area; use the first sampling plan below the arrow. This refers to both the sample size and acceptability constant k_{σ} (or k_{σ}).

The plan given in this area gives a high degree of security but at the expense of a large sample. At the discretion of the responsible authority the next plan above the arrow may be used.



The heavy lines indicate the boundary of the equivalent attribute sampling plans in BS 6001.

Table III-C. Single sampling plans for reduced inspection (master table): 'σ' method (see clauses 4 and 18)

Code letter	Acceptable quality levels											
	0.10		0.15		0.25		0.40		0.65		1.00	
	<i>n</i>	<i>k_σ</i>	<i>n</i>	<i>k_σ</i>	<i>n</i>	<i>k_σ</i>	<i>n</i>	<i>k_σ</i>	<i>n</i>	<i>k_σ</i>	<i>n</i>	<i>k_σ</i>
B												
C												
D												
E												
F	3 2.19		3 2.07		3 1.91		4 1.80		4 1.69		4 1.53	
G	4 2.30		4 2.14		5 2.05		5 1.88		6 1.78		6 1.62	
H	5 2.34		6 2.23		6 2.08		7 1.95		7 1.80		8 1.68	
I	6 2.37		7 2.25		8 2.13		8 1.96		9 1.83		10 1.70	
J	9 2.45		9 2.29		10 2.16		11 2.01		12 1.88		14 1.75	
K	12 2.49		13 2.35		14 2.21		16 2.07		17 1.93		19 1.79	
L	17 2.54		19 2.41		21 2.27		23 2.12		25 1.97		28 1.84	
M	20 1.17		24 0.964		27 0.737		38 0.770		56 0.803			
N	25 1.42		29 1.21		33 0.995		38 0.770		56 0.803			
P	36 1.46		42 1.24		49 1.03		56 0.803					

NOTE 1. All AQL values are in percent defective.

NOTE 2. The code letters and inspection levels in this standard correspond to those given in BS 6001; they are *not* identical with those given in MIL STD 414.

NOTE 3. Symbols

There is no suitable sampling plan in this area; use the first sampling plan below the arrow. This refers to both the sample size and acceptability constant k_s (or k_σ).

The plan given in this area gives a high degree of security but at the expense of a large sample. At the discretion of the responsible authority the next plan above the arrow may be used.



The heavy lines indicate the boundary of the equivalent attribute sampling plans in BS 6001.

Table IV. Values of f for maximum standard deviation (MSD): 's' method (see 13.4)

Sample size		Acceptable quality levels (normal inspection)											
		0.10	0.15	0.25	0.40	0.65	1.00	1.50	2.50	4.00	6.50	10.00	
3									0.436	0.453	0.475	0.502	0.538
4							0.339	0.353	0.374	0.399	0.432	0.472	0.528
5						0.294	0.308	0.323	0.346	0.372	0.408	0.452	0.511
7				0.242	0.253	0.266	0.280	0.295	0.318	0.345	0.381	0.425	0.485
10			0.214	0.224	0.235	0.248	0.261	0.276	0.298	0.324	0.359	0.403	0.460
15	0.188	0.195	0.202	0.211	0.222	0.235	0.248	0.262	0.284	0.309	0.344	0.386	0.442
20	0.183	0.190	0.197	0.206	0.216	0.229	0.242	0.255	0.277	0.302	0.336	0.377	0.432
25	0.180	0.187	0.193	0.203	0.212	0.225	0.238	0.251	0.273	0.297	0.331	0.372	0.426
35	0.176	0.183	0.189	0.198	0.208	0.220	0.232	0.245	0.266	0.291	0.323	0.364	0.416
50	0.172	0.178	0.184	0.194	0.203	0.214	0.227	0.241	0.261	0.284	0.317	0.356	0.408
75	0.168	0.174	0.181	0.189	0.199	0.211	0.223	0.235	0.255	0.279	0.310	0.348	0.399
100	0.166	0.172	0.179	0.187	0.197	0.208	0.220	0.233	0.253	0.276	0.307	0.345	0.395
150	0.163	0.170	0.175	0.185	0.193	0.206	0.216	0.230	0.249	0.271	0.302	0.341	0.388
200	0.163	0.168	0.175	0.183	0.193	0.203	0.215	0.228	0.248	0.269	0.302	0.338	0.386
	0.10	0.15	0.25	0.40	0.65	1.00	1.50	2.50	4.00	6.50	10.00		
Acceptable quality levels (tightened inspection)													
		0.10	0.15	0.25	0.40	0.65	1.00	1.50	2.50	4.00	6.50	10.00	
Acceptable quality levels (reduced inspection)													

NOTE. The MSD is obtained by multiplying the factor f by the difference between the upper specification limit U and lower specification limit L , i.e. $MSD = f(U-L)$.

The MSD serves as a guide for the magnitude of the estimate of lot standard deviation when using plans for the double specification limit case, based on the estimate of lot standard deviation of unknown variability. The estimate of lot standard deviation, if it is less than the MSD, helps to ensure, but does not guarantee, lot acceptability.

B

Table V-B. Tables for sample size code letter B

Chart B. Operating characteristic curves for single sampling plans

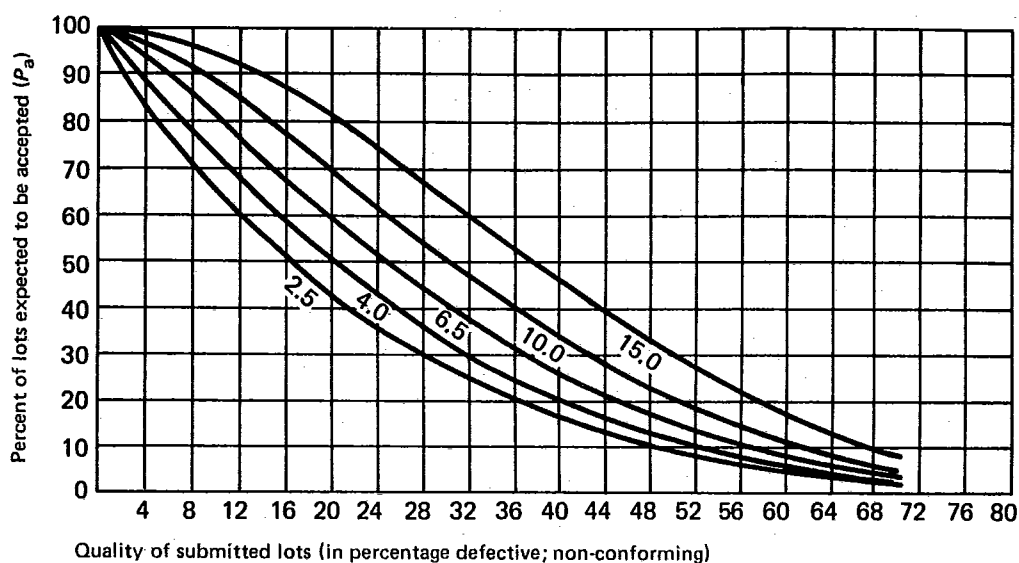


Table V-B-1. Tabulated values for operating characteristic curves for single sampling plans

P_a	Acceptable quality level (normal inspection)											P_a
	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10.0	
99.0								0.18	0.44	1.07	2.28	99.0
95.0								1.04	1.89	3.52	6.02	95.0
90.0								2.26	3.65	6.03	9.39	90.0
75.0								6.66	9.18	12.95	17.71	75.0
50.0								16.68	20.30	25.22	30.97	50.0
25.0								32.40	36.35	41.45	47.14	25.0
10.0								49.34	52.88	57.24	62.08	10.0
5.0								59.45	62.44	66.20	70.30	5.0
1.0								75.99	77.93	80.34	82.98	1.0
	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10.0	
	Acceptable quality level (tightened inspection)											

BS 6002 : 1979

C

Table V-C. Tables for sample size code letter C

Chart C. Operating characteristic curves for single sampling plans

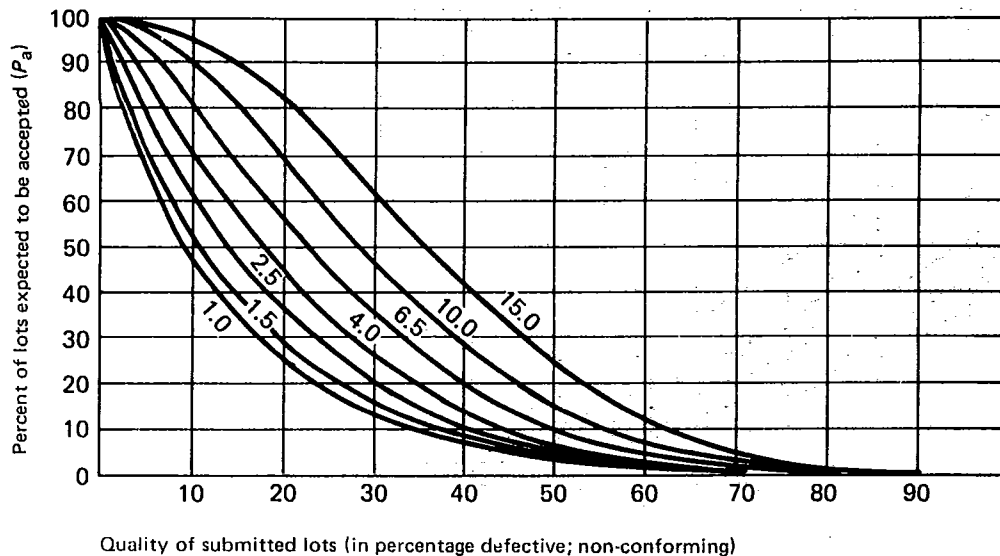


Table V-C-1. Tabulated values for operating characteristic curves for single sampling plans

P_a	Acceptable quality level (normal inspection)											P_a
	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10.0	
99.0							0.13	0.32	0.69	1.55	3.05	99.0
95.0						0.44	0.69	1.32	2.29	4.13	6.85	95.0
90.0						1.02	1.48	2.53	3.98	6.51	10.00	90.0
75.0						3.36	4.37	6.37	8.81	12.61	17.35	75.0
50.0						9.52	11.28	14.44	17.93	22.89	28.61	50.0
25.0						20.81	23.11	27.00	31.02	36.43	42.37	25.0
10.0						34.88	37.26	41.15	45.05	50.13	55.55	10.0
5.0						44.29	46.53	50.14	53.72	58.33	68.20	5.0
1.0						61.76	63.48	66.23	68.95	72.37	75.98	1.0
	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10.0	
	Acceptable quality level (tightened inspection)											

Table V-D. Tables for sample size code letter D

Chart D. Operating characteristic curves for single sampling plans

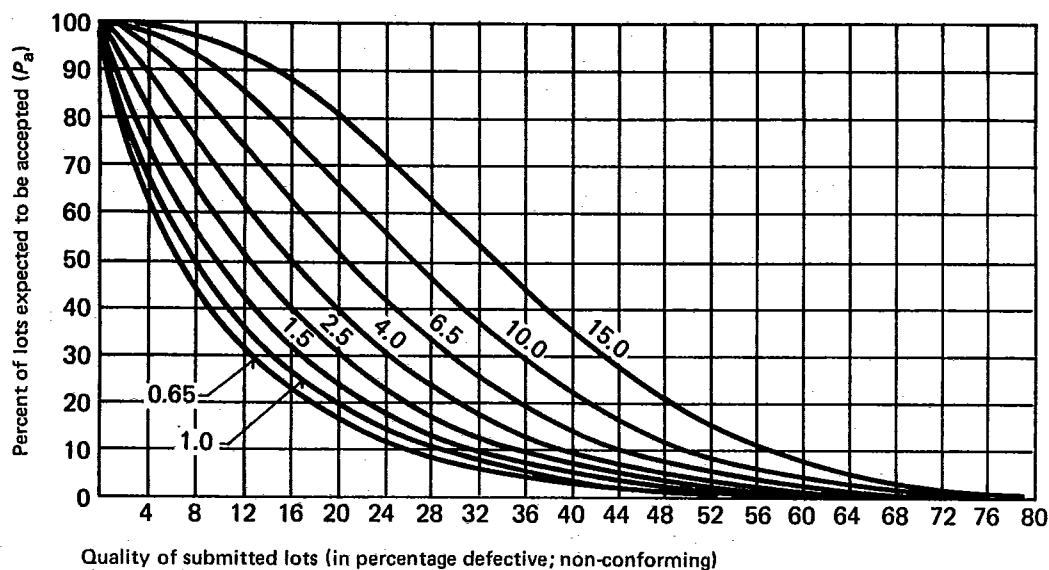


Table V-D-1. Tabulated values for operating characteristic curves for single sampling plans

P_a	Acceptable quality level (normal inspection)												P_a
		0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10.0	
99.0						0.04	0.09	0.18	0.40	0.84	1.79	3.44	99.0
95.0						0.28	0.46	0.77	1.38	2.43	4.30	7.11	95.0
90.0						0.64	0.98	1.51	2.48	3.99	6.49	10.00	90.0
75.0						2.15	2.93	4.02	5.78	8.23	11.89	16.55	75.0
50.0						6.34	7.82	9.71	12.47	15.97	20.75	26.40	50.0
25.0						14.64	16.79	19.36	22.88	27.06	32.43	38.46	25.0
10.0						25.94	28.40	31.24	34.98	39.25	44.55	50.32	10.0
5.0						34.06	36.52	39.33	42.97	47.06	52.06	57.42	5.0
1.0						50.47	52.63	55.04	58.11	61.51	65.57	69.89	1.0
	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10.0		
Acceptable quality level (tightened inspection)													

BS 6002 : 1979

E

Table V-E. Tables for sample size code letter E

Chart E. Operating characteristic curves for single sampling plans

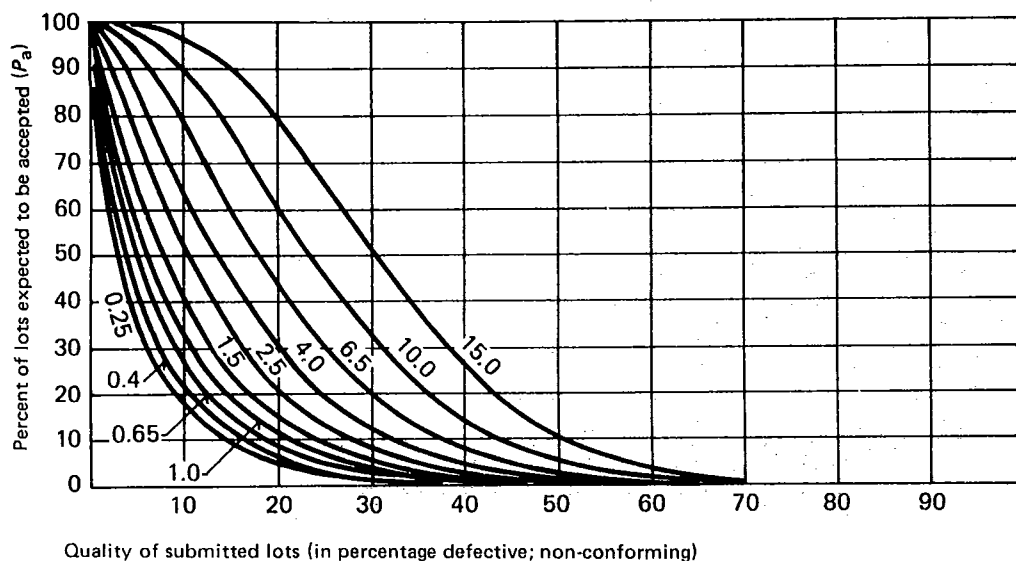


Table V-E-1. Tabulated values for operating characteristic curves for single sampling plans

P_a	Acceptable quality level (normal inspection)												P_a
		0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10.0	
99.0				0.02	0.03	0.07	0.14	0.25	0.53	1.09	2.19	4.04	99.0
95.0				0.11	0.18	0.32	0.53	0.83	1.50	2.65	4.57	7.46	95.0
90.0				0.25	0.40	0.64	1.01	1.48	2.47	4.04	6.50	9.99	90.0
75.0				0.90	1.27	1.83	2.58	3.47	5.15	7.56	11.00	15.49	75.0
50.0				2.89	3.72	4.83	6.18	7.69	10.28	13.66	18.11	23.53	50.0
25.0				7.38	8.80	10.57	12.60	14.71	18.11	22.27	27.41	33.35	25.0
10.0				14.42	16.33	18.60	21.09	23.58	27.43	31.93	37.28	43.25	10.0
5.0				20.09	22.20	24.65	27.29	29.88	33.82	38.33	43.60	49.38	5.0
1.0				33.10	35.32	37.83	40.45	42.95	46.72	50.89	55.64	60.73	1.0
	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10.0		
Acceptable quality level (tightened inspection)													

Table N-F. Tables for sample size code letter F

Chart F. Operating characteristic curves for single sampling plans

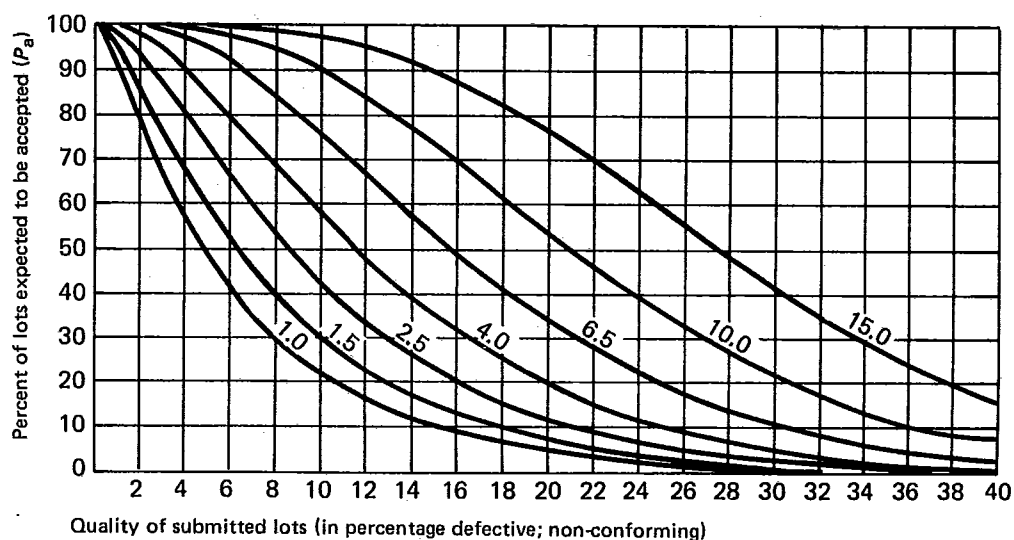
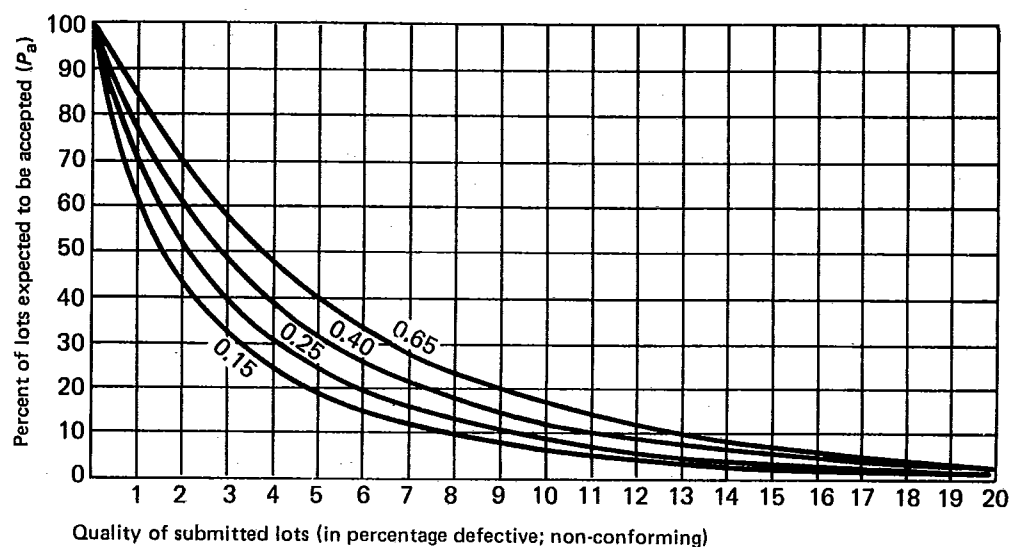


Table V-F-1. Tabulated values for operating characteristic curves for single sampling plans

P_a	Acceptable quality level (normal inspection)											P_a
	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10.0	
99.0		0.01	0.03	0.05	0.11	0.19	0.35	0.69	1.35	2.62	4.69	99.0
95.0		0.07	0.12	0.21	0.36	0.57	0.94	1.65	2.83	4.84	7.81	95.0
90.0		0.15	0.25	0.40	0.66	0.98	1.52	2.50	4.04	6.52	10.01	90.0
75.0		0.49	0.74	1.08	1.61	2.21	3.15	4.70	6.93	10.25	14.60	75.0
50.0		1.53	2.08	2.79	3.77	4.82	6.33	8.62	11.69	15.91	21.09	50.0
25.0		3.93	4.95	6.16	7.72	9.29	11.41	14.45	18.25	23.20	28.96	25.0
10.0		7.95	9.44	11.15	13.23	15.23	17.84	21.40	25.66	30.99	36.98	10.0
5.0		11.40	13.17	15.13	17.47	19.68	22.49	26.27	30.68	36.09	42.06	5.0
1.0		20.10	22.24	24.53	27.18	29.58	32.59	36.50	40.92	46.18	51.82	1.0
	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10.0	
Acceptable quality level (tightened inspection)												

G

Table V-G. Tables for sample size code letter G

Chart G. Operating characteristic curves for single sampling plans

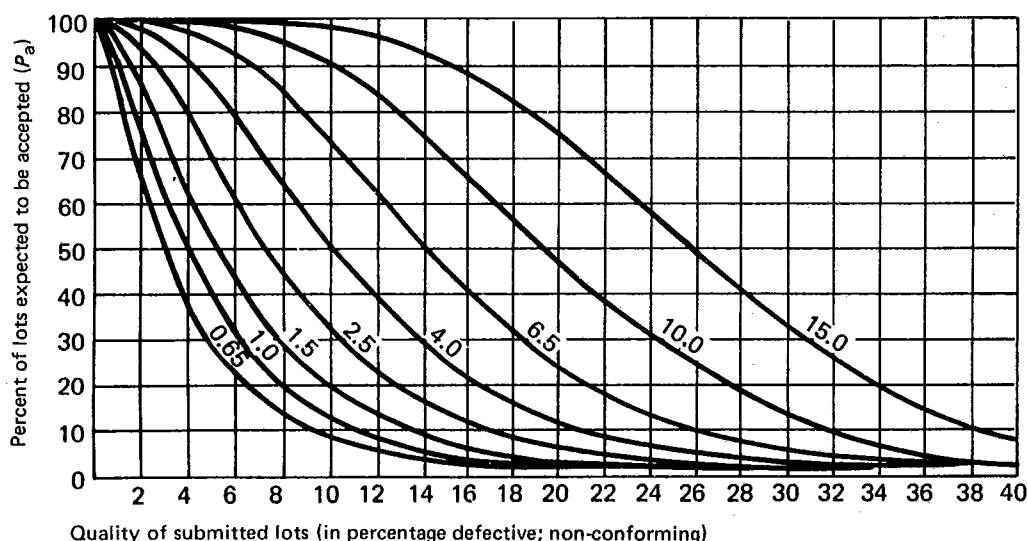
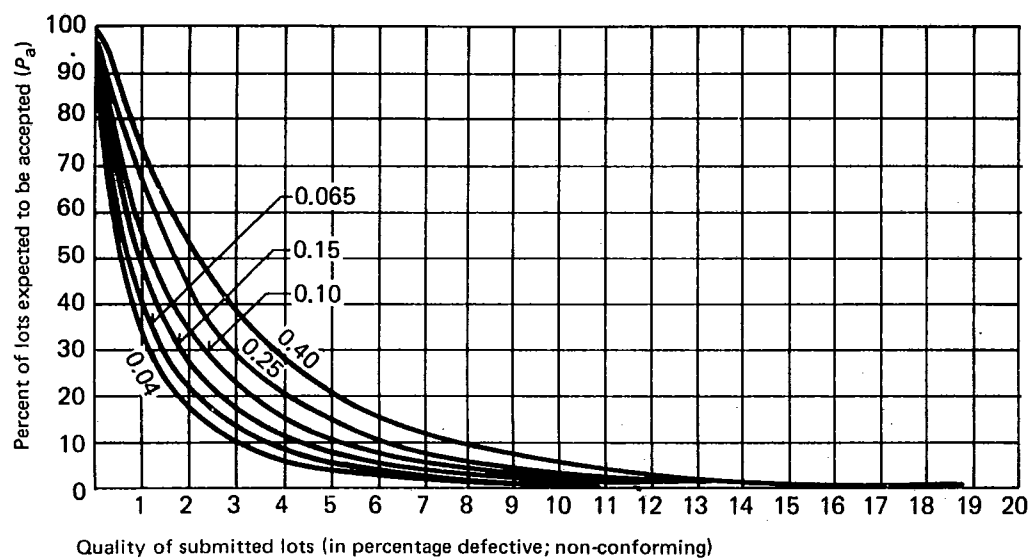


Table V-G-1. Tabulated values for operating characteristic curves for single sampling plans

P_a	Acceptable quality level (normal inspection)												P_a
		0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10.0	
99.0	0.01	0.01	0.02	0.04	0.08	0.17	0.28	0.49	0.96	1.71	3.23	5.58	99.0
95.0	0.03	0.06	0.09	0.15	0.25	0.45	0.68	1.09	1.91	3.09	5.30	8.41	95.0
90.0	0.07	0.11	0.17	0.26	0.43	0.72	1.06	1.61	2.67	4.14	6.76	10.30	90.0
75.0	0.22	0.32	0.45	0.65	0.98	1.50	2.07	2.94	4.49	6.50	9.83	14.09	75.0
50.0	0.67	0.90	1.17	1.57	2.20	3.09	3.99	5.32	7.51	10.15	14.27	19.25	50.0
25.0	1.73	2.18	2.67	3.38	4.41	5.77	7.09	8.92	11.77	15.02	19.84	25.38	25.0
10.0	3.58	4.31	5.07	6.13	7.58	9.41	11.12	13.38	16.77	20.48	25.76	31.63	10.0
5.0	5.27	6.19	7.13	8.40	10.11	12.22	14.13	16.63	20.28	24.20	29.67	35.63	5.0
1.0	9.91	11.18	12.45	14.11	16.24	18.76	21.00	23.83	27.82	31.97	37.57	43.50	1.0
Acceptable quality level (tightened inspection)													
	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10.0		