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Standard Practice for Sampling Yarn for Testing[1]

This standard is issued under the fixed designation D2258/D2258M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This practice describes a procedure for the division of shipments of yarn into test lots and the sampling of such lots for testing.

1.1.1 This practice can be used for lot sample testing of yarns for both pre-fabric production and post-fabric production.

1.2 This practice is applicable to single, plied, or cabled yarns, and cords, made of any fiber or mixture of fibers, and supported on any form of package, including beams.

1.3 This practice also describes procedures for the sampling of yarn(s) removed from woven or knitted fabrics; however, when thus sampled, the yarns are usually not representative of entire shipments, as referred to in 1.1. Consequently, the resultant sampling can only be used to determine the characteristics of the yarn and is usually not used for acceptance testing. Moreover, it should be recognized that the characteristics of yarns from fabrics may be different than the characteristics of the same yarn(s), prior to being entered into the fabric manufacturing process.

1.4 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D123 Terminology Relating to Textiles

D1578 Test Method for Breaking Strength of Yarn in Skein Form

D1907 Test Method for Linear Density of Yarn (Yarn Number) by the Skein Method

D4849 Terminology Related to Yarns and Fibers

3. Terminology

3.1 For terminology related to Yarns and Fibers, see Terminology D4849.

3.2 The following terms are relevant to this standard: beam, beam set, bulk sample, case, cone, end, fabric package, laboratory sample, lot, lot sample, primary sampling unit, production lot, sample, sampling unit, sample skein, specimen, and yarn package.

3.3 For definitions of all other textile terms see Terminology D123.

4. Summary of Practice

4.1 Instructions are given for dividing the yarn into lots, for determining the number of cases, beams, or fabric packages to be selected from each lot as a lot sample, and for determining the number of packages, including the number of ends, representing those packages taken from the lot sample as a laboratory sample.

5. Significance and Use

5.1 Assigning a value to any property of the material in a container or in a lot, consignment, or delivery involves a measurement process that includes both sampling and testing procedures. The correctness of the value assigned depends upon the variability due to testing and sampling plan. Even

[1] This practice is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D13.58 on Yarns and Fibers.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

when the variability due to testing is minimized by carefully developed procedures, correct and consistent estimates of the true value of the property are possible only when the sampling procedure avoids systematic bias, minimizes variations due to sampling, and provides a laboratory sample of adequate size.

5.2 Practice D2258 may not give the most efficient sampling plan that might be devised in special situations but does present a general procedure that gives satisfactory precision with an economical amount of sampling. Many plans that include stratified sampling can be found in textbooks and through the use of statistical software tools and calculators.

5.2.1 If not specified by the purchaser, the manufacturer will define suitable production lots based on one or more of the following: supply lot, production shift/time segment, production equipment or production line, operator, designated shipment, production run, or a combination herein.

5.2.2 If not specified by the purchaser, the manufacturer will define sampling and testing frequency based on the following: process capability or capability analysis, historical trends, level of detection rate required, confidence level requirements, known variations or special causes, or both. Every attempt to ensure conforming product is being produced, identify potential nonconforming product or proper isolation and identification, will be carried out by the manufacturer.

5.2.3 Sampling count and number of specimens will be based on standard practice listed within the document. Increase or decrease in count or frequency might be applied based on typical standard deviation, precision and confidence level, Measurement System Analysis (MSA), gauge R&R study, or gauge linearity and bias study. Higher variations would indicate reason for an increase in count, while lower variations would indicate reason for decrease in count, while lower variations would indicate reason for decrease in count.

5.2.4 When selecting a suitable sample size, several considerations need to be made: (*1*) size of the lot being sampled, (*2*) historical trends, (*3*) distribution of the data, (*4*) level of accuracy and confidence, (*5*) cost, and (*6*) practicality.

5.2.5 Minimizing and reducing measurement error will improve product testing reliability, reduce overall variation of test data accuracy, and improve confidence level of the reported values.

5.3 The smallest number of specimens required for a given variability in the average result will usually be obtained by (*1*) maximizing the number of shipping containers in the lot sample, (*2*) taking a single package end per shipping container in the laboratory sample, and (*3*) taking only one specimen per package. Unfortunately, this is rarely the most economical way to test a product because it normally costs most to take a shipping container as part of the lot sample, costs an intermediate amount to take a package from a shipping container as part of a laboratory sample, and costs least to take and test a specimen from a package or yarn.

5.4 To minimize the cost of sampling a lot of material, it is necessary to agree on the required variance for the reported average for a lot of material:

5.4.1 Estimate the variance due to lot samples, the variance due to laboratory samples, and the variance due to testing specimens.

5.4.2 Calculate the total variance for average test results for several combinations of the number of lot samples, the number of laboratory samples per lot sample, and the number of specimens per laboratory sample.

5.4.3 Calculate the cost of performing each of the sampling schemes considered in 5.4.2.

5.4.4 Select the sampling scheme that (*1*) has the required precision and (*2*) is most economical to perform.

6. Procedure

6.1 *Division into Lots*—Instructions on the division of product into lots is best given in the appropriate specification. In the absence of such instructions, sample and test as a separate lot any portion of a shipment or order that differs from other portions in specifications, put-up, or physical characteristics, or that is billed or designated by the supplier as a separate lot. If portions of a larger order are shipped on different dates, from plants or warehouses, or in more than one carload or truckload, treat each such separately shipped portion as a separate lot. If the cases in a shipment do not have consecutive numbers, divide the shipment into groups of cases having consecutive numbers and treat each group as a separate lot if it is separated from an adjacent group by as many as ten case numbers. Treat each beam set as a separate lot.

NOTE 1—Many manufacturers have elected to test while manufacturing product (in-process testing). This method of sampling and testing provides faster information in real-time analysis of data for timely adjustments and reactions to potential shifts within a process. In either method chosen by the manufacturer (in-process or post-process), the applied practice for sampling yarn contained or its equivalency (frequency and count), may still be extracted from this standard.

6.2 *Lot Sample*—As a lot sample for acceptance testing, unless otherwise agreed upon, as when specified in an applicable material specification, proceed as follows:

NOTE 2—An adequate specification or other agreement between the purchaser and the supplier requires taking into account the variability between shipping units, between packages or ends within a shipping unit, and between specimens from a single package so as to provide a sampling plan with a meaningful producer's risk, consumer's risk, acceptable quality level, and limiting quality level.

6.2.1 *Cases or Fabric Packages*—For the lot sample, assign each case or fabric package with consecutive numbers and take for acceptance testing, the number of cases or fabric packages specified in Table 1. Select the cases or fabric packages by a random process using the assigned numbers by either placing these numbers on small slips or chips, placing them in a

TABLE 1 Number of Cases, Beams, or Fabric Packages[A,B]

In Lot	In Lot Sample
1	1
2 to 4	2
5 to 9	3
10 to 19	4
20 or more	5

[A] For cases containing only a few packages per case, enough cases must be taken in the lot sample so there will be at least ten packages in the lot sample. (See 6.2.1.1 and 6.2.1.2.)

[B] Table 1 is an empirical practice schedule found by experience to be satisfactory for the lot sample from homogeneous lots of yarn or fabric support packages, such as rolls or boards.

container, mixing thoroughly and drawing out the number or numbers by selection, or by using a random number table or its computer equivalent.

6.2.1.1 When fabric packages, such as bolts or pieces, are contained in cases, consider the case as the sampling unit. When fabric packages, such as rolls are self-contained, consider the individual fabric package as the sampling unit.

6.2.1.2 When known, fabric packages, such as rolls, pieces, or bolts produced from one beam set may be treated in the same manner as beams.

6.2.2 *Beams*—For the lot sample, assign each beam with consecutive numbers and take for acceptance testing, one beam from the beam set. Select the beam by a random process using the assigned numbers by either placing these numbers on small slips or chips, placing them in a container, mixing thoroughly and drawing out the number by selection, or by using a random number table or its computer equivalent.

6.3 *Laboratory Sample*—For a laboratory sample for acceptance testing, unless otherwise agreed upon, as when specified in an applicable material specification, proceed as follows:

6.3.1 *Cases*—When sampling cases, take a total of ten packages from the lot sample. When there are five cases in the lot sample, select randomly two packages from each case. When there are four cases in the lot sample, select randomly two packages from each case then randomly select two of the four cases and select randomly a third package from each of the selected cases. When there are three cases in the lot sample, select randomly three packages from each case then randomly select one of the three cases and select randomly a fourth package from the selected case. When there are two cases in the lot sample, select randomly five packages from each case. When there is one case in the lot sample, select randomly ten packages from the case.

6.3.2 *Fabric Packages*—When sampling fabric packages, discard the outside layer of the fabric package, and then take a full width swatch, 2 m [2 yd.] from each selected lot sampling unit. Treat each type of yarn in the fabric, the warp and filling yarns in woven fabrics, and the machine direction of knitted fabrics as separate sampling units. Take a total of ten ends from the fabric swatches. When there are five swatches in the lot sample, select randomly two ends from each swatch. When there are four swatches in the lot sample, select randomly two ends from each swatch then randomly select two of the four swatches and select randomly a third end from each of the selected swatches. When there are three swatches in the lot sample, select randomly three ends from each swatch then randomly select one of the three swatches and select randomly a fourth end from the selected swatch. When there are two swatches in the lot sample, select randomly five ends from each swatch. When there is one swatch in the lot sample, select randomly ten ends from the swatch. Remove ends from the fabric swatches as directed in 6.3.4, 6.3.5, and 6.3.6, as required.

NOTE 3—Individual yarns removed from fabric may come from several yarn shipments and may not be representative of a given yarn lot. Yarns removed from fabric are generally used for identification purposes.

6.3.3 *Beams*—When sampling beams of yarn, take ten ends from the first beam in the lot sample. Randomly take the first end from among those included between 2.5 and 7.5 % of the beam end count from one beam flange. Take the other nine ends from positions each 10 % of the beam end count from the first end toward the other beam flange. When sampling yarn on beams, reel sample skeins, or reel test skeins directly from the beams using minimal tension to prevent stretching of yarns. Place the beam containing the yarn to be tested on two bearings high enough for the beam flanges to clear the floor. Attach a crank arm to one end of the beam shaft. Place the reel a convenient distance from the beam to draw the yarn from the beam at less than a 20° angle. Fasten the required number of ends from the beams to the reel. Let one operator turn the beam slowly to unwind the yarn while a second operator turns the reel fast enough to take up the yarn as it comes from the beam.

NOTE 4—In using beams after the test ends have been removed, a set of spools containing the same kind of yarn or thread as that on the beam may be placed behind the beam on a small creel to replace the ends that have been used for testing. When the ends which supply the test skeins come up on the beam, the auxiliary spools may be broken out.

6.3.4 *Sample Skeins*—It is often preferable, but is not mandatory except when sampling yarn on beams, to reel sample skeins. Skeins condition more rapidly than tightly wound packages, and it is sometimes more convenient to handle the laboratory sample in skein form. From each of the yarn packages or ends selected for the laboratory sample, reel a skein containing sufficient length to provide all the specimens required. If yarn strength or yarn number is to be determined by skein methods, the test skeins specified in Test Method D1578 and Test Method D1907 may be reeled directly from the yarn packages or beams, and additional sample skeins may be reeled as a source of specimens for other tests. Remove the yarn from packages either by drawing over the end of bobbins, cops, cones, etc., or from the side of flanged spools or beams, whichever is done in normal use. When the normal means of yarn removal is not known, draw the yarn from the side of the package. Removal of yarn over-end drawing from the side results in a difference of twist of $1/\pi\ d$, where d is the package diameter. When several ends are wound parallel on a single package or beam, draw each end through a separate guide and reel a skein from each selected end in the laboratory sample, drawing from the side of the package form or beam. When selecting ends directly from in-process or straight from an extrusion line, obtain random ends from across the full width of the production line to accurately obtain a fair account of the distribution.

6.3.5 *Removing Yarn from Woven Fabrics*—Cut the fabric parallel to the direction (warp or filling yarns) to be tested. Ravel and discard the warp (or filling) yarns until full length yarns can be removed from the fabric swatch.

NOTE 5—If the fabric is tightly woven, it may be necessary to cut the fringe frequently to allow the yarns to be raveled from the fabric without stretching.

6.3.6 *Removing Yarn from Weft Knit Fabrics*—Cut the fabric along a course line. Clean the raveling edge to obtain a free pulling yarn at least 0.2 m [8 in.] longer than the specimen length required for the property of interest. For double knit fabric, randomly take five ends from the short feed length courses and five ends from the long feed length courses to