bruni glass
a berlin packaging company

QUALITY SUPPLY SPECIFICATIONS
(TERMS, DEFINITIONS, METHODS)

SUPPLY SPECIFICATIONS
FOR FOOD BOTTLES AND JARS

FOOD - OIL - SPIRITS

GENERAL CONDITIONS

1. DEFINITION

These specifications establish the quality parameters of the supply agreement/contract with the aim of facilitating the Customer-Supplier relationship. For each type of defect, they set out the minimum levels of quality that are acceptable to the Customer together with the control methods the Supplier needs to carry out in order to guarantee them.

2. CONTAINER DESCRIPTION

Specifically, these specifications define the minimum quality levels for defects that are acceptable to the Customer, with reference to bottles and jars for food use.

3. RESPONSIBILITIES

Where there is clear evidence of defects, Bruni Glass will replace, at its own expense, any consignment that is found defective in accordance with these specifications and following the procedures specified in point 4 below.
Bruni Glass will despatch the goods within 7 days (if in stock) or with the least possible delay if a new product is necessary, and in any case within a maximum of 60 days from the validation of the complaint (except in very exceptional cases where a new glass/colour production cycle is required).
However, the supplier has the option to use the defective products on agreement with the Customer, paying them the additional cost for the percentage of scrap that exceeds the limits stated in these specifications. Clearly, when a claim is submitted it is in both parties' interests to plan and agree on the most efficient, rapid and cost-effective solution in a spirit of reciprocal cooperation.
Bruni Glass deems that an incoming control is an essential prerequisite for the acceptance of a batch and will not, in any case, accept any responsibility for damage caused by breakages, scrap, or losses in production, products and accessories (caps, labels, etc.) that have occurred on the Customer's production line.
Bruni Glass and the Customer may also agree on different A.Q.L. (Acceptance Quality Levels), in the case of formats that cause particular production problems.

3.1 CLEANING

While the Supplier is committed to preventing any risk of contamination during the production and storage phases, it is entirely the filler's responsibility to ensure the hygiene of the product before using it (Law. 155/97).

4. AUDIT

The two parties may agree on a mutual Audit procedure:

- Customer audit of the Bruni Glass Quality System.
- A Bruni Glass audit at the Customer's plant, if it is necessary, in order to find out the methods of use and consequent characteristics required by the products concerned.

5. VALIDITY/ACCEPTANCE

This agreement, signed by both parties - the Customer and Bruni Glass - shall be deemed to be tacitly renewed without any time limit. Any amendment to this agreement must be approved by both Parties.

GENERAL
CHARACTERISTICS

1. CHEMICAL AND PHYSICAL CHARACTERISTICS

1.1 GENERAL REQUIREMENTS

The containers for food use should comply with current EU regulations:

- EC Reg. No. 1935/2004 - on materials and objects destined to come into contact with food products
- EC Reg. No. 2023/2006 - on good production practices for materials and objects destined to come into contact with food products
- Pres. Decree 777/82 and subs. Amendments and updates
- Minis. Decree 21/03/1973 and subs. Amendments and updates
- Law Decree No. 152 dated 3 April 2006 art. 226 (environmental regulations).

1.2 MATERIALS

Items are produced with soda-lime glass Class III (unless otherwise specified).

1.3 SPECIAL TREATMENT

Where applicable, this consists of a treatment with tin or titanium tri-chloride (hot treatment) or with oleic acid or polyethylene (cold treatment).

1.4 LIGHT TRANSMISSION

This varies according to the colour and thickness of the glass; the table below shows the approximate values of glass filtering power:

COLOR OF GLASS	SAMPLE THICHNESS	FILTERING POWER
FLINT	5 mm	12%
HALF GREEN	3 mm	16%
BLUE	3 mm	18 +/- 5%
UVA GREEN	3 mm	87%
ANTIQUE GREEN	3 mm	99%
OAK GREEN	3 mm	64%

AMBER	3 mm	> 99%
EMERALD	3 mm	45 +/- 5%
YELLOW	3 mm	99,5%
GOLD	3 mm	60%

1.5 ANNEALING

The containers are judged to be properly “annealed” when the deformation does not exceed 4 standard deforming disks.

2. TECHNICAL DRAWING

The Supply specifications shall include the Technical Drawings for the items concerned, approved by the Customer. Any change in the dimensions, either required by the Customer or proposed by Bruni Glass, will entail the issue of a new Technical Drawing, which, on approval by the Customer, shall replace the earlier drawing.

The Technical Drawing shall include the following indications:

- code number
- overall dimensional values
- nominal filling level
- brim capacity
- date and approval signature

The Nonconformity of the Article in just one of the Dimensional Values given with tolerance limits will be deemed a Major Defect.

3. PACKAGING

The Supply specifications shall be accompanied by the Packaging Sheet indicating the details of the packaging and palletization. In particular, the following information shall be provided:

- code number
- item description
- type of pallet
- total number of units per pallet
- total number of units per layer
- number of layers
- packaging material used (e.g. plastic or cardboard separators)

4. PALLET LABEL

Labels providing the necessary identification data regarding the packaged product shall be affixed to each pallet, indicating the:

- item code and/or description
- number of pieces per pallet
- progressive number of pallets
- date of production
- place of production

5. QUALITY LIMIT SAMPLES

Quality limit sample is a container which has aesthetic defects to a degree that constitutes the maximum acceptable limit. All quality limit samples represents the Panoply defects range.
Generally, and for private containers in particular, the “Panoply” will be established in the presence of the Customer for the first production or sampling and will be considered to be the aesthetic benchmark for future production.

6. DEFINITION OF BATCH

Glass production is a continuous production cycle; therefore a Production Batch is represented by the total production campaign of the same item, which may last one or more days. During the Delivery phase the “Batch” is represented by the quantity corresponding to a delivery independently of the quantity of the production itself.

DEFINITION
OF DEFECTS

1. DEFECTS CLASSIFICATION

Defects are grouped into three classes, according to their severity:

- **critical defects**: defects that may cause physical injury to the consumer of the product;
- **major defects**: defects that may prevent the container from being used or cause a deterioration of the product;
- **minor defects**: defects of an aesthetic nature that do not affect the functionality of the container or the packaging process for the article.

CRITICAL DEFECTS	
(ACCEPTANCE QUALITY LEVEL) **A.Q.L. = 0.065**	**INSPECTION LEVEL II**
BIRDCAGE/SWING	•
SPIKE, HOT PLUG, STUCK PLUG (INTERNAL)	•
OVERPRESS ON THE FINISH, THAT MAY BREAK	•
STUCK OR LOOSE GLASS INSIDE	•
INTERNAL DIRT NOT RELATE D TO MANUFACTU RING	•

MAJOR DEFECTS	
(ACCEPTANCE QUALITY LEVEL) **A.Q.L. = 2.5**	**INSPECTION LEVEL II**
DIMENSION OUT OF TOLERANCE	•
CAPACITY OUT OF TOLERANCE	•
SEAM ON TOP OR SIDE OF FINISH	•
MALFORMED FINISH	•
SERIOUS DEFORMATIONS	•
THIN GLASS DISTRIBUTION AFFECTING STRENGTH	•
BODY CHECKS	•
SHOULDER AND NECK CHECKS	•
BROKEN OR STRETCHED BLISTERS ON THE FINISH >2 MM	•

MINOR DEFECTS	
(ACCEPTANCE QUALITY LEVEL) **A.Q.L. = 6.5**	**INSPECTION LEVEL II**
WASHBOARDS	•
EXTERNAL DIRT	•
IMPACT MARK	•
PROMINENT MOLD JOINT	•
STONES > 2 MM	•
AIR BUBBLES > 2 MM	•
COLOR	•
ORANGE PEEL	•
IRREGULAR DISTRIBUTION OF GLASS	•

N.B.: Control level II is the average level of standard sampling indicated in Military Standard 105 E, which also indicates Levels I (less restrictive) and III (more restrictive).

STATISTICAL INSPECTION

1. SAMPLING ACCEPTANCE

The sample used for the acceptance controls should be representative of the whole batch. A random selection of the sample will be carried out at various points of the supply in order to respect the uniformity of the batch following the table below:

SAMPLING TABLE	
NO. BATCH PALLETS	**NO. PALLETS TO BE INSPECTED**
0 - 25	5
26 - 36	6
37 - 49	7
50 - 64	8
65 - 81	9
82 - 100	10
N0 > 100	(N)½

Damaged pallets should not be part of the statistical sampling, but should be put aside and sampled separately.
The sample size and the criteria to be followed for acceptance or refusal of the batch are those described in Military Standard 105 E:
Level II General Inspection for normal inspections (Table 1).

TABLE 1: LEVEL II GENERAL INSPECTION							
BATCH SIZE	**SAMPLING SIZE**	**A.Q.L. (*) 0.065**		**A.Q.L. 2.5**		**A.Q.L. 6.5**	
PCS	PCS	A (°)	R (°)	A	R	A	R
3,201 - 10,000	200	0	1	10	11	21	22
10,001 - 35,000	315	0	1	14	15	21	22
35,001 - 150,000	500	1	2	21	22	21	22
150,001 - 500,000	800	1	2	21	22	21	22
> 500,000	1.250	2	3	21	22	21	22

(*) A.Q.L.: acceptance quality level *(°) A: accepted / R: refused*

2. INSPECTION PROCEDURES FOR ACCEPTANCE

Once the sampling has been carried out in accordance with Table 1, the container defects are identified and classified according to the categories described. If a container exhibits several defects, only the highest category of defect will be considered for the purposes of the sampling.
A batch must be accepted if, during the incoming supply inspection, the number of defective containers is below the established acceptance limit.

If the number of defects exceeds the established limit, the batch will not be accepted. The samples of the defective products should be returned along with all the information necessary for dealing with the complaint as described in point 4.

Bruni Glass reserves the right to carry out a second inspection. If the batch is rejected, Bruni Glass undertakes to send a replacement of the products to the Customer. In exceptional cases, the Customer may make a fresh selection of goods, subject to prior arrangement and agreement on procedures and costs.

3. DEFECTS DISCOVERED DURING PRODUCTION

In the event of repeated production line accidents which may indicate that the established A.Q.L.s have been exceeded, a statistical inspection shall be carried out on the remaining containers to verify if the batch quality complies with the Supply Specifications. If a batch that has passed the acceptance inspections subsequently reveals a defect on use that may be traced to a clearly defined phase of the production period (for instance a pallet or a shift), the articles concerned in that phase (the pallet or the shift) shall undergo a special inspection and shall subsequently be refused if the A.Q.L. established in the specifications have been exceeded. In the event of a claim, Bruni Glass will withdraw the goods and replace them.

Complaints will only be considered if accompanied by all the necessary identification details for the batch concerned.

4. COMPLAINTS

The Customer should inform Bruni Glass of any defects that have been discovered by submitting a complaint which is defined here as a claim. The Complaint Form should be submitted to Bruni Glass in writing and the samples considered defective should be sent as soon as possible, together with the identification details of the pallet (item code, batch and production date, number of pallets, percentage of defective items).

Complaints will only be accepted if accompanied by all the required data.

SPECIAL
INSPECTIONS

1. TECHNOLOGICAL TESTS

1.1 AXIAL LOAD RESISTANCE

The Axial Load Resistance is determined by means of the Vertical Load Tester by applying an increasing stress onto the top of the container finish until it breaks.

The Axial Load Resistance limits are defined by Bruni Glass according to the type of item and are inspected following the methods indicated in UNI Standard 9035 (ISO 8113). Non-compliance with such limits constitutes a Major Defect.

1.2 IMPACT TEST

The Impact Test (inch/pounds) is carried out by monitoring the container breakage caused by the impact with an oscillating hammer with a given mass positioned at a given height. The measurement can be made either at the height of the shoulder or at the bottom of the container.

The Impact Test Limits are defined by Bruni Glass according to the type of item and are tested using the methods described in UNI Standard 9302.

Non-compliance with these limits constitutes a Major Defect.

1.3 THERMAL SHOCK

The resistance to the so-called “Thermal Shock” is evaluated in accordance with international regulations.

The equipment used is composed of two basins containing water at a determined and constant temperature: one is at room temperature (about 20°C), the other is at a higher temperature (about 65°C).

The containers are immersed for 15 minutes in the water at the higher temperature and then in the water at room temperature for two minutes. According to ASTM regulations, a resistance to 40°C or 113°F is considered acceptable.

1.4 RESISTANCE TO INTERNAL PRESSURE

Each glass container has its own pressure resistance which depends on its shape, weight and the type of application for which it is intended. The pressure resistance test is carried out using the standardized methods and equipment indicated in UNI 7458 table (ISO 7458).

2. FUNCTIONAL TESTS

2.1 CAPACITY

The total brimful capacity is measured using the gravimetric method by calculating the difference in weight between two containers of the same type, one filled with distilled water at a temperature of 20°C, and an empty one. The value obtained represents the capacity of the container expressed in millilitres (ml). (See also page 190).

2.2 OVALITY

The Ovality is the difference between the maximum and minimum diameters of the body and it is measured using a precision tool calibrated to a hundredth of a millimetre. (See also page 190).

2.3 VERTICALITY

The verticality is checked using an instrument consisting of a table with a reference dihedral measure and a rod with a comparator.

The glass container is placed on the table next to the dihedral measure.

The verticality is given by the difference of the half-distance between the top of the product and a fixed point on the gauge. This is measured after the product has completely rotated on itself, according to the table in ISO 9008 (UNI 29008). (See also page 191).

TOLERANCES
(IN ACCORDANCE WITH ISO/DIS 9058/2)

1. TOLERANCE FOR BRIMFUL CAPACITY

The tolerance for brimful capacity must comply with the standards indicated in the following Table 1.

	TOLERANCE FOR BRIMFUL CAPACITY	
NOMINAL CAPACITY ML	**% OF NOMINAL CAPACITY**	
from 50 to 100		± 3
from 100 to 200	± 3	
from 200 to 300		± 6
from 300 to 500	± 2	
from 500 to 1000		± 10
from 1000 to 5000	± 1	

2. TOLERANCE FOR NOMINAL HEIGHT

The tolerance for nominal height, calculated in mm, should be calculated using the following formula:

$T_H = \pm (0.6 + 0.004\ H)$
where H is the nominal height of the product in mm.

3. TOLERANCES FOR MAXIMUM NOMINAL DIAMETER OF THE BODY

The tolerance for the maximum nominal diameter of the body in mm should be calculated using the following formula:
$T_D = \pm (0.5 + 0.012\ D)$
where D represents maximum diameter of the body expressed in mm.

4. TOLERANCE FOR VERTICALITY Tv
(VARIATION FROM THE VERTICAL AXIS - IN ACCORDANCE WITH ISO STANDARD)

The tolerance for verticality (expressed in mm) should be calculated using the following formulas:

a. for a nominal height H < 220 mm
$T_V = 1.3 + 0.005\ H$

b. for a nominal height H > 220 mm
$T_V = 0.3 + 0.01\ H$
where H is expressed in mm.

5. TOLERANCE FOR NON-PARALLELISM BETWEEN FINISH AND BOTTOM OF THE CONTAINER (IN ACCORDANCE WITH ISO STANDARD)

The tolerance for non-parallelism between the finish and the bottom of the container shall not exceed the values (expressed in mm) indicated in the following table

FINISH NOMINAL DIAMETER	MAXIMUM TOLERANCE FOR NON-PARALLELISM BETWEEN FINISH AND BOTTOM OF THE CONTAINER
< 20	0,45
from 20 to 30 (INCLUSIVE)	0,6
from 30 to 40 (INCLUSIVE)	0,7
from 40 to 50 (INCLUSIVE)	0,8
from 50 to 60 (INCLUSIVE)	0,9
> 60	1,0

EXTRACT
FROM UNI ISO 2859/1 STANDARD

UNI ISO 2859

Sampling procedures for inspection by attributes.
Sampling plans indexed by acceptable quality limits (A.Q.L.) for lot-by-lot inspection.

UNI ISO 2859/2 and UNI ISO 2859/3 replace UNI 4842.

National foreword to ISO 2859/1.

This standard has been prepared by the Technical Committee ISO/TC 69 “Application of statistical methods”. It has received majority approval for acceptance by the ISO Council as an international standard.

In view of this, the UNI statistical methods Committee for quality has judged that the standard ISO 2859/1 complies with national requirements from the technical point of view.

Italian version of standard ISO 2859/1.

FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standard institutions.
The development of the International Standards is normally carried out by the ISO technical committees.
Any national organization with an interest in a subject for which a technical committee has been established has the right to be represented on that committee. International, governmental and non-governmental organizations, in liaison with ISO, also participate.
Draft International Standards adopted by the technical committees are circulated to the regulatory member bodies to be voted on.
Publication as an International Standard requires approval by at least 75% of the members casting a vote.

ISO 2859 consists of the following parts, under the general title “Sampling procedures for inspection by attributes”:

- Part 0: Introduction to the ISO 2859 attribute sampling system.
- Part 1: Sampling plans indexed by acceptable quality limit (A.Q.L.) for lot-by-lot inspection.
- Part 2: Sampling plans indexed by limiting quality (L.Q.) for isolated lot inspection.
- Part 3: Skip-lot sampling procedures.

SUMMARY

1. GOAL

This part of ISO 2859 specifies an acceptance sampling system for inspection by attributes. It is indexed in terms of the acceptable quality limit (A.Q.L.).
Its purpose is to use the economic and psychological pressure of lot non-acceptance to induce a supplier to maintain an average level of process at least as good as the specified acceptable quality limit, while at the same time providing an upper limit for the risk to the consumer of accepting the occasional poor lot. This part of ISO 2859 should not be seen as a procedure for estimating the quality of the lot or for dividing lots according to quality. The sampling plans designated in this part of ISO 2859 are applicable, but not limited, to inspection of:

A. finished products;
B. components and raw materials;
C. operations;
D. materials throughout the process;
E. supplies in storage;
F. maintenance operations;
G. data or records;
H. administrative procedures.

These schemes are intended primarily to be used for a continuing series of lots, that is, a sufficient series to allow switching of rules to be applied. These rules provide:

- protection to the consumer (by means of a switch to tightened inspection or discontinuation of sampling inspection), should a deterioration in quality be detected;
- an incentive (at the discretion of the responsible authority) to reduce inspection

costs (by means of a switch to reduced inspection), should good quality consistently be achieved.

Sampling plans in this part of ISO 2859 may also be used for the inspection of lots in isolation but in this case the user is strongly advised to consult the operating characteristic curves to find a plan that will yield the desired protection (see point 12.6).
In that case, the user is also referred to the sampling plans indexed by limiting the Quality Limits (Q.L.) given in ISO 2859/2.

2. REGULATION REFERENCES

The following standard regulations contain provisions which are also valid with regard to this standard (ISO 2859) since they expressly include these provisions. The editions indicated below were in force at the moment of publication of this standard regulation. However, parties in agreements based on this standard ISO 2859 are advised to check the possibility of applying the most recent editions of the regulation standards indicated below.
The UNI and CEI maintain a list of the International Standards in force on a particular date.

3. TERMS, DEFINITIONS AND SYMBOLS

Terms and definitions used in UNI ISO 2859/1 are in compliance with ISO 3534.

3.1 DEFECT

When a quality characteristic in a particular product, process or service does not meet its established quality specifications.

3.2 NONCONFORMITY

When a particular product, process or service does not meet the established quality specifications.
Nonconformities are generally classified according to the level of seriousness as follows:

- **class A**: nonconformities considered to be of the highest concern for a product or service; acceptance inspections controls should assign a low acceptable quality limit (A.Q.L.) to these types of nonconformity.
- **class B:** nonconformities considered to be less important than those of class A,

continuing down in decreasing order of importance.

These can therefore be assigned a higher acceptable quality limit (A.Q.L.) value than those in class A and lower than in class C, if a third class exists, etc..

Note 1 - The term “defect” is limited to nonconformities that lead to a product or service not meeting the specified requirements for the use for which it is intended.
Note 2 - Users are informed that the addition of characteristics and classes of nonconformity will generally affect the overall probability of acceptance of the product.

Note 3 - The number of classes, the assignment to a class, and the choice of acceptable quality limit (A.Q.L.) for each class, should be appropriate to the quality requirements of the specific situation.

3.3 NONCONFORMING UNIT

This is a unit of a product or service containing at least one nonconformity. Nonconforming units must generally be classified according to the seriousness of their nonconformity.
For example:

- **class A**: a unit containing one or more class A nonconformities can also contain a class B or C nonconformity.
- **class B**: a unit containing one or more class B nonconformities can also contain class C nonconformities, but no class A nonconformities.

3.4 NONCONFORMING PERCENTAGE

Irrespective of the quantity of units produced, the nonconformity percentage is a hundred times the number of nonconforming items divided by the total of product units produced i.e.:

% nonconforming = (no. of nonconforming units/no. of total units) x 100

Note - Sample schemes in the inspection by attributes are indexed by the percentage or fraction of units in a lot (or “batch”) that deviate from the specified requirements, or by the number of the deviations.

In this part of ISO 2859 the terms “percent nonconforming” or “nonconformities per 100 items” are mainly used in place of the theoretical terms “proportion of nonconforming items” and “nonconformities per item”, since the former terms are the most widely used in sampling.

3.5 NONCONFORMITIES PER 100 ITEMS

This is one hundred times the number of nonconformities in the batch (one or more are possible in each product unit) divided by the total number of units produced, i.e.: nonconformity for 100 units = (no. of nonconformities/total units produced) x 100

3.6 ACCEPTABLE QUALITY LEVEL (A.Q.L.)

This is the level of quality that is the lowest acceptable limit of the average quality level for sampling purposes when a continuing series of lots is submitted for acceptance sampling (see point 5).

3.7 SAMPLING PLAN

This plan indicates the number of units of each batch to evaluate (the number of samples or the number of a sequence of samples) and the relevant criteria for the batch acceptance (this means the number of accepted units Na or the number of rejected units Nr).

Note - For the purposes of this part of ISO 2859, a distinction should be made between the terms sampling plan (3.7), sampling scheme (3.8) and sampling system (3.9).

3.8 SAMPLING SCHEME

The set of all the sampling plans with rules for switching from one plan to another..

3.9 SAMPLING SYSTEM

A collection of sampling plans, or sampling schemes. This part of ISO 2859 is a sampling system indexed by lot-size ranges, inspection levels and A.Q.L.s. A sampling system for L.Q. plans is given in ISO 2859/2.

3.10 RESPONSIBLE AUTHORITY

This is a generic term used to maintain the neutrality of this part of ISO 2859 (primarily for specification purposes), irrespective of whether it is being invoked or applied by the first, second or third interested party.

Note 1 - The responsible authority may be:

A. the quality department within a supplier's organization (first party);

B. the purchaser or buying organization (second party);
C. an independent verification or certification authority (third party);
D. any of a), b) or c), that may differ according to function (see note 2) as described in a written agreement between two of the parties, for example an agreement between supplier and purchaser.

Note 2 - The duties and functions of a responsible authority are outlined in this part of ISO 2859 (see point 5.2, 6.2, 7, 9.1, 9.3.3, 9.4, 10.1, 10.3).

3.11 INSPECTION

Activity such as measuring, evaluating, examining, or Pass-Fail testing or any other way of comparing the product unit (see 3.14) against the appropriate specifications.

3.12 ORIGINAL INSPECTION

The first inspection of a particular product as distinct from the inspection of a product which has been resubmitted after a previous non-acceptance.

3.13 INSPECTION BY ATTRIBUTES

Inspection whereby either the product unit is classified simply as conforming or nonconforming with respect to a specified requirement or set of specified requirements, or the number of nonconformities in the product unit is counted.

3.14 PRODUCT UNIT

The element that is examined in order to evaluate its classification as conforming or nonconforming or to calculate the number of nonconformities.

It can be a part of a finished product or the finished product itself. The product unit can coincide with the unit of purchase, supply, production or delivery.

3.15 LOT

A collection of product units, from which a sample is drawn for inspection, to determine if it conforms to the acceptance criteria; it may differ from the collection of product units referred to as a “batch” for other purposes (i.e. for production, delivery, etc.) (see point 6).
Note - “Batch” is another term also used for “lot”.

3.16 LOT SIZE

Number of product units in a lot.

3.17 SAMPLE

One or more product units selected at random from a lot without reference to their quality. The number of product units in the sample represents the sample size.

3.18 LIMITING QUALITY (L.Q.)

The Limiting Quality is applied when a lot is considered in isolation: it is the quality level which, for the purposes of sampling inspection, corresponds to a low probability of acceptance.

Note - For a particular sampling system (see UNI ISO 2859/2) the acceptance probability of a L.Q. must come within a defined range

4. EXPRESSION OF NONCONFORMITY

The extent of nonconformity shall be expressed either in terms of nonconforming percentage (see 3.4) or in terms of nonconformities per 100 items (see 3.5).

Tables are based on the assumption that nonconformities occur randomly and are statistically independent.
There may be good reasons to believe that one nonconformity in an item may be caused by a condition that is likely to cause other nonconformities. In this case, it may be better to consider simply whether the items are conforming or not and to ignore multiple nonconformities.

5. ACCEPTABLE QUALITY LIMIT (A.Q.L.)

5.1 USE AND APPLICATION

The A.Q.L., together with the sample size code letter (see 10.2), is used to index the sampling plans and schemes in this part of ISO 2859.
When a specific value of the A.Q.L. is designated for a certain nonconformity or group of nonconformities, the sampling scheme is such that it will accept the majority of the lots submitted, provided that the quality level (nonconforming percentage or nonconformities per 100 items) in these lots is not greater than the

designated value of the A.Q.L..
Thus, the A.Q.L. is an established value of the nonconforming percentage (or non conformity per 100 items) which will be accepted most of the time by the sampling plan in force.
The sampling plans indicated are arranged so that the probability of acceptance at the designated A.Q.L. value depends upon the sample size for a given A.Q.L., being generally higher for large samples than for small ones. The A.Q.L. is a parameter of the sampling scheme and should not be confused with the average process level that describes the operating level of the manufacturing process.
It is expected that the average process level will be lower or equal to the A.Q.L. to avoid excessive rejections under this system.

CAUTION: The designation of an A.Q.L. does not imply that the supplier has the right to supply nonconforming items.

5.2 SPECIFYING A.Q.L.S

The A.Q.L. to be used shall be designated in the contract or established by, or agreed with the responsible authority. Different A.Q.L.s may be designated for groups of nonconformities considered collectively or for individual nonconformities as defined in 3.2. The classification into groups should be appropriate to the quality requirements of the specific situation.
An A.Q.L. for a group of nonconformities may be designated in addition to A.Q.L.s for individual nonconformities, or subgroups within that group.
A.Q.L. values lower or equal to 10 can be expressed either in percentage of nonconforming units or as numbers of nonconformities per 100 items; values higher than 10 can be expressed only as nonconformities per 100 items.

5.3 PREFERRED A.Q.L.S

The series of values of A.Q.L.s given in the tables are known as the preferred series of A.Q.L.s. If, for any product, an A.Q.L. is designated as other than one of these values, this standard is not applicable.

6. SUBMISSION OF PRODUCT FOR SAMPLING

6.1 FORMATION OF LOTS

The product shall be assembled into identifiable lots, sub-lots, or in some other way in the order in which it is produced (see point 6.2).

Each lot shall, as far as it is practicable, consist of product units of a single type, grade, class, size and composition, essentially manufactured under the same conditions at the same time.

6.2 PRESENTATION OF LOTS

The formation of the lots, the lot size and the manner in which each lot will be presented and identified by the supplier should be designated or approved by the responsible authority, or agreed with them.
Where necessary, the supplier shall provide suitable storage space, the necessary equipment for proper identification and presentation, and the necessary personnel for handling the products required for sampling.

7. ACCEPTANCE AND NON-ACCEPTANCE

7.1 ACCEPTABILITY OF LOTS

Acceptability of a lot shall be determined by the use of one or more sampling plans in relation to the A.Q.L. or A.Q.L.s indicated.
The term “non-acceptance” is used in this context to mean “rejection” when it refers to the result of applying this regulation standard. Forms of the term “reject” are retained when they refer to actions the customer may take, as in “number of rejections”.

The responsible authority will make the necessary decisions on the rejected lots. They can be scrapped, selected (with or without replacement of nonconforming items), re-worked, re-tested under more specific criteria regarding their use, kept for further information, etc..

7.2 NONCONFORMING UNITS

You have the right to reject any product unit judged to be nonconforming during inspection, whether that the item formed part of a sample or not, even if the lot as a whole has been accepted.

Rejected product units may be reworked or corrected and resubmitted for inspection with the approval of, and in the manner specified by, the responsible authority.

7.3 SPECIAL CLAUSES FOR PARTICULAR NONCONFORMITIES

Since the acceptance inspection procedure generally requires an evaluation of several different quality characteristics that may differ in importance as regards the

consequences in terms of quality and cost, it is often advisable to identify the types of nonconformity in accordance with the categories indicated in point 3.2. The assignment of the different types of nonconformity to each class depends on the agreement with regard to the specific sampling applications.

In general, the purpose of this classification is to allow the use of a collection of sampling plans which share the same sample size but with different acceptance numbers for each class with its own A.Q.L., as shown in tables II, III and IV. It is at the discretion of the responsible authority to decide whether every product unit in the lot is required to be inspected for particular categories of nonconformity. You have the right to inspect every product unit submitted for particular categories of nonconformity and to reject the lot immediately if a nonconformity of this type is found. You also have the right to sample every lot submitted by the supplier for particular categories of nonconformity and to reject any lot if a sample drawn from it is found to contain one or more of these nonconformities.

7.4 RESUBMITTED LOTS

All parties shall be immediately notified if a lot is found not acceptable. Such lots shall not be resubmitted until all items have been re-examined or retested and the supplier is satisfied that all nonconforming product units have been removed or the nonconformities have been corrected.
The responsible authority shall determine whether normal or tightened inspection shall be used on re-inspection and whether the re-inspection shall include all types or classes of nonconformity or only the particular types or classes of nonconformities which caused the initial rejection.

8. DRAWING OF SAMPLES

8.1 SAMPLE SELECTION

Under some circumstances the number of units of samples must be selected proportionally according to the number of parts or layers of the batch, following a particular logical criterion. When a layered sample is used, the units of each layer of the batch will be selected at random.

8.2 TIME FOR DRAWING THE SAMPLES

Samples may be drawn after all the product units that make up the lot have been completed, or during production of the lot. In either case, the samples shall be selected at random.

8.3 DOUBLE OR MULTIPLE SAMPLING

When double or multiple sampling is used, each sample should be selected from the entire lot.

9. NORMAL, TIGHTENED AND REDUCED INSPECTION

9.1 START OF INSPECTION

Normal inspection should be carried out at the start of inspection, unless otherwise directed by the responsible authority.

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9.2 CONTINUATION OF INSPECTION

Normal, tightened or reduced inspection shall continue unchanged on the following lots, except when a change is required by the switching procedures (see point 9.3). The switching procedures should be applied to each class of nonconformities or nonconforming product units independently.

9.3 SWITCHING RULES AND PROCEDURES

(see figure I)

9.3.1 FROM NORMAL TO TIGHTENED

When a normal inspection is being carried out, tightened inspection shall be implemented as soon as two out of five (or fewer than five) consecutive lots have been found unacceptable on original inspection (that is, ignoring lots or batches that have been resubmitted).

9.3.2 FROM TIGHTENED TO NORMAL

When tightened inspection is being carried out, normal inspection shall be reinstated when five consecutive lots have been considered acceptable on original inspection.

9.3.3 FROM NORMAL TO REDUCED

When normal inspection is being carried out, reduced inspection shall be implemented when all of the following conditions have been met:

A. the previous 10 batches (or more, as indicated in the note to table VIII) have been presented for normal inspection and they have all been accepted during the original inspection, and
B. the total number of nonconforming units (or nonconformities) in the samples from the previous 10 batches (or from a different number of batches in relation to condition “A” above) is equal or lower than the appropriate boundary number given in table VIII.

If a double sampling system is adopted, all samples must be considered, not only the first ones, and:

C. production is at a steady rate; and
D. reduced inspection is considered desirable by the responsible authority.

9.3.4 REDUCED TO NORMAL

When reduced inspection is being carried out, normal inspection shall be reinstated if any of the following occur on original inspection:

A. a lot is not accepted, or
B. a lot is considered acceptable with the reduced inspection criteria as set out in 11.1.4, or
C. production becomes irregular or delayed, or
D. other conditions warrant that normal inspection shall be reinstated.

9.4 SAMPLING BREAKDOWN

If the number of rejected batches in a sequence of batches submitted to the original tightened inspection amounts to 5, the procedures under the present part of UNI ISO 2589 should be interrupted.
Inspection under the criteria of the present part of UNI ISO 2859 will not re-commence until the supplier has taken the necessary measures to improve the quality of the product or service provided.
The responsible authority must agree that the action taken has been genuinely effective. Tightened inspection should then be used as if required under point 9.3.1.

10. SAMPLING PLANS

10.1 INSPECTION LEVEL

The inspection level required for any particular application shall be specified by the responsible authority. This allows the authority to require a higher level of discrimination for some purposes and lower for others. At each inspection level, the switching rules shall operate to require normal, tightened and reduced inspection, as specified in clause 9. The choice of inspection level is quite separate from these three methods of inspection.

Three inspection levels, I, II and III, are given in table 1 for general use. Unless otherwise specified, level II should be used. Level I may be used when less discrimination is needed or level III when greater discrimination is required. Four additional special levels, S-1, S-2, S-3 and S-4 are also given in table 1 and may be used where relatively small sample sizes are necessary and larger sampling risks can or should be tolerated.

In the designation of inspection levels S-1 to S-4, care should be taken to avoid A.Q.L.s that are incompatible with these inspection levels. In other words, the purpose of special inspection levels is to allow small samples when necessary.
For instance, the code letters under S-1 go no further than D, equivalent to a single sample size of 8, but there is no point specifying S-1 if the A.Q.L. is 0.1%, because the minimum sample size for this A.Q.L. is 125.

The information about the quality of a lot gained from examining samples drawn from the lot depends upon the absolute size of the samples, not upon the percentage of the lot that is examined, provided the lot is large as compared to the sample.
In spite of this, there are three reasons for varying the sample size as the lot size changes:

A. when a risk relates to a larger lot, it is more important to make the right decision;
B. with a large lot, a sample size can be afforded that would be uneconomic for a small lot;
C. truly random sampling requires relatively more time if the sample is too small a proportion of the lot.

10.2 SAMPLE SIZE CODE LETTERS

Sample sizes are designated by sample size code letters.
Table 1 should be used to find the applicable code letter for the particular lot size and the prescribed inspection level

10.3 OBTAINING A SAMPLING PLAN

The A.Q.L. and the sample size code letter should be used to obtain the sampling plan from tables II, III and IV.
When no sampling plan is available for a given combination of A.Q.L. and sample size code letter, the tables direct the user to a different letter. The sample size to be used is then given by the new sample size code letter, not by the original letter.
If this procedure leads to different sample sizes for different classes of nonconformities or nonconforming items, the sample size code letter corresponding to the largest sample size derived may be used for all classes of nonconformities or nonconforming items, when designated or approved by the responsible authority.
As an alternative to a single sampling plan with an acceptance number of 0, the plan with an acceptance number of 1 with its correspondingly larger sample size for a designated A.Q.L. may be used, when designated or approved by the responsible authority.

10.4 TYPES OF SAMPLING PLANS

Three types of sampling plans, single, double and multiple, are given in tables II, III and IV, respectively. When several types of plans are indicated for a given A.Q.L. and sample size code letter, any one plan may be used. A decision as to the type of plan, either single, double or multiple, if available for a given A.Q.L. and sample size code letter, should normally be based on a comparison between the difficulty in administering the different plans and the average sample sizes of the plans.
For the sampling plans given in this part of ISO 2859, the average sample size of multiple plans is smaller than for a double one and both of these are smaller than the single sample size (see pages 156 and 157).
Usually, there is less difficulty in administering single sampling and the cost per sample unit is lower than for double or multiple sampling.

11. DETERMINATION OF ACCEPTABILITY

To determine the acceptability of a lot under nonconforming percentage inspection, the applicable sampling plans shall be used in accordance with 11.1.1, 11.1.2, 11.1.3 and 11.1.4.

11.1 INSPECTION BASED ON NUMBER OF NONCONFORMING UNITS

11.1.1 SINGLE SAMPLING PLANS

The number of sample units inspected shall be equal to the sample size given by the plan. If the number of nonconforming units found in the sample is equal to or less than the acceptance number, the lot shall be considered acceptable. If the number of nonconforming units is equal to or greater than the rejection number, the lot shall be considered not acceptable.

11.1.2 DOUBLE SAMPLING PLANS

The number of sample items first inspected shall be equal to the first sample size given by the plan. If the number of nonconforming units found in the first sample is equal to or less than the first acceptance number, the lot shall be considered acceptable.
If the number of nonconforming items found in the first sample is between the first acceptance and rejection numbers, a second sample of the size given by the plan shall be inspected. The number of nonconforming items found in the first and second samples should be added together.
If the total number of nonconforming items is equal to or less than the second acceptance number, the lot shall be considered acceptable. If the total number of nonconforming items is equal to or greater than the second rejection number, the lot shall be considered not acceptable.

11.1.3 3 MULTIPLE SAMPLING PLANS

In multiple sampling, the procedure is similar to that specified in 11.1.2. In this part of UNI ISO 2859, there are seven stages so that a decision will be reached by the seventh stage at the latest.

11.1.4 SPECIAL PROCEDURE FOR REDUCED INSPECTION

In the reduced inspection, the sample can contain a number of nonconforming units or of non conformities per 100 units within the numbers of acceptance or rejection. In this case the batch is considered to be acceptable, but ordinary inspection will be reinstated starting from the following batch (see point 9.3.4.b).

11.2 INSPECTION FOR NONCONFORMITIES PER HUNDRED UNITS

In order to determine the acceptability of a lot in this type of inspection, the same procedure specified for nonconforming inspection (see 11.1) should be used, except the term “nonconformities” should be replaced by “nonconforming units”.

12. FURTHER INFORMATION

12.1 OPERATING CHARACTERISTIC (OC) CURVES

The operating characteristic curves for normal and tightened inspection, shown on pages 156 and 157, indicate the percentage of lots which may be expected to be accepted under the various sampling plans for a given process quality level.

The operational curve which characterizes an unqualified acceptance in the reduced inspection (when the number of nonconforming units is lower or equal to the acceptance number) can be found using the A.Q.L. of the ordinary plan with the sample size/s and number/s of acceptance of the reduced plan. The curves shown are for single sampling; curves for double and multiple sampling are practically identical.

The OC curves shown for A.Q.L.s greater than 10 are based on the Poisson distribution and can be applied to nonconformities per 100 units; curves for A.Q.L.s of 10 or lower and sample sizes of 80 or lower are based on the binomial distribution and can be applied to inspection by nonconforming %; the curves of A.Q.L. 10 or lower and sample sizes higher than 80 are based on the Poisson distribution and can be applied both to nonconformities per 100 units and to nonconforming % (the Poisson distribution is a good approximation of the binomial distribution under these conditions).

The levels in the tables, corresponding to pre-set levels of probability of acceptance Pa (expressed in %), are indicated for each OC curve in the tables, including for tightened inspection, for nonconformities per 100 units for A.Q.L.s of 10 or lower and for sample sizes of 80 or lower.

12.2 AVERAGE PROCESS LEVEL

The average process level can be estimated by the average nonconforming percentage or average number of nonconformities per 100 items (whichever is

applicable) found in the product samples submitted by the supplier for original inspection, provided that inspection was not curtailed.
When double or multiple sampling is used, only first sample results shall be included in the average process estimation.

12.3 AVERAGE OUTGOING QUALITY (AOQ)

The average outgoing quality is the average quality of the outgoing product, including all accepted lots, plus all lots which are not accepted, after such lots have been effectively 100% inspected and all nonconforming items replaced by conforming items.

12.4 AVERAGE OUTGOING QUALITY LIMIT (AOQL)

The AOQL is the maximum value of the average outgoing qualities for all possible qualities submitted for a particular acceptance sampling plan. Approximate AOQL values are given in table V-A for each of the single sampling plans for normal inspection and in table V-B for each of the single sampling plans for tightened inspection.

12.5 AVERAGE SAMPLE SIZE CURVES

Average sample size curves for double and multiple sampling, as compared with the corresponding single sampling plan for each acceptance number, are given on pages 156 and 157.
These curves show the average sample sizes which may be expected to occur under the various sampling plans for given levels of process quality. The curves assume that the inspection is not interrupted.

12.6 PROTECTION BY MEANS OF LIMITING QUALITY (LQ)

12.6.1 USE OF INDIVIDUAL PLANS

This part of ISO 2859 is designed to be used as a system of rules employing tightened, normal and reduced inspection on a successive series of lots to achieve customer protection while assuring the producer that acceptance will occur most of the time if quality is better than the A.Q.L..
Occasionally, single plans are selected from this part of ISO 2859 and used without the switching rules. For example, a purchaser may be using the plans for

verification purposes only. This is not the intended application of the system given in this part of ISO 2859 and its use in this way should not be referred to as “inspection in compliance with ISO 2859/1”. When used in this way, this part of ISO 2859 simply represents a repository for a collection of individual plans indexed by A.Q.L..

The operating characteristic curves and other parameters of a plan chosen in this way should be established by each interested party taking the appropriate information from the tables provided.

12.6.2 LIMITING QUALITY TABLES

If a lot (or “batch”) is by its nature isolated, it may be advisable to limit the selection of sampling plans to those that in addition to being associated with a designated A.Q.L. value, also give a level of protection that is no lower than a given limiting quality. Sampling plans for this purpose can be selected by choosing a Limiting Quality (L.Q.) and a consumers risk quality (CRQ) associated with it. For the definition of a Limiting Quality (see 3.18).
Tables VI and VII give the nonconformity levels for which probability of acceptance of the lot are 10% and 5% respectively.

For individual lots with nonconforming percentage or number of nonconformities per hundred equal to the established limiting quality, the probability of lot acceptance is lower than 10% in the case of the plans listed in table VI and of 5% for the plans listed in table VII.

When there is a reason to avoid more limiting percentages of nonconforming product units (or nonconformities) in a lot, tables VI and VII may be useful for establishing the minimum sample sizes to be associated with the A.Q.L. and the specified inspection level for a continuous series of lots.
For example, if an L.Q. of 5% is required for individual lots with an established probability of acceptance of 10% or less, table VI indicates that the minimum sample size shall be given by sample size code letter L.
UNI ISO 2859/2 provides further details of the sampling methods for isolated lots

FIGURE 1
DIAGRAM OF THE SWITCHING RULES

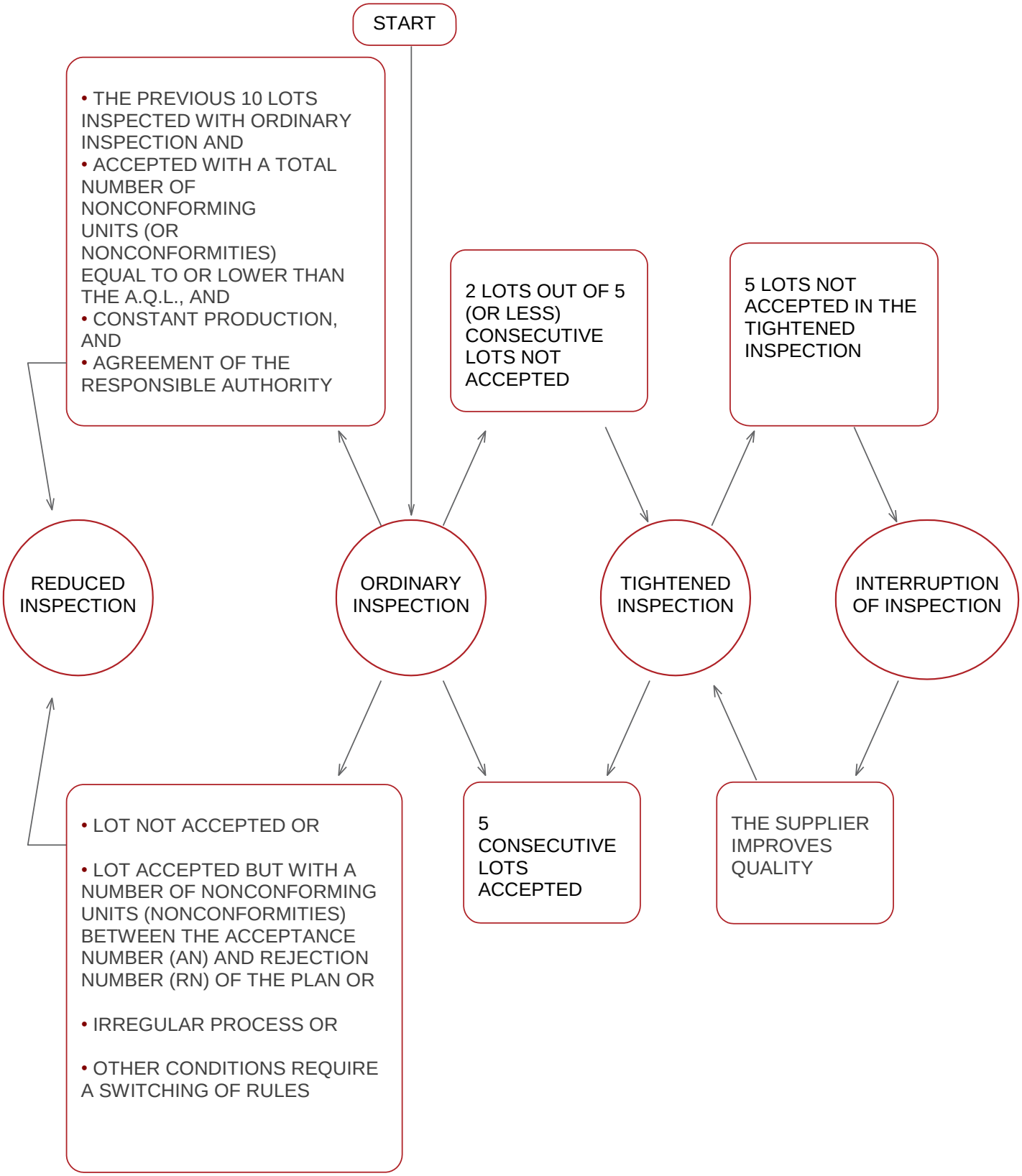

TABLE I: SAMPLE SIZE CODE LETTERS (SEE POINTS 10.1 AND 10.2)

BATCH SIZE	SPECIAL INSPECTION LEVELS				CURRENT INSPECTION LEVELS		
	S-1	S-2	S-3	S-4	I	II	III
FROM 2 TO 8	A	A	A	A	A	A	B
FROM 9 TO 15	A	A	A	A	A	B	C
FROM 16 TO 25	A	A	B	B	B	C	D
FROM 26 TO 50	A	B	B	C	C	D	E
FROM 51 TO 90	B	B	C	C	C	E	F
FROM 91 TO 150	B	B	C	D	D	F	G
FROM 151 TO 280	B	C	D	E	E	G	H
FROM 281 TO 500	B	C	D	E	F	H	J
FROM 501 TO 1.200	C	C	E	F	G	J	K
FROM 1,201 TO 3,200	C	D	E	G	H	K	L
FROM 3,201 TO 10,000	C	D	F	G	J	L	M
FROM 10,001 TO 35,000	C	D	F	H	K	M	N
FROM 35,001 TO 150,000	D	E	G	J	L	N	P
FROM 150,001 TO 500,000	D	E	G	J	M	P	Q
FROM 500,001 AND OVER	D	E	H	K	N	Q	R

TABLE II A
MASTER TABLE FOR SINGLE SAMPLING PLANS FOR NORMAL INSPECTION (SEE POINT 10.1 AND 10.2)

Sample size code letter	Sample size	ACCEPTANCE QUALITY LEVELS (NORMAL INSPECTION)											
		0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5
		An Rn	An Rn	An Rn	An Rn	An Rn	An Rn	An Rn	An Rn	An Rn	An Rn	An Rn	An Rn
A	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
B	3												
C	5												
D	8												0 1 ↕
E	13											0 1 ↕	
F	20										0 1		
G	32									0 1 ↕		↓	
H	50								0 1 ↑		1 2 ↕	1 2 3	1 2 2 3 3 4
J	80							0 1					
K	125						0 1 ↕	↕	↓	1 2 2 3 3 4	2 3 3 4 5 6	3 4 5 6 7 8	5 6 7 8 10 11
L	200					0 1 ↑		1 2	1 2 2 3				
M	315				0 1								
N	500			0 1 ↕	↕	↓	1 2 2 3 3 4	2 3 3 4 5 6	3 4 5 6 7 8	5 6 7 8 10 11	7 8 10 11 14 15	10 11 14 15 21 22	14 15 21 22 ↑
P	800		0 1 ↑		1 2	1 2 2 3							
Q	1250	0 1											
R	2000	↑	↑	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	

↓ = Use the first sampling plan below the arrow. If the sample size equals, or exceeds, lot size, carry out 100% inspection.

↑ = Use the first sampling plan above the arrow.

An = Acceptance number Rn = Rejection number

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ACCEPTANCE QUALITY LEVELS (NORMAL INSPECTION)												
2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
An Rn	An Rn	An Rn	An Rn	An Rn	An Rn	An Rn	An Rn	An Rn	An Rn	An Rn	An Rn	An Rn	An Rn
0 1	0 1	0 1	1 2	1 2 2 3	1 2 2 3 3 4	2 3 3 4 5 6	3 4 5 6 7 8	5 6 7 8 10 11	7 8 10 11 14 15	10 11 14 15 21 22	14 15 21 22 30 31	21 22 30 31 44 45	30 31 44 45
1 2	1 2 2 3	1 2 2 3 3 4	2 3 3 4 5 6	3 4 5 6 7 8	5 6 7 8 10 11	7 8 10 11 14 15	10 11 14 15 21 22	14 15 21 22	21 22 30 31	30 31 44 45	44 45		
2 3 3 4 5 6	3 4 5 6 7 8	5 6 7 8 10 11	7 8 10 11 14 15	10 11 14 15 21 22	14 15 21 22	21 22							
7 8 10 11 14 15	10 11 14 15 21 22	14 15 21 22	21 22										
21 22													