Note. Increase in the rejection risk means smaller AQL values and/or lower probability of acceptance.

3.4 It is important that, during acceptance inspection, stress is laid on the fitness of the fasteners to perform their intended function. Complaints may only be made if the defects impair the intended function or use of the fasteners. The customer shall give the supplier the opportunity of verifying defects discovered.

If at the time of inspection the proposed use of the fastener is not known (this applies for example to parts taken from stock), then any deviation from the limiting values (e.g. tolerances) specified may be regarded as impairing the function or use.

3.5 A rejected lot of fasteners shall not be presented for renewed inspection unless the defect has been rectified or the lot sorted out (see subclause 5.5).

Note. If such rectification could impair the intended function or use, it requires prior consent of the customer.

3.6 Gauges and measuring instruments used for inspection shall determine only those fasteners to be unacceptable whose dimensions or properties are not within the specified limits.

In case of doubt, the final decision should be based on direct measurements.

3.7 Even if the lot complies with the acceptance conditions of this standard, complaints may be made about individual fasteners that do not comply with the specifications agreed upon.

4 Concepts

The following definitions shall apply for the purpose of this standard; they are based on ISO 3534.

4.1 Acceptance inspection

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

4.2 Supplier

The manufacturer of the fasteners or a dealer or representative who supplies these fasteners.

4.3 Customer

The receiver or his representative who accepts these fasteners. The receiver is not necessarily the final user of the fasteners.

4.4 Inspection lot

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

4.5 Lot size (N)

The number of fasteners contained in a lot.

4.6 Sample

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

4.7 Sample size (n)

The number of fasteners in a sample.

4.8 Characteristic

A dimensional element, a mechanical or other recognizable property of a part, for which limits are specified, e.g. head height, shank diameter, tensile strength or hardness.

4.9 Major characteristic

A characteristic which, if defective, is likely to result in a failure or to reduce materially the usability of the fastener for its intended purpose.

4.10 Minor characteristic

A characteristic that, if defective, is not likely to reduce materially the usability of the fastener for its intended purpose, or that, in the case of departure from the specified requirements, has only little bearing on the effective use or operation of the fastener.

4.11 Defect

Any deviation of a characteristic of a fastener from the specification given in a standard or an ordering document (e.g. a drawing) to which it should be produced.

4.12 Defective part

A fastener with one or more defects.

4.13 Acceptance number (A_c)

The maximum number of defects in any given sample that still allows acceptance of the lot.

4.14 Sampling plan

A plan in accordance with which a sample is taken, in order to obtain information and to reach a decision on the acceptance of the lot.

4.15 Acceptable quality level (AQL)

A quality level which, in a sampling plan, corresponds to a specified, relatively high probability of acceptance.

4.16 Limiting quality (LQ)

A quality level which, in a sampling plan, corresponds to a specified, relatively low propability of acceptance. The limiting quality LQ_{10} is the percentage of defects of a characteristic of submitted products that has a 10% probability of being accepted when a sampling plan is used. This also counts as the customer's risk.

4.17 Supplier's risk

The degree of probability that a lot will not be accepted which complies with the requirements and whose quality level corresponds to the appropriate AQL value, when a sampling plan is used.

4.18 Probability of acceptance (L)

The probability that a lot which contains a certain number of defective parts cannot be rejected as a whole on the basis of a sampling plan.

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

5.1 Find the description of the fasteners to be inspected for dimensional characteristics in table 1 and note the associated AQL values. For mechanical properties, note the characteristics to be inspected and the associated AQL values to be obtained from table 3.

5.2 The appropriate ratio LQ_{10}/AQL shall be chosen by the customer in accordance with subclause 3.3. See table 2 for examples.

Note 1. Multiplying this ratio by the AQL value gives the LQ_{10} value. This value shall be selected in accordance with the function or use of the fastener. For more important functions or applications, the LQ_{10} value may be smaller; however, this requires greater sample sizes and will involve higher inspection costs. The scope of the acceptance inspection of fasteners from known sources of supply, where continuous in-process control is carried out, may be reduced by selecting a greater LQ_{10} value, if previously inspected lots have shown compliance with the requirements. It may be necessary to take fasteners from different points in the inspection lot, and, by doing so, to increase the proportion of fasteners inspected, if the lot cannot be presumed to be uniform or is not from one manufacturer. The ratio LQ_{10}/AQL used shall be within the sole judgement of the customer.

Note 2. The examples of sampling plans given in table 2 are determined by the choice of the AQL value and the customer's risk (LQ_{10}).

The selection of these two parameters also determines the sample size and the acceptance number. Hence the lot size/sample size relationship as given in table 1 of DIN 40 080, April 1979 edition, which is intended to apply only in the case of production of a continuous series of lots is not appropriate. Table 2 can, however, be applied to such a case by selecting a suitable LQ_{10} value in the case of production of a continuous series of lots and for isolated lots.

In case of dispute between customer and supplier, a sampling plan shall be chosen according to which the supplier's risk is not higher than that specified in subclause 3.3.

5.3 The AQL value and the ratio LQ_{10}/AQL determine the sample size and the acceptance number given in table 2.

5.4 The sample shall be selected in accordance with subclause 4.6. Acceptance inspection shall be carried out separately for each characteristic, the number of defects determined and the whole lot accepted, if the total number of defects per characteristic is equal to or less than the acceptance number.

5.5 If a lot does not comply with the requirements, then a suitable further treatment shall be agreed between the customer and the supplier (see subclause 3.5).

5.6 The samples for the tensile test (see table 3) should, where possible, be those used for the hardness test, with the lowest and/or highest hardness values. (The tensile test, being destructive, requires fewer samples than the non-destructive hardness test).

The proof load test is regarded as a destructive test.

Examples:

1. Inspection of threads of hexagon grade A bolts of a supplier well known for his steady quality; a ratio LQ_{10}/AQL of 6,2 is applicable:
   AQL: 1,0; sample size: 80;
   acceptance number A_c: 2.
2. Inspection of the driving media of hexagon socket head screws of an unknown supplier; the ratio LQ_{10}/AQL is to be lowered to 3,1:
   AQL: 1,0; sample size: 500;
   acceptance number A_c: 10.
3. Inspection of mechanical properties
   Proof load test for nuts; see footnote 2 of table 2.
   AQL: 1,5; sample size: 8;
   acceptance number A_c: 0.

Table 1. Dimensions

National note. Table 1 of the ISO Standard is not applicable and has, therefore, been included in the Explanatory notes for editorial reasons.

Characteristic	AQL value
Major characteristics: thread limit dimensions (accuracy to gauge) driving media for mounting radius under head	1,0
Minor characteristics, e.g. lengths (length of screws, length of thread), geometrical tolerances, support surfaces, heights (height of head, height of nuts), diameters	1,5

Table 2. **Examples of sampling plans** 1)

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

1) All the figures in this table have been taken from ISO 2859 (= DIN 40 080).
2) Samples with an acceptance number $A_c = 0$ shall only be used for the inspection of mechanical properties.
3) If the lot size is smaller than the sample size, 100 % inspection shall be carried out.

Sample sizes in brackets are for information only.

Table 2a. **Sample sizes for destructive testing of mechanical properties**

Number of units inspected (inspection lot)		Sample size
from	to	
–	200	1
201	400	2
401	800	3
801	1200	4
1201	1600	5
1601	3000	6
3001	3500	7

Where proof can be provided that the bolts or screws originate from one melt, the inspection of 4 lots will suffice, independent of the number of units.
Note: It is intended that this table be included in the instruction sheets dealing with bolts, screws and nuts published by the *Vereinigung der Technischen Überwachungsvereine* (Association of Technical Control Boards).

Table 3. **Mechanical properties**

Characteristic 1), 6) (see ISO 898 2), ISO 3506 and ISO 6157	Carbon steel and alloy steel				Stainless steel		
	Socket screws, bolts, screws and studs	Nuts	Slotted head screws, cross recessed head screws	Self-tapping screws, thread forming screws	Screws		Nuts
					up to and including M 5	over M 5	
	AQL value						
Tensile strength	1,5	–	1,5	–	1,5	1,5	–
Hardness 4)	0,65	–	–	–	–	0,65 3)	0,65 3)
Stress at 2 % permanent strain	1,5	–	–	–	–	1,5	–
Elongation at break 3)	–	–	–	–	–	1,5	–
Stress under proof load 3)	–	1,5	–	–	–	–	1,5
Stress under wedge loading	1,5	–	–	–	–	–	–
Surface discontinuities 4)	0,65	0,65	0,65	0,65	–	–	–
Decarburization (for property classes ≥ 8.8)	1,5	–	–	–	–	–	–
Screwing test	–	–	–	1,5	–	–	–
Torque test	–	–	–	1,5	1,5	–	–
Widening test		1,5	–	–	–	–	–

1) Other properties (characteristics) can be tested in accordance with the relevant standards, e.g. screwing torques for prevailing torque type nuts.
2) Only for test programme B in accordance with ISO 898 Part 1.
3) For all destructive tests, use sample size 8, $A_c = 0$.
4) For the non-destructive hardness and surface discontinuities tests, use sample size 20, with $A_c = 0$.
5) Where applicable, according to the steel standards concerned.
6) In addition, reference is made to the following Standards: DIN 267 Part 4, Part 11, Part 12, Part 15, Part 18 to Part 21 and Part 23 to Part 25 and ISO 898 Part 5.

Standards referred to

ISO 898/1 Mechanical properties of fasteners. Part 1: Bolts, screws and studs *)
ISO 898/2 Mechanical properties of fasteners. Part 2: Nuts with specified proof load values
The other standards of the ISO 898 series are also applicable.
ISO 2859 Sampling procedure and tables for inspection by attributes *)
ISO 3506 Corrosion-resistant stainless steel fasteners; specifications
ISO 3534 Statistics; vocabulary and symbols *)
ISO 4759/1 Tolerances of fasteners. Part 1: Bolts, screws and nuts with thread diameters ≥ 1,6 and ≤ 150 mm and product grades A, B and C
ISO/DIS 6157/1 Fasteners; surface discontinuities. Part 1: M 5 to M 39 bolts, screws and studs
ISO/DIS 6157/2 Fasteners; surface discontinuities. Part 2: M 5 to M 39 nuts

*) Obtainable from: *Auslandsnormenvermittlung im DIN*, Burggrafenstraße 6, D-1000 Berlin 30.

Standards referred to in the national addenda

DIN	267 Part 4	Fasteners; technical delivery conditions; property classes for nuts (previous classes)
DIN	267 Part 11	Fasteners; technical delivery conditions, with addenda to ISO 3506; corrosion-resistant stainless steel components
DIN	267 Part 12	Bolts, screws, nuts and similar threaded and formed parts; technical delivery conditions; self-tapping screws
DIN	267 Part 15	Fasteners; technical delivery conditions; prevailing torque type nuts
DIN	267 Part 18	Fasteners; technical delivery conditions; non-ferrous metal components
DIN	267 Part 19	Fasteners; technical delivery conditions; surface discontinuities on bolts
DIN	267 Part 20	Fasteners; technical delivery conditions; surface discontinuities on nuts
DIN	267 Part 21	Fasteners; technical delivery conditions; widening test on nuts
DIN	267 Part 23	Fasteners; technical delivery conditions; property classes for nuts with fine thread (ISO classes)
DIN	267 Part 24	Fasteners; technical delivery conditions; property classes for nuts (hardness classes)
DIN	267 Part 25	(at present at the stage of draft) Fasteners; technical delivery conditions; torsional test for M 1 to M 10 screws
DIN 40 080		Sampling procedures and sampling plans for inspection by attributes
ISO	898 Part 1	Mechanical properties of fasteners; bolts screws and studs
ISO	898 Part 2	Mechanical properties of fasteners; nuts with specified proof load values
ISO	898 Part 5	Mechanical properties of fasteners; set screws and similar threaded fasteners not under tensile stresses
ISO 4759 Part 1		Tolerances for fasteners. Part 1: Bolts, screws and nuts with thread diameters $\geq 1{,}6$ and ≤ 150 mm and product grades A, B and C

Previous editions

DIN 266: 03.31x; DIN 589: 07.31, 01.34; DIN Kr 550: 03.36; DIN 267 Part 1 and Part 2: 04.37; DIN 267: 06.40, 01.43, 01.54, 12.60; DIN 267 Part 5: 04.68, 01.84

Amendments

The following amendments have been made in comparison with the January 1984 edition.

The content of the standard has been aligned with International Standard ISO 3269 – 1984. See Explanatory notes.

Explanatory notes

Standard DIN 267 Part 5 issued in January 1984 was based on the draft specifications of International Standard ISO 3269 which had found international acceptance but had not yet been published. As there was an urgent domestic requirement for a revised edition of DIN 267 Part 5, May 1968 edition, the delay involved in the publication of the ISO Standard was considered too long. When ISO 3269 was published in the course of 1984, there was a closer conformity between its final specifications and those laid down in DIN 267 Part 5. Thus, the present revision of DIN 267 Part 5 is of editorial nature, and the standard is now a modified version of ISO 3269.

This edition incorporates ISO 3269 without any substantial amendments. For better comprehension of DIN 267 Part 5, the Explanatory notes of the January 1984 edition have been retained without amendments.

a) Differences in comparison with ISO 3269 – 1984:

- In the "Concepts" clause, the definitions were so worded as to conform to ISO 3534 and ISO 3269, while being abridged and simplified to fit the scope of DIN 267 Part 5.
- Table 1 giving the AQL values for dimensional characteristics was changed as compared to the ISO Standard: The AQL values given in the previous edition of DIN 267 Part 5 have been retained. Product grades and/or property classes were not differentiated by the AQL values but by the tolerances allocated to the product grades or by the values that were specified for the mechanical properties allocated to the property classes. Table 1 of ISO 3269 has, in essence, the following content.

b) Amendments in comparison with the April 1968 edition of DIN 267 Part 5:

The general requirements and the inspection procedure as specified in the revised edition correspond to the previous edition of the standard.

Although the general requirements were restructured and slightly reworded in the international discussions, their material content was not changed. The definitions of all concepts retained have been adopted in an abbreviated form under clause 4.

The following were changed in comparison with the April 1968 edition.

- The double check for (individual) defects and for defective pieces has been omitted; only the individual characteristics with the AQL values unchanged are now to be inspected. The inspection procedure has been explained by examples given in notes.

Table 1. **Dimensions**

Characteristics 1)	Product group					
	Socket screws, grades A and B bolts and screws, studs	Grade C bolts and screws 2)	Nuts assigned to property classes ≥ 8 3)	Nuts assigned to property classes < 8 3)	Slotted head screws, cross recessed head screws	Self-tapping screws, thread forming screws
	AQL 4)					
Major characteristics						
Width across flats	1,0	1,5	1,0	1,5	1,5	1,5
Width across corners	1,0	1,5	1,0	1,5	–	1,5
Width of slot or socket	1,0	–	–	–	1,5	1,5
Depth of slot or socket	1,0	–	–	–	1,5	1,5
Depth of recess	–	–	–	–	1,5	1,5
Radius (transition) under screw head	1,5	–	–	–	–	–
Thread limits GO thread gauge	1,0	1,5	1,5	1,5	1,5	1,5
Thread limits Not GO thread gauge	1,0	1,5	2,5	2,5	1,5	–
Major thread diameter	–	–	–	–	–	2,5
Minor characteristics						
All other characteristics	2,5	4,0	2,5	4,0	4,0	4,0

1) Characteristics shall be individually assessed.
2) The product grades refer to the accuracy of the products and to the size of the tolerances. Product grade A has the closest tolerances and product grade C the widest (see ISO 4759/1).
3) For property class for nuts, see ISO 898/2.
4) For hot formed parts use an AQL value of 2,5. These parts shall be submitted for inspection separately.

– The radius under the screw head has been added as a further major characteristic, the number and type of minor characteristics remaining unchanged.
– The most important amendments made are the examples of sampling plans given in table 2. These do not assign the samples to the lot sizes, but they give the ratio LQ_{10}/AQL and the supplier's risk. By multiplying the ratio LQ_{10}/AQL by the different AQL values, the risk of importance for the user (LQ_{10}) associated with the different sample sizes can be found. It is up to the user which sampling plan (involving different sample sizes and corresponding testing costs) he uses for the acceptance inspection. The sample size which is most suitable can be selected in accordance with the different requirements. If there is no agreement differing from the standard, then the supplier's risk is limited to 5 % for dimensions and to 12 % for mechanical properties, for referee cases concerning the acceptance or rejection of a lot.
– The April 1968 edition did not include any data on the mechanical properties to be tested. They are now listed in full in table 3, together with AQL values that were not to be found in table 5 of the previous edition. The dimensions and mechanical properties are therefore to be tested taking into account the specified customer's and supplier's risk. The slightly larger sample sizes can be justified both for technical and economical reasons by the more accurate results which can be achieved in this way.
– The reasons for these amendments are given in a detailed article on the draft DIN Standard, issued in June 1982, to be found in *DIN-Mitteilungen* 61, 1982, No. 7, pp. 409–413, entitled: "Progress through standardization: International standard for acceptance inspection of fasteners" by C. O. Bauer.

c) Instructions for users

Defective parts cannot be prevented from occurring in mass production. In particular, larger lots may therefore occasionally contain some defective parts. Technical specifications do not generally demand that these parts be sorted out, a procedure which is any case difficult and uneconomic.

Each defective part, the defect in which may adversely affect its intended use to a more than negligible extent may give rise to complaint.

If the customer tests each unit and therefore the total delivery, he will sort out the defective parts and can make a complaint if necessary. In these cases, the procedures and AQL values specified in DIN 267 Part 5 cannot be used.

Larger lots are usually inspected by the customer by random sampling only. The results of random inspection permit a conclusion as to the actual number of defective parts present in a lot, the degree of probability of the correctness of such conclusion depending on the sample size.

It is the purpose of this standard to specify objective criteria for deciding in what circumstances a complaint may be raised about a whole lot, without knowing the precise proportion of defects in the lot. This is intended to protect the supplier against complaints about those inspection lots in which the proportion of defects is small (smaller than the AQL value), but where it has been incorrectly indicated as too large by unsuitable sampling inspections (e.g. as a result of too small sample sizes).

The standard therefore specifies quality limits (AQL values) and gives sampling plans, where the supplier's risk of 5 % for dimensions and 12 % for mechanical properties of lots with a proportion of defects equal to the AQL value is not exceeded.

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

The customer can therefore match the scope of inspection with the functional requirements and with his experience of previous lots from the same supplier (case history). The greater the sample size, i.e. the nearer the LQ value of the sampling plan is to the AQL value, the greater the probability of recognizing lots where the proportion of defects appreciably exceeds the AQL value, but the greater, too, the effort and expense involved. This system permits the customer to select that scope of inspection which is best suited to his need.

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

Each sampling plan is described by its operating characteristic, OC (see figure 1). It gives the probability of acceptance in a sampling inspection as a function of the actual proportion of defects in the inspection lot. The points on the operating characteristic indicating a 95 % probability of acceptance and a 10 % probability of rejection have been selected for this standard to determine suitable sampling plans. The 95 % point of the operating characteristic is required to be equal to or greater than the given AQL value. The 10 % point of the operation characteristic (LQ value) is to be selected by the customer at his own discretion. The LQ value corresponds to the proportion of defective units in inspection lots on the grounds of which a complaint will, with high (90 %) probability, be made.

The standard includes table Z for users having no sampling system of their own. The LQ_{10} value is to be calculated from this table by multiplying the ratio LQ_{10}/AQL by the AQL value.

Sampling inspection is used to decide on the acceptance or rejection of the whole lot. That does not affect complaints about individual defective parts which are still possible, even if the lot as a whole was accepted.

During the discussions on AQL values, it was generally accepted that it was generally uneconomical for the customer to make complaints about dimensional defects amounting to less than 5 % of the lot, and defective mechanical properties amounting to less than 12 %. The AQL values and the supplier's risk specified in this standard shall therefore only be considered parameters for determining suitable sampling plans. The quality of fasteners manufactured is usually better than the AQL value.

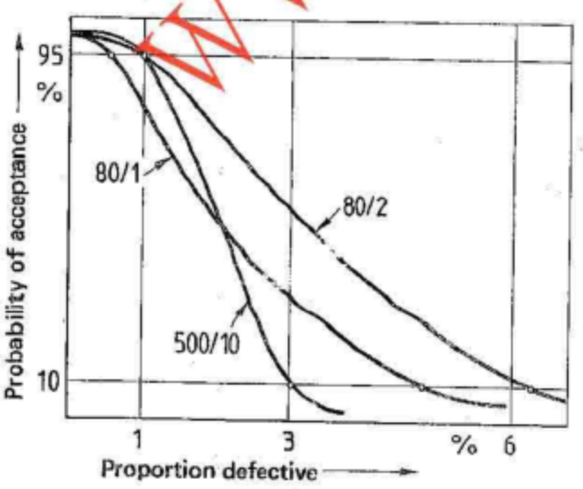

Figure 1. Operating characteristics for sampling plans
In this graph, sampling plans 80/2 and 500/10 are permitted for AQL = 1,0, whereas 80/1 is not.

Re clause 3

The manufacturer tests his products at his own discretion, using the means and processes which seem appropriate to him, according to his knowledge of the relationship between manufacturing processes, materials, types of screws and nuts and the frequency of defects. He is not obliged to use the processes and tests described in this standard either in manufacture of in final inspection, if he can produce the same result using different means and processes.

The customer may use any test which appears suitable to him. However, a more severe test (lower AQL values or lower probability of acceptance) may only be used as the basis for a decision on complaints about an inspection lot, if such a deviation from this standard was expressly agreed at the time of ordering.

Some deviations from tolerances or limits specified have no adverse effects either on the function or on the use of the fasteners, and no complaints should be made about these, in accordance with subclause 3.4. For example, the ISO thread tolerances provide for an amount of play, to allow galvanic coatings to be applied without adverse effect on the functioning of the treads. If the upper limit of the effective bolt thread diameter is exceeded slightly, and it is known that this thraed will not be coated, this deviation can have no adverse effects on the function or the use of the screws and no complaint may be made. For further details, see "Inspection sampling and complaint clauses in technical delivery conditions" by G. Henzold in *DIN-Mitteilungen* 57, 1978, No. 12, pp. 697–701.

The different measurement and inspection procedures shall not qualify a part as defective, regardless of their type and the use of gauges or measuring instruments, if the actual values still lie within the specified limits. The standards dealing with inspection and measurement procedures specify how this principle is to be realized in individual methods and for individual items of test equipment. For referee purposes, the effect of the uncertainty of inspection procedures and measuring equipment is to be included in the assessment of the results of inspection and measurement.

Re clause 5

The classification into major and minor characteristics was made in accordance with the major functions of screws and nuts. Other classifications may be agreed at the time of ordering. However, these may possibly increase the manufacturing costs.

Properties for which no limits are specified in the standards of the DIN 267 series or in other standards, e.g. ISO 898 Parts 1 and 2, or in the dimensional standards, may be important in individual cases. In order to avoid misunderstandings, permissible limiting values and/or limit specimens shall be exchanged at the time of ordering.

Inspection of mechanical properties, materials and coatings involves complicated and expensive procedures. In order to minimize such costs, fasteners of the same type, property class, design or made from the same material, which, for example, differ only in length, may be treated as being of the same type.

Minimum values have been specified for the greater part of the properties to be assessed. If defects are found, then, depending on the function of the part and the deviation from the limits determined, in individual cases an agreement may have to be made between the supplier and the customer regarding acceptance, rejection or further machining or processing, on the basis of additional inspections having been carried out before.

Recording of test results from various lots supplied by a manufacturer over an appropriate period gives a statistically representative picture of the quality level of this manufacturer. It is therefore recommended that the results of non-destructive and destructive tests should be recorded regularly, so as to provide reliable figures for the assessment of the quality level of the individual manufacturer.

The distinction between destructive and non-destructive testing is based on whether it is possible to use the specimens after the test. In hardness testing, only small parts of the surfaces are ground off, which does not usually adversely affect the usefulness of the samples. The hardness test is therefore regarded as being non-destructive.

International Patent Classification

F 16 B 33-00
G 01 M 13/00