BRITISH STANDARD

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Textiles — Sampling of fibres, yarns and fabrics for testing

The European Standard EN 12751:1999 has the status of a British Standard

ICS 59.060.01; 59.080.20; 59.080.30

National foreword

This British Standard is the English language version of EN 12751:1999. It supersedes BS 2545:1965 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee TCI/24, Physical testing of textiles, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Summary of pages

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Textiles - Sampling of fibres, yarns and fabrics for testing

Textiles – Echantillonage des fibres, des fils et des étoffes en vue des essais

Textilien – Probenahmen von Fasern, Garnen und textilen Flächengebilden für Prüfungen

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 248 "Textiles and textile products", the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2000, and conflicting national standards shall be withdrawn at the latest by January 2000.

It is related to ISO 1130 Textile fibres – Some methods of sampling for testing

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

No single technique of sampling can be devised that will serve in all circumstances. Sampling from a bale of cotton, for example, presents problems quite different from those encountered in sampling from a consignment of yarn packages, while sampling from a card web is again different from either.

The samples are generally taken as the shipping units making up a lot; such as bales of fibre, cases of yarn, rolls of fabric, or cartons of garments or other finished products. Adequate sampling for acceptance testing requires taking into account not only the variability between the laboratory samples but also the variability between the laboratory test samples and between the test specimens.

The objective of sampling may vary with the purpose for which the test method is used. The objective of sampling for acceptance testing is to obtain material which will estimate without bias a property of the lot being evaluated and which allows making a decision on whether to accept or reject a lot with reasonable producers and consumers risks when the acceptable quality level and the limiting quality level are at realistic levels. There are normally many ways to estimate the property of interest to a specified degree of precision. The most economical way to do so will depend on the relative size of the sources of variability associated with sampling the laboratory samples.

A selection of methods is therefore presented, illustrating techniques that have been found acceptable in meeting the commoner types of problem encountered in sampling for the assessment of fibre, yarn or fabric quality. Methods peculiar to the requirements of research are not included, nor are such special techniques as have to be used, for example, in sampling of wool from the fleece, or cotton from the seed.

1 Scope

This European Standard specifies several methods for preparing laboratory samples of fibres, yarns or fabrics and presents a limited treatment of the problem of drawing specimens for testing.

The principle of each method is given at the beginning of the clause dealing with the method.

It is not possible for the coverage of each individual procedure to be fully comprehensive; in many instances, the selection of test samples or test specimens is necessarily covered by the appropriate method of test.

The selection of length-biased samples is not within the scope of this standard, nor are particular procedures for determination of commercial weights or moisture content.

Annex A and the tables are given in this standard for general guidance in determining the size of the test sample to be taken in order that the determined sample mean has given confidence limits.

2 Definitions

For the purposes of this standard the following definitions apply:

2.1 laboratory sample: Sample intended to be representative of a large bulk of material, in the state in which it is sent to the laboratory. A convenient size of sample for many types of test involving only small test specimens is about 25 g to 50 g; a larger amount will be required for tests involving relatively large test specimens.

2.2 laboratory test sample: That portion of fibres, yarn or fabrics taken from the laboratory sample in such a way as to ensure its representative character and to provide a quantity small enough to be easily convertible into test specimens.

2.3 test specimen: That part of the laboratory sample (yarns, fibres, fabrics, etc.) which is tested at one time.

2.4 numerical sample: Sample in which all individuals (fibres, yarns or fabrics) in the population have an equal chance of being represented.

2.5 length-biased sample: Sample in which the chance of any fibre of the population being represented is proportional to the length of that fibre.

2.6 individual: Any single specimen of fibre or yarn or fabric that could be taken for the purpose of measurement.

2.7 population: The aggregrate of individuals that it is desired to characterize in one or more particulars (for example: fibres contained in a bale of cotton; all the constituent fibres in a set of yarn cops).

2.8 zoning: When the population to be sampled is known to vary from part to part with respect to the property to be investigated, the individuals or groups of individuals in the population are taken at random from within the different parts or zones, chosen so that all variations of the property are represented in due proportion. This operation is known as zoning.

3 Sampling of fibres

3.1 Sampling methods for cotton fibres

3.1.1 General

This clause gives methods for the preparation of numerical laboratory samples.

The methods described in 3.1.2 to 3.1.5 are applicable to bulks of cotton fibres in various forms.

3.1.2 Sampling from a small bulk of raw or blended cotton

If the bulk consists of less than 5 kg of loose raw cotton, spread it out in an even layer. Unless otherwise stated, obtain the laboratory sample by selecting at random a minimum of 100 tufts, each of 0,25 g to 0,50 g.

If the bulk is greater than 5 kg, divide it into a number of equal portions, and take an equal number of tufts (of 0,25 g to 0,50 g each) from each portion such that the total number from all portions exceeds 100.

3.1.3 Sampling from a bulk consisting of a bale of cotton

3.1.3.1 General

There is variation in most fibre properties between and within layers of the same bale of cotton. The values of coefficients of within- and between-layer variation and of the ratio of these coefficients of variation vary according to the fibre characteristics under consideration, and also with the type of cotton.

3.1.3.2 Procedure

If the bale is open, a suitable laboratory sample may be obtained by selecting 10 tufts at random throughout each of 10 equally spaced layers.

If the bale has not been opened, the above procedure cannot be followed. In this case, the following procedure may be feasible:

Extract the required number of tufts by removing cotton from one or more of the edges that are perpendicular to the layers in the bale, so that the sample includes material from many layers. In taking the tufts, reject any soiled cotton from the outside of the bale (the procedure may be facilitated by cutting one of the end bands round the bale).

> NOTE : A less satisfactory sample is yielded by selecting tufts from various places over the upper and lower sides of a bale.

Although this cotton is easily accessible, any laboratory sample obtained in this manner will represent at the most two layers, one on each side of the bale.

3.1.4 Sampling from a bulk consisting of several bales of cotton

3.1.4.1 General

The detailed method of sampling depends on the type of test to be carried out, the number of bales, and the likely variation between the bales.

3.1.4.2 Procedure

The following procedure shall be used unless the specification states otherwise.

3.1.4.2.1 When the number of bales is greater than 10 and the real variation in the bulk is not appreciably greater than the precision required in the test result, make a random choice of 10 % of the bales (or 10 bales if 10 % of the bulk is less than 10 bales); then from the selected bales take a minimum of 100 tufts, taking an equal number of tufts from each layer of each bale.

3.1.4.2.2 Sampling without opening bales

For most commercial purposes, when selecting a sample from a bale of cotton it is impracticable to obtain a representative sample by opening a bale and following the procedure described in 3.1.2 above. Samples prepared by selecting cotton from one or two layers in a bale are acceptable for many purposes for quality classification, and for some forms of testing (for example, determination of micronaire value) when past experience indicates that the

feature under consideration varies appreciably more from bale to bale in a commercial lot than between layers in the same bale. Under such circumstances, it is recommended that a sample be prepared in the form of two clumps of cotton, similar in surface area and mass, taken from opposite outer layers of the bale and with the distance to the edges of the bale a minimum of 100 mm. The face of the sample shall be not less than 120 mm × 150 mm and the total mass not less than 150 g. A sample consisting of a clump, of the same surface area and total mass, cut from one outer layer only, is less representative and fulfils the requirements of this Standard only if mutually agreed by the parties concerned.

3.1.5 Preparation of laboratory test samples

3.1.5.1 General

In certain cases, it may be necessary to have a laboratory test sample, prepared from the laboratory sample.

These laboratory test samples shall be prepared by a method which takes into consideration the test to be performed and the degree of accuracy desired.

In general, fibre blending by a mechanical blender is preferable, particularly when the test specimen is small in size, as is the case in the flat-bundle strength test. However, in some cases, samples prepared by hand are adequate.

When the laboratory sample consists of tufts taken by cutting into the bales, cut fibres shall not be included in the laboratory test sample.

3.1.5.2 Mechanical blending (preferred method)

The mechanical blender is designed to use a certain mass of fibres, for example up to 10 g.

Spread out the laboratory sample so that pinches can be taken from it at any point. Take small pinches of fibre from at least 32 different evenly spaced points in the laboratory sample.

Perform a light drafting action on the pinches before feeding them into the mechanical blender, so as to form as uniform a sheet of fibre as possible. Blend the fibres using the blender so as to produce a practically homogeneous sample, taking care not to damage the fibres.

3.1.5.3 Manual methods

Different methods have been designed for different methods of test, for example "cut-squaring", making hand slivers and making small samples for successive halving and combining. In some cases, it is preferable to prepare test specimens directly from the laboratory sample.

3.2 Sampling method for man-made staple fibres

3.2.1 General

This method gives a numerical sample. It is suitable for most types of man-made fibres in bale form. Unusual consignments of staple fibre and supplies of staple produced from filament waste may require a modified sampling procedure.

3.2.2 Number of bales to be sampled

If the consignment comprises not more than 5 bales, sample all the bales. If the consignment comprises more than 5 but not more than 25 bales, take 5 bales at random. If there are more than 25 bales in the consignment, take 10 bales at random.

3.2.3 Preparation of final sample representative of the consignment

From each bale to be sampled take four handfuls each of about 10 g, taking two of them from different places in the outside zone and two from different places in the inside zone. Keep the four handfuls separate. A bale is

considered to consist of an outside zone and an inside zone, the dimensions of the inside zone being equal to 80 % of the corresponding dimensions of the whole bale, so forming about half the total volume.

From each of the handfuls, take a tuft of about 100 mg and divide it into four parts, each of about 25 mg. Lay out separately the 16 resulting tufts, all derived from the same bale. With each of these tufts combine one of the other sampled bales. In this way prepare 16 tufts, each of which includes about 25 mg of fibres from each bale that has been sampled. Prepare the final representative sample from these 16 tufts by repeated doubling and halving as follows.

Place the first and second tufts together and mix them thoroughly by repeated drawing and doubling. Split the resulting tuft into two equal tufts; retain one tuft and discard the other. In the same way combine and mix the other pairs of tufts (3 and 4; 5 and 6; 7 and 8, etc.), each time retaining only one half of the mixed tuft. Then combine and mix the two tufts derived from 1 and 2, 3 and 4; split the mixed tuft and retain half of it. Continue this mixing of pairs and halving until one tuft is left forming a representative sample. Take care that the drawing is done very gently so as not to stretch or break any fibres. When dividing a tuft in order to discard one half, it is essential to split it in the middle and to separate the parts laterally; do not pull them apart by their ends.

3.2.4 Sampling without opening bales

Use this sampling procedure in cases when it is not possible to obtain a representative sample by opening a bale and following the procedure described in 3.2.3 above. Samples prepared by selecting fibres from one or two layers in a bale are acceptable for many purposes of quality classification, and for some forms of testing when past experience indicates that the feature under consideration varies appreciably more from bale to bale in a commercial lot than between layers in the same bale. Under such circumstances, it is recommended that a sample be prepared in the form of two clumps of fibres, similar in surface area and mass, taken from opposite outer layers of the bale. The distance to the edges of the bale shall be a minimum of 100 mm. The face of the sample shall be not less than 120 mm $\times$ 150 mm and the total mass not less than 150 g. A sample consisting of a clump, of the same surface area and total mass of 150 g, cut from one outer layer only, is less representative and will be deemed to fulfil the requirements of this standard only if mutually agreed by the parties concerned.

3.2.5 Sampling method for man made fibre tows

If the consignment comprises not more than 5 cases, sample all the cases. If the consignment comprises more than 5 but not more than 25 cases, take 5 cases at random. If there are more than 25 cases in the consignment, take 10 cases at random. From each case to be sampled take, after opening the case, from the end of the tow at minimum 1 m by cutting and discard this length.

Take one sample from each case and repeat, if necessary, to give 10 samples in total . The length of the sample shall be at least 1 m. Seal the ends of the tow samples with an adhesive tape. Take care to retain the flat structure of the tow samples and lay them, for transporting purposes, in a case in straight form.

3.3 Sampling methods for wool fibres

3.3.1 General

Methods are given for the preparation of numerical laboratory samples, particularly for the measurement of fibre length.

The method given in 3.3.2 is applicable to wool fibres. The methods given in 4.1 and 4.2 are applicable to all fibres processed on the woollen or worsted systems.

3.3.2 Sampling method for loose fibres - Method of zoning

3.3.2.1 General

Two typical cases are described and most samples of intermediate size can be dealt with by small modifications to one of the procedures given.

3.3.2.2 Sampling from a bulk consisting of a bag or bale of greasy wool

A typical bag of wool can weigh about 350 kg and can comprise a large number of fleeces or parts of fleeces.

The total variability in fibre length may be considered in the following two parts:

a) the variability within a fleece or part fleece. This will be termed within-zone variation;

b) the variability between fleeces or part fleeces. This will be termed between-zone variation.

It cannot be assumed in general that the sackful of wool is homogeneous and it is thus necessary to sort through the whole bulk to obtain a representative sample. Consequently it may be convenient to carry out the following sampling procedure whilst transferring the wool to a hopper, bin, or lattice for the next stage of processing.

3.3.2.2.1 Choice of number of zones

The standard deviation σ of N fibres is given by

$$\sigma = \sqrt{\frac{V_R}{N} + \frac{V_z}{n}}$$

where

V_r is the residual variance within zones;
V_z is the variance between zones;
n is the number of zones;
N is the total number of fibres measured.

Then the average number of measured fibres per zone (which in general is not a whole number) is

$$\frac{N}{n}$$

In measuring mean fibre length, if the values of V_r and V_z typical of the type of wool to be tested are known, table 1 of annex A may be consulted to obtain the approximate values of n and N that will yield a mean length having a standard error of the value required for the immediate purpose. If values of V_r and V_z are not known, use the underlined values of n and N from the same table which correspond to values of V_r and V_z found to be typical of many types of wool.

In deciding N and n, it should be remembered that the time taken to measure a fibre once zoning has been completed is very much less that the time taken to sort a zone.

3.3.2.2.2 Selection of zones

The procedure to be described utilizes the simplest apparatus. Mechanical handling equipment, for example conveyor belts, may possibly be used to speed it up.

When the number of zones and the total number of fibres have been decided on, obtain a box or measure that can hold about 0,5 kg of fibre. If the total mass of the bulk is Q boxfuls, calculate the quotient, Q/n, to the nearest whole number. Let this number be P.

Note: The mass of the bulk in this case is $Q \times 0{,}5$ kg

Select the required zones for sampling as follows. Fill the box repeatedly with fibres and empty it until the bulk to be sampled has been transferred, reserving the first boxful and each following boxful that is a multiple of the value of P, and keeping these boxfuls in the order in which they were drawn from the bulk. The contents of each boxful reserved constitutes a zone.

3.3.2.2.3 Sampling the zones

Divide each boxful in turn into halves by hand and discard the left half. Divide the right half into two halves and discard the left half. Continue this process of reduction until, as judged by eye, approximately the number of fibres required per zone, *N*/*n*, has been obtained (see A.3). Transfer these fibres to a velvet board and cover them with a small transparent plate. Repeat this process for each selected zone or box. The final representative sample consists of the number, *n*, of groups of fibre on the velvet board and, to avoid bias, it is essential that all the fibres in each group be measured.

3.3.2.3 Sampling from a bulk consisting of several kilograms of loose wool fibres

This procedure is suitable for samples of wool of mass up to a few kilograms.

Lay out the locks of wool or groups of fibres constituting the sample side by side and parallel on a table so that, as far as possible, equal numbers of fibres occupy the same total length of the table. This can be done by splitting the larger groups into smaller units.

From table A.1, find the total number of fibres required, *N*, and number of zones required, *n*.

Take a group of fibres from each of *n* different points approximately equally spaced along the total length of the table.

Reduce each selected group by repeated halving, as described in 3.3.2.2.3 until the number of fibres required in each zone is obtained.

4 Sampling of fibres from processed materials, yarns and fabrics

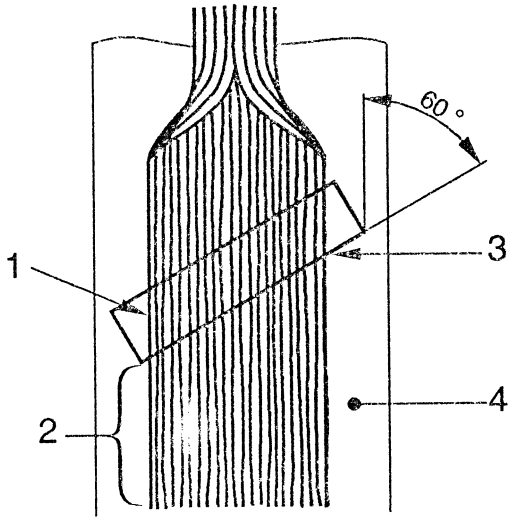
4.1 Sampling fibres from sliver or roving

4.1.1 General

If the bulk consists of many cans or packages each prepared and processed in the same manner, obtain a laboratory sample sufficiently accurate for most purposes by taking equal lengths from a minimum of four cans or packages, chosen from different parts of the bulk. If the number of cans or packages is smaller than four, take equal lengths from each.

4.1.2 Cut square method - Procedure

From the sample under test take at random a length of sliver or roving of at least three times the length of the longest constituent fibre of the sliver. Untwist roving by hand. Lay the sliver or roving spread out on a velvet board and cover it with a transparent glass plate(see figure 1). Then cut the protruding fibres on the front edge of the plate. Move the plate about 2 mm and discard the fibres that project in front of the plate with a pair of forceps, taking not more than 20 fibres at a time with the forceps. Repeat this procedure two times. This procedure is termed squaring. Move the plate once more 2 mm and take the fibres for the sample with the forceps. The number of fibres to be taken depends on the testing method to be applied.



1 Glass plate
2 Velvet board
3 Cut at edge of glass plate
4 Length longer than the longest fibre

Figure 1 Cut square method

4.1.3 Sampling method for slivers - Random draw method

4.1.3.1 General

This method is suitable for fibres processed on the woollen or worsted systems, twistless sliver such as card sliver and top, and also for any sliver that can be untwisted easily prior to sampling.

This method gives a procedure for preparing the fibres by hand; automatic means of preparing the specimen, similar to the manual method, are not described.

4.1.3.2 Apparatus

A grip, suitable for taking a draw of fibres from a sliver, is required for this method. This can be made from a type of letter clip about 150 mm wide. The straight edge of the clip is, if necessary, ground to be parallel to the bent edge. A thin strip of leather is then cemented in the groove of the bent edge so that the clip so modified will hold a single wool fibre firmly at all points along its edge.

4.1.3.3 Procedure

Firmly hold the sliver to be sampled in the right hand near a free end and then grip it at a distance of about 300 mm with the left hand. Gently part the sliver by separating both hands and discard the shorter piece. Place the remaining piece along the centres of the two velvet boards placed edge to edge with the parted end near the front of the first board, as shown in figure 2. Place a weighted glass or transparent plastics plate on the sliver near the back edge of the second board to prevent the sliver from moving. Alternatively, use one large board.

Use the grip with leather lined jaws to remove and discard a 2 mm fringe of fibres. This distance, which is the length of fibre in the grip, may be gauged at first by marking a number of parallel lines on a piece of paper and placing them under the parted end. After a little practice it is quite safe to estimate the distance by eye.

Repeat the procedure, removing and discarding successive 2 mm fringes for a distance about equal to that of the longest fibre in the sliver.

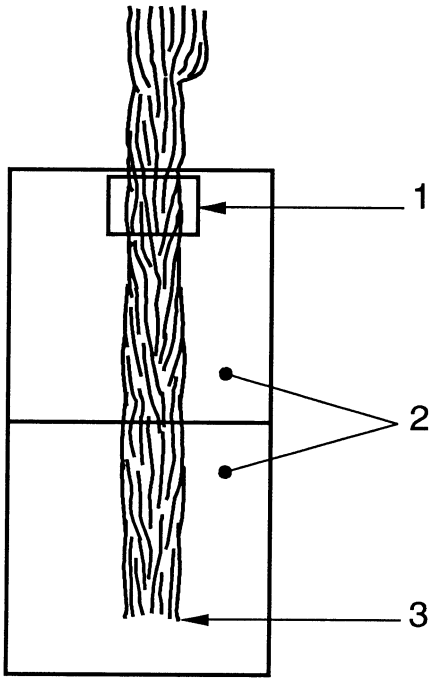
Note: For a 22 μm top this distance is generally about 200 mm.

The sliver end has now been prepared and any succeeding draw of fibre ends will be a representative sample.

Choose a draw at random from 10 successive draws. If required, a second draw may be chosen in the same way from the same prepared end. Then transfer the selected draw of fibres to a small velvet board and cover it with a small transparent plate. Measure all the fibres according to the specified method.

It is permissible to reduce the size of the last 10 draws by taking them from a 1 mm fringe if only a moderate sized sample is required.

Note: The number of fibres in a 1 mm draw will vary according to the fibre length and diameter, but for a 24 mm top it will be between 250 and 400.



Key
1 Weighted glass plate
2 Velvet boards
3 Parted end

Figure 2 Sampling method for slivers - Random draw method

4.1.3.4 Number of fibres in the cross-section of a sliver

It is sometimes useful in sampling to have some knowledge of the average number of fibre tips per unit length (the fibre-end density).

Calculate these quantities from the linear density of the sliver and the average fibre length and root mean square diameter. The following approximate formulae apply to wool fibres:

Average number of fibres in cross-section is

$972\ \rho \times 10^3/d^2$

and average number of fibres (or fibre tips) per millimetre of sliver is

$97{,}2\ \rho \times 10^3/d^2 \times L$

where

ρ is the linear density of sliver, in kilotex;

d is the root mean square fibre diameter, in micrometers;

L is the average fibre length, in centimetres.

4.2 Sampling fibres from yarn

4.2.1 General

In testing packages of yarn from a consignment, select four packages from different parts of the bulk; if the bulk consists of fewer than four packages, select all of them.

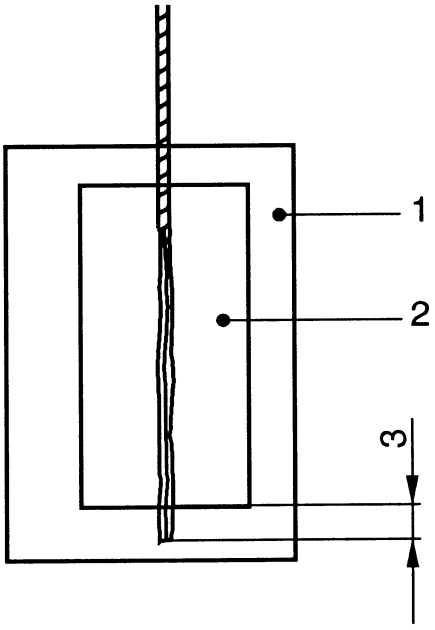
4.2.2 Sampling from a bulk consisting of yarns - Cut square method

4.2.2.1 General

This method is suitable for yarns composed of any fibres if the yarn can be opened by untwisting to separate the fibres. In general it is suitable for all ring spun yarns. For yarns which are processed using other techniques (for example rotor yarns, airjet yarns) it has to be proved that the fibres can be separated without being damaging.

4.2.2.2 Procedure

From the sample under test take at random a length of yarn equal to at least three times the length of the longest constituent fibre of the yarn. Untwist the yarn by hand, lay it down centrally on a small velvet board and cover it with a small transparent plate. Then cut the yarn about 5 mm from the front edge of the plate (see figure 3).



Key
1 Velvet boards
2 Glass plate
3 approx 5 mm

Figure 3 Sampling from a bulk consisting of yarns - Cut square method

Remove the fibres that project in front of the plate one by one, with a pair of forceps, right back to the edge of the plate. This procedure is termed squaring. Move the plate back a few millimetres, exposing a band of fibre ends; remove these one by one and measure them in accordance with the specified method. Continue this process until a total of at least 50 fibres has been taken.

In all cases, however, once the plate has been moved back, remove all the available fibres whose ends project. Then discard the length of yarn, take another from the sample and square it, and measure at least 50 fibres from it. Obtain the required number of fibres by repeating the procedure on fresh lengths of yarn, chosen at random from the bulk available.

4.3 Sampling fibres from fabric

For woven fabrics select a minimum of four yarns for testing. Select warp yarns at approximately equal intervals across the width, and if possible select weft yarns from different places along the fabric so as to include yarn from different cops.

For knitted fabrics, select a minimum of four yarns from consecutive courses, so as to include yarn from different packages.

5 Sampling of yarns

5.1 General

The objective of sampling may depend on the purpose for which the testing is being carried out. The method of sampling depends on the properties being measured and their expected variability.

The method describes procedures for populations consisting of consignments, lots, cases, a single case or a number of individual packages.

The sampling is applicable for single yarns, spun yarns or filament yarns, plied yarns, cabled yarns and cords, made of any fibres, for mixtures of fibres, unsupported or supported on any package form, including beams. It is applicable for sampling of yarns from fabrics.

5.2 Procedure for shipments, consignments and lots

From the cases in a lot or shipment separate a certain number of cases to form a lot sample. For the lot sample, take for acceptance testing cases which have been designated by drawing a number of cases from a container after mixing them thoroughly or by using a table of random numbers. Take the number of cases specified in table 1.

Table 1: Number of cases and packages

Number of cases in lot	Number of cases in lot sample	Minimum number of packages of each case	Minimum number of packages in the laboratory sample
1	1	10	10
2 to 10	2	5	10
11 to 30	3	5	15
31 to 75	4	5	20
more than 75	5	5	25

Take as nearly as possible the same number of packages per case. Determine randomly which cases, if any, are to have a different number of packages taken from them. Select packages from each case at random so that each package in the case has an equal chance of being selected.

5.3 Length of yarns on the package

Each package shall have a minimum length of yarn as specified in table 2.

Table 2 Minimum yarn length

Linear density of yarn tex	Minimum yarn length m
less than 12 from 12 to 100 more than 100	2 000 1 000 600

If the minimum yarn length is shorter than specified in table 2, then take more packages from the same case until the minimum yarn length specified in table 2 is obtained. These packages then fully meet the requirements of the laboratory sample.

5.4 Sampling of yarns from beams

For the lot sample for testing yarns from beams take one beam from a beam set which has been designated either by drawing numbers from a container after mixing them thoroughly or by using a table of random numbers.

When sampling yarn from beams, reel sample skeins, or reel test skeins directly from the beams using minimal tension to prevent stretching of yarns. Place the reel at a convenient distance from the beam to draw the yarn from the beam at less than a 20°-angle. Fasten the required beam in order to slowly unwind the yarn while a second operator turns the reel fast enough to take up the yarn as it comes from the beam. Take at least 1 m warp length.

The number of required ends depends on the test method to be applied.

5.5 Procedure during sampling and the number of specimens

Before sampling discard packages or beams which have been damaged or wetted or which appear to be in an irregular state on visual inspection. The interested parties shall agree whether irregular packages are tested and the procedure to be used.

The number of test specimens per package in the laboratory samples shall be as specified according to the applicable test method. If the yarn length per package for the applied test method is not appropriate enough, more packages shall be taken from the lot sample.

5.6 Sampling of yarns from fabrics

If the test specimens have to be extracted from fabrics, then the fabric sample shall be large enough to furnish a sufficient number and length of test specimens. The test specimens shall be taken in such a way that the properties in the yarn will not be changed during sampling. In woven fabrics, warp test specimens shall be taken

from different ends and weft specimens shall be taken at random from several sections of the sample to be as representative as possible for the yarn. With regard to knitted fabrics, specimens shall represent as many different yarn packages as possible.

6 Sampling of fabrics

6.1 General

Theoretically correct methods of sampling from lengths or rolls of fabric require that laboratory samples be taken at intervals along the length of the fabric.

In practice, rolls of fabric can be very long, and there are economic and practical handling difficulties in applying such methods.

In most cases fabrics cannot be cut, except at the ends of the fabric piece, and therefore sampling cannot be carried out across the whole population. The recommended procedure is described in 6.3.

If a particular fabric property is known to vary along the length of the roll, then tests carried out only at the ends of the roll will not be representative of the whole length of the fabric. In this case a statement to this effect shall be included in the test report, and if the results are to be used as a basis for quality standards, then this shall be agreed between the interested parties.

In special cases, for example where faults or changes in a property along the length of the fabric are to be examined, samples may need to be taken at intervals along the whole length of the roll. In this case, the number and arrangement of samples depends on the specific requirement and shall be agreed between the parties.

6.2 Procedure for shipments, consignments and lots

The number of cases (containers, etc.) and the number of rolls shall be as specified in table 3.

Table 3: Sampling procedure for shipments, consignments and lots

Supplied in m or kg			
Total length in the lot m	Total mass in the lot kg	Number of cases, containers etc.	Number of rolls
less than 2 500	less than 500	at least 1	3
less than 5 000	less than 1 000	3	3
more than 5 000	more than 1 000	3	3
		and for each subsequent 5 000 m or 1 000 kg more	1

If there are less than three cases in the lot, then take at least three rolls from the cases even if this means two or three rolls from one case.

If the lot contains only rolls, take a number of rolls as specified in table 3 depending on the total length or total mass.

6.3 Procedure for sampling

Take the samples from the selected rolls by cutting, not tearing, at a distance of 1 m from the end of the roll.

If the rolls have previously been separated from larger rolls by cutting, the samples can be taken directly from the cut ends of the roll.

The size of the sample taken shall be sufficient to carry out the required tests. Any visible irregularities, damage or colour differences shall be avoided.

7 Test report

The test report shall include the following information :

a) the number and year of publication of this European Standard;

b) a description of the sample;

c) details of the procedure used for sampling.

Annex A (Informative)
Determination of number of tests for fibres

The number of individuals to be tested will depend on the variability of the material and the accuracy required. In random sampling the mean of e.g. the breaking load of the test specimens will, about 19 times out of 20, be within

$$\pm \frac{2C}{\sqrt{n}}\%$$

of the population mean,

where

C is the coefficient of variation, in per cent, for the property considered;

n is the number of test specimens.

The values of $\pm 2C/\sqrt{n}$ % are the confidence limits of error.

Often the value of the coefficient of variation is known approximately and the number of fibres necessary to achieve given confidence limits of error can then be calculated. Some of these values, which are known, are given in table A.2. Table A.3 can then be used to find the number of fibres required to test for any desired confidence limits of error of the mean.

EXAMPLE: The mean strength of the fibres from a wool top is required to confidence limits of error of 10%. From table A.2 the coefficient of variation is seen to be 50% and table A.3 shows that about 100 fibres will be needed for 10% confidence limits of error. (The top was sampled by the cut square method, which yielded 113 fibres, all of which were tested for strength.)

For a heterogeneous population, the variability of the sample mean is due partly to the between-zone variation and partly to the within-zone variation, and the above simple formula cannot then be used. If the between-zone variation is relatively large, it is best to take many zones and measure only a few fibres from each. If the converse is true, the population can, of course, be treated as homogeneous.

Whenever random sampling is specified, the use of tables of random numbers is recommended.

TABLE A.1 - Standard error of mean fibre length in centimetres

Variance (cm^2)		N^* = 400			N^* = 800			N^* = 1 600		
Between zones	Within zones	n^{**} =			n^{**} =			n^{**} =		
V_z	V_r	50	100	200	50	100	200	50	100	200
	8	0,42	0,32	0,24	0,41	0,30	0,22	0,41	0,29	0,21
8	4	0,41	0,30	0,22	0,41	0,29	0,21	0,40	0,29	0,21
	2	0,41	0,29	0,21	0,40	0,29	0,21	0,40	0,28	0,20
	8	0,32	0,24	0,20	0,30	0,22	0,17	0,29	0,21	0,16
4	4	0,30	0,22	0,17	0,29	0,21	0,16	0,29	0,21	0,15
	2	0,29	0,21	0,16	0,29	0,21	0,15	0,29	0,20	0,15
	8	0,24	0,20	0,17	0,22	0,17	0,14	0,21	0,16	0,12
2	4	0,22	0,17	0,14	0,21	0,16	0,12	0,21	0,15	0,11
	2	0,21	0,16	0,12	0,21	0,15	0,11	0,20	0,15	0,11

* N = total number of fibres
** n = number of zones

TABLE A.2 - Some approximate percentage values of coefficients of variation of properties of individual fibres

(Figures are for a numerical sample unless otherwise stated and are necessarily approximate and may vary appreciably from bulk to bulk)

Source of fibres	Length %	Diameter %	Breaking load %	Breaking extension %	Linear density %
Cotton	40	25	50	35	25
Wool, sorted and scoured	50 to 60	20 to 26*	50	60	-
Wool card sliver	60	20 to 26*	50	60	-
Wool top	50	20 to 26*	50	60	-
Woollen slubbing, yarn	90	30*	-	-	-
Viscose staple fibre	-	-	15	15	10
Cellulose acetate staple fibre	-	-	15	15	15
* Denotes length-biased sample					
NOTE: For wool, the coefficients of variation for breaking load and breaking extension given in this table are not a significant factor. In fact, experience between laboratories in different countries has shown that dynamic measurements on wool fibres (breaking load and breaking extension) do not always give reproducible results.					

TABLE A.3 - Number of fibres* required for various confidence limits of the mean

Coefficient of variation %	Confidence limits as percentage of the mean						
	1	2	3	5	10	20	30
2	16	4	2	1	1	1	1
5	100	25	12	4	1	1	1
10	400	100	45	16	4	1	1
15	900	225	100	36	9	3	1
20	1 600	400	178	64	16	4	2
25	2 500	625	278	100	25	7	3
30	3 600	900	400	144	36	9	4
35	4 900	1 225	545	196	49	13	6
40	6 400	1 600	712	256	64	16	8
45	8 100	2 025	900	324	81	21	9
50	10 000	2 500	1 112	400	100	25	12
55	**	3 025	1 345	484	121	31	14
60	**	3 600	1 600	576	144	36	16
65	**	4 225	1 878	676	169	43	19
70	**	4 900	2 178	784	196	49	22
75	**	5 625	2 500	900	225	57	25
80	**	6 400	2 845	1 024	256	64	29
85	**	7 225	3 212	1 156	289	73	33
90	**	8 100	3 600	1 296	324	81	36
100	**	10 000	4 443	1 600	400	100	45

** Denotes more than 10 000 fibres.

* Values for number of fibres given in the body of the table are calculated from the approximate values of

$$\left(\frac{2 \times \text{percentage coefficient of variation}}{\text{percentage of confidence limits}}\right)^2$$

and apply to the 95% (19 in 20) probability level.

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