Designation: D 1244 – 98

Standard Practice for Designation of Yarn Construction[1]

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INTRODUCTION

This practice conforms in general with the practices adopted by the International Organization for Standardization in Document ISO 1139 Designation of Yarns. The ISO document, however, covers the use of the tex direct yarn numbering system only, whereas ASTM Practice D 1244, as in previous texts, also covers other direct yarn numbering systems and traditional indirect yarn numbering systems.

1. Scope

1.1 This practice covers instructions for the designation of yarn construction and is applicable to single yarns, plied yarns, and cabled yarns or cords of filaments or spun fibers. The application of the practice to specific cases is illustrated with examples. This practice does not cover the description of novelty yarns or core spun yarns of various types.

1.2 The primary purpose of this practice is to establish a reference system for use in the trade and particularly for use in correspondence and publications. To secure a simplified notation, certain portions may be omitted provided there is no doubt as to the omitted parts.

1.3 *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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 123 Terminology Relating to Textiles[2]

D 861 Practice for Use of the Tex System to Designate Linear Density of Fibers, Yarn Intermediates, and Yarns[2]

2.2 *Other Standard:*

ISO1139 Designation of Yarns[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *resultant yarn number, n*—the yarn number based on the observed mass per unit length of a plied yarn, a cabled yarn, or a yarn whose number has been changed by processing such as twisting or bulking.

3.1.1.1 *Discussion*—A calculated yarn number obtained from the yarn number(s) of the components should not be called a resultant yarn number.

3.1.2 For definitions of other textile terms used in this practice, refer to Terminology D 123.

4. Explanation of Abbreviations and Symbols

4.1 *B*—A symbol designating the resultant yarn number of bulked yarns, to be placed before the numerical value.

4.2 *R*—A symbol designating the resultant yarn number of plied or cabled yarns, to be placed before the numerical value.

4.3 ×—The multiplication symbol is used before the number of identical component strands combined in any stage of manufacture for yarns numbered in a direct yarn numbering system.

4.4 +—The plus sign is used to denote the addition or combination of dissimilar component strands in a more complex structure.

4.5 /—When used with direct yarn numbers, the solidus denotes the separation of a structure numbered in a direct yarn numbering system into its component strands. When used with indirect yarn numbers, the solidus denotes combining (plying) of identical component strands, numbered in an indirect yarn numbering system. See also Note 2.

4.6 *f*—An abbreviation for filaments, to be placed before the number of filaments.

4.7 *t0*—Symbol indicating zero twist in a yarn.

4.8 *tpi*—An abbreviation for turns of twist per inch in a yarn.

4.9 *tpm*—An abbreviation for turns of twist per metre in a yarn.

4.10 ( )—Parentheses are used to enclose information describing the material from which the yarn is made.

4.11 [ ]—Brackets are used to enclose the description of dissimilar components forming a subcomponent of a cabled yarn or cord.

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[1] This practice is under the jurisdiction of ASTM Committee D-13 on Textiles, and is the direct responsibility of Subcommittee D13.58 on Yarn Test Methods, General.

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[2] *Annual Book of ASTM Standards*, Vol 07.01.

[3] Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

4.12 { }—Braces are used to enclose the description of dissimilar components forming a multiple wound yarn, plied yarn, cabled yarn, or cord.

4.13 Ne_c—Abbreviation for cotton count.

4.14 Nw_w—Abbreviation for worsted count.

4.15 *Nwe*—Abbreviation for woolen run.

4.16 *den.*—Abbreviation for denier.

NOTE 1—Other abbreviations may be found in specific examples or in trade usage.

5. Summary of Practice

5.1 The structure of a yarn is described by a group or series of groups of logically ordered symbols which describe the characteristics of a yarn. One group of symbols describes completely a single yarn or a component of a more complex yarn. A plied yarn is described by two groups; for example, in the single-to-ply notation, the first group describes the structure of the single yarn or yarns, and the second group describes the structure of the plied yarn. The groups are connected with appropriate symbols. Other yarns are described similarly.

5.2 Two orders of notation are presented for direct yarn numbering systems, single-to-ply and ply-to-single. For indirect yarn numbering systems, only the traditional single-to-ply notation is presented.

NOTE 2—Alternative names for the single-to-ply and ply-to-single notation are single-to-fold and fold-to-single, used in ISO/TC 38 Document N362, and single-to-resultant and resultant-to-single. The resultant-to-single term is particularly applicable to the description of cabled yarns and to single yarns that have been bulked or given added twist. See also 7.3.2, 7.3.3, and Note 3.

6. Significance and Use

6.1 The two orders of notation are presented to satisfy two separate needs encountered in the textile industry and in textile technology. The single-to-ply notation meets the needs of yarn manufacturers to describe a single yarn, or a plied or cabled yarn primarily in terms of its manufacturing specifications. The ply-to-single notation, based on the resultant yarn number, meets the needs of users of yarn who have relatively little interest in the linear density or twist of the single yarn component(s) but are interested mainly in the final product. The chief difference between the two notations is the order in which the information is presented. In this practice the same symbols are used for both notations and retain their usual mathematical meanings.

6.2 The single-to-ply notation is prescribed for yarns numbered in both direct and indirect yarn numbering systems and conforms with current usage in large sections of the textile industry. The ply-to-single notation is prescribed for yarns numbered in a direct yarn numbering system and its use is approved by the ISO/TC 38 in Document N362. This latter notation has not been included previously in Practice D 1244. The ply-to-single notation has not been recommended for use with yarns numbered in indirect yarn numbering systems because of possible confusion when symbols are used with different meanings in different notations or used in conflict with their established mathematical significance.

6.3 At first glance, the recommended notation may appear rather involved, but in actuality it is a concise method for describing complex structures. For example, compare the following description of a yarn: "A cabled yarn or cord with a resultant cotton count of 1.4 and 5 turns per inch of Z twist made from 3 strands of plied yarn with 9 turns per inch of S twist each plied from 5 strands of 24 cotton count yarn with 15 turns per inch of Z twist and spun from 1 1/16 in. staple, graded strict low middling, and having a Micronaire reading of 4.3" with the description of the same yarn stated in Example 23,

24 Ne_c Z 15 tpi (cotton, 1 1/16 in., SLM, 4.3 Micronaire Reading) /5 S 9 tpi/3 Z 5 tpi; R 1.4 c.c. (23)

6.4 ASTM recommends (see Practice D 861), the general use of the tex universal yarn numbering system.

6.5 The designation of a numbering system, for example, cotton count, woolen run, and linen lea, does not restrict the yarn composition to the named fiber. See Example 5.

6.6 The terms used to designate different yarn numbering systems are frequently abbreviated. See 4.13-4.16.

6.7 The various yarn numbering *units* (cotton count, tex, etc.) should be carefully distinguished from the *property* which has been designated as linear density. This last term covers the concept of size or fineness. The distinction is comparable to the use of the *units*, (litres or gallons), to express a *property* such as the volume of an object.

7. Designation of Single Yarns, Direct and Indirect Yarn Numbering Systems

7.1 *Spun Yarns*—To describe the structure of spun yarns, state (*1*) the yarn number and the numbering system used, (*2*) the direction of twist, and (*3*) the amount of twist. Express the amount of twist in turns per inch (tpi) or turns per metre (tpm). Show the yarn number observed when the yarn is twisted to the extent specified. When known and needed, indicate in parentheses the type of fiber, the average linear density of the fibers, the length of the fibers, and other pertinent information with respect to fiber characteristics. If the single yarn has been spun from two or more fiber types, note the nominal percentages of each fiber.

Examples:

25 tex Z 15 tpi (cotton) (1)

24 Ne_c Z 15 tpi (cotton, 1 1/16 in., SLM, 4.3 Micronaire Reading) (2)

24 Ne_c Z 15 tpi (rayon, 1.5 den., 1 9/16 in. staple) (3)

35 Ne_w Z 381 tpm (80 % wool, 58's and 20 % dull acetate 3 den., 3 in. staple) (4)

20 Nwe Z 5 5 tpi (wool) (5)

See 13.1, Example 2a, for a simplified notation of Example 2.

7.2 The use of traditional and tex yarn numbers as recommended by ISO for use during stages 1, 2, and 3 of transition to the tex system is shown in Examples 6, 7, and 8. Only one number has been shown in later examples of this recommended practice to avoid confusion in the illustrations (examples).

Examples:

30 Ne_c(20 tex) Z 15 tpi (spun rayon) (6)

20 tex (30 c.c.) Z 15 tpi (spun rayon) (7)

20 tex Z15 tpi (spun rayon) (8)

7.3 *Filament Single Yarns*—Describe the yarn structure as directed in 7.1 for spun yarns but insert a notation showing the number of filaments following the yarn number. Designate this information with the letter *f* followed by the number of

component filaments. Designate monofilaments as *f1*. Write fractional twists in decimal form. State the yarn number obtained with the manufacturer's twist.

Examples:
11 tex f40 S 2.5 tpi (nylon 2.75 dtex) (9)

See 13.1, Example 9a for a simplified notation of Example 9.

7.3.1 *Filament Yarn with Zero Twist*—Omit the symbols *S* and *Z* and include the symbol *t0*.

Examples:
11 tex f40 t0 (nylon, 2.5 den.) (10)
100 den. f34 t0 (polyester) (11)

7.3.2 *Filament Yarns with Increased Twist*—When the original filament yarn is subsequently twisted, the yarn number in the twisted condition (or resultant yarn number) may be appreciably different from the yarn number obtained with manufacturer's twist. In such cases, follow the complete description by the resultant number preceded by the letter *R*. Place a semicolon before the letter *R*.

Example:
1 tex f40 Z50 tpi (rayon, 2.75 dtex); R 12.7 tex (12)

7.3.2.1 If the yarn number of the original yarn is not known or there is a need for only a resultant yarn number, state the resultant number of the yarn preceeded by the letter *R* and include at the end information about the original yarn if it is available.

Example:
R 12.7 tex f40 Z 50 tpi (rayon); 11 tex (13)

7.3.3 *Bulked Filament Yarns*—For yarns the linear density of which has been increased by a bulking or texturizing operation, indicate the original yarn number in the initial designation. Give the yarn number after bulking preceeded by the letter *B*. Place a semicolon before the *B*.

Example:
70 den. f34 t0 (nylon, 2.07 den.); B 80 den. (14)

7.3.3.1 Where the degree of bulking is not known or only the bulked yarn number is needed, state the final or bulked yarn number preceded by the letter *B* and include at the end information about the original yarn if it is available.

Example:
B 80 den. f34 t0 (nylon, 2.07 den.); 70 den. (15)

NOTE 3—Paragraphs 7.3.2.1, 7.3.3.1, and Examples 13 and 15 are presented in this place for convenience. They do not represent the use of the single-to-ply notation but are an adaptation to a special single yarn of the notation based on resultant yarn number (ply-to-single notation), presented more fully in Sections 11 and 12. In these special yarns, the linear density of the single yarn has been increased by the insertion of additional twist or by bulking, instead of by a plying operation. See Note 2.

8. Designation of Plied Yarns, Single-to-Ply Notation, Direct and Indirect Yarn Numbering Systems

8.1 Use two groups of data to describe the yarn structure. Describe the single yarn components in the first group as directed in 7.1 or 7.3. In the second group, describe the ply yarn, stating (*1*) the number of single yarn components in the plied yarn, (*2*) the direction of plying twist, and (*3*) the amount of plying twist. State the resultant yarn number, if required, as additional information following the second group, but separate it from the second group with a semicolon. Report the experimentally determined yarn number only, not a calculated number.

8.2 *Plied Yarns Having Identical Components*—Provide the information as directed in 8.1. Connect the first and second groups with a multiplication sign (×) for yarn numbers in direct yarn numbering systems and with a solidus (/) for yarn numbers in indirect yarn numbering systems.

Example:
25 tex Z 15 tpi (cotton) × 3 S 7 tpi; R 83 tex (16)
24 Ne_c Z 15 tpi (cotton)/5 S 9 tpi; R 4.4 Ne_c (17)
1650 den. Z 12 tpi (rayon) × 3 S10 tpi (18)
35 Ne_w Z 9 tpi (58's wool)/3 S 4 tpi

See 13.1, Examples 16a and 17a, for simplified notations of Examples 16 and 17.

8.3 *Plied Yarns Having Dissimilar Components*—Write the designation of the single yarns in sequence connected with one or more plus signs (+). Enclose the group in braces and omit the multiplication sign and the solidus.

Example:
{24 Ne_c Z15 tpi (cotton) + 10 c.c. Z 23 tpi (cotton)} S 8 tpi;
R 7 Ne_c (20)
{11 tex f40 Z50 tpi (nylon) + 12 tex f40 S 3 tpi (acetate)}
S 12 tpi; R 24.0 tex (21)

See 13.1, Example 20a, for a simplified notation of Example 20.

9. Designation of Cabled Yarns or Cords, Single-to-Ply Notation, Direct and Indirect Yarn Numbering Systems

9.1 Use three groups of data to designate the yarn structure, the first two of which describe the plied yarn components as directed in Section 8. In the third group, state (*1*) the number of plied yarn components constituting the cabled yarn or cord, (*2*) the direction of cable of hawser twist, and (*3*) the amount of cable or hawser twist. State the resultant yarn number if required, as additional information following the third group, but separate it from the third group by a semicolon. Report the experimentally determined yarn number only, not a calculated number.

9.2 *Cabled Yarns or Cord Having Identical Components*—Provide the information as directed in 9.1. Connect the second and third groups with a multiplication sign (×) for yarns numbered in direct yarn numbering systems and with a solidus (/) for yarns numbered in indirect yarn numbering systems.

Example:
25 tex Z15 tpi (cotton) × 3 S 7 tpi × 2 Z 4 tpi; R 160 tex (22)
24 Ne_c Z15 tpi (cotton, 1$\frac{1}{16}$in., SLM, 4.3 Micronaire
Reading)/5 S 9 tpi/3 Z 5 tpi; R1.4 Ne_c (23)
35 Ne_w Z tpi (58's wool)/3 S 4 tpi/2 Z 2.5 tpi; R 5.6 Ne_w (24)

See 13.1, Examples 22a and 23a, for simplified notations of Examples 22 and 23. See also 6.3.

9.3 *Cabled Yarns or Cords Having Dissimilar Components*—Write the description of the single yarns as directed in 7.1 or 7.3 and of the plied yarns as directed in Section 8. Connect the terms with one or more plus signs (+). Enclose the first two groups in braces and omit the multiplication sign and the solidus. If necessary, use brackets to enclose the description of the dissimilar components forming the cabled yarn or cord.

Example:

{[24 Ne_c Z15 tpi (cotton)/5 S 9 tpi] + 10 c.c. Z 12 tpi (cotton)} Z8 tpi; R3 Ne_c (25)

See 13.1, Example 25a, for a simplified notation of Example 25.

9.3.1 When the yarns are too complicated to be described clearly by the preceding arrangement, use a tabular arrangement.

Example:

24 Ne_c Z15 tpi (cotton)	(		
10 Ne_c Z 23 tpi (cotton)	S 8 tpi		(26)
18 Ne_c Z 21 tpi (cotton)/2 S 8 tpi}		Z 6 tpi; R 3.6 c.c. }	

10. Multiple Wound Yarns, Direct and Indirect Yarn Numbering Systems

10.1 *Multiple Wound Yarns Having Identical Components*—Indicate the appropriate designation for single or plied yarns followed by the number of yarns laid together and the symbol, *t0*. Connect these groups with a multiplication sign (×) for yarns numbered in direct yarn numbering systems and with a solidus (/) for yarns numbered in indirect yarn numbering systems.

Example:

25 tex Z 15 tpi (cotton) × 2 t0 (27)

35 Ne_w Z 9 tpi (58's wool)/2 t0 (28)

10.2 *Multiple Wound Yarns Having Dissimilar Components*—Write the description of the single or plied yarns in sequence connected with one or more plus signs (+). Enclose the group in braces and omit the multiplication sign, the solidus, and the number of components.

Example:

{25 tex S 420 tpm (cotton) + 60 tex Z 80 tpm (cotton)} t0 (29)

{20 Nwe Z 5 tpi (wool) + 450 denier f80 Z 5 tpi (bright acetate)} t0 (30)

11. Designation of Plied Yarns, Ply-to-Single Notation, Direct Yarn Numbering Systems Only

11.1 Use two groups of data to describe the yarn structure. Describe the ply yarn components in the first group, stating (*1*) the resultant yarn number preceded by the symbol, *R*, and followed by the numbering system, (*2*) the direction of plying twist, and (*3*) the amount of plying twist. In the second group state (*1*) the number of single yarn components in the ply yarn, (*2*) the direction of the single yarn twist, and (*3*) the amount of the single yarn twist.

11.2 *Plied Yarns Having Identical Components*—Provide the information as directed in 11.1, and connect the first and second groups with a solidus (/). State the single yarn number if required as additional information, but separate it from the preceding part by a semicolon.

Example:

R 83 tex S 7 tpi (cotton)/3 Z 15 tpi; 25 tex (31)

See 13.1, Example 31a, for a simplified notation of Example 31.

NOTE 4—The solidus used as directed in 8.2 for indirect yarn numbering systems and in 11.2 for direct yarn numbering systems has its traditional connotation of division when relating the first yarn number stated in the example to the yarn number following the semicolon (if stated).

11.3 *Plied Yarns Having Dissimilar Components*—Write the description of the plied yarn as directed in 11.1 followed by the description of each single yarn connected by one or more plus signs (+). Enclose the description of the single yarns in braces and separate the plied yarn and the single yarn descriptions with a solidus. If the components are made of dissimilar fibers, note the type in the description of the individual component.

Example:

R 24 tex S 12 tpi/{f60 Z 50 tpi (rayon) + f40 S 3 tpi (acetate)}; 11 tex + 12 tex (32)

See 13.1, Example 32a, for a simplified notation of Example 32.

12. Designation of Cabled Yarns or Cords, Ply-to-Single Notation, Direct Yarn Numbering Systems Only

12.1 Use three groups of data to designate the yarn structure. The first group describes (*1*) the resultant yarn number of the cord, (*2*) the direction of cable or hawser twist, and (*3*) the amount of cable or hawser twist. Separate the first and second groups with a solidus and indicate the number of plied yarn components contained in the cabled yarn or cord in the second group. Complete the second group (ply yarn components) and third group (single yarn components) as directed in Section 11, except omit the resultant yarn number in the second group.

12.2 *Cabled Yarns or Cords Having Identical Components*—Provide the information as directed in 12.1.

Example:

R 132 tex Z 200 tpm (cotton/3 S 400 tpm/2 Z 700 tpm; 20 tex (33)

See 13.1, Example 33a, for a simplified notation of Example 33.

12.3 *Cabled Yarns or Cords Having Dissimilar Components*—Write the description of the cabled yarn or cord as directed in 12.1. Write the description of the plied yarns as directed in Section 11, except omit the resultant yarn number and connect by one or more plus signs. Enclose this description in braces. If necessary, use brackets to enclose the description of the dissimilar components forming the cable yarn or cord. Connect the groups with a solidus.

Example:

R 96 tex Z 5 tpi (cotton)/{S 15 tpi + [S 10 10 tpi/3 S 17 tpi]}; 34 tex + 20 tex × 3 (34)

See 13.1, Example 34a, for a simplified notation of Example 34.

12.3.1 When the yarns are too complicated to be described, clearly by the arrangement just cited, use a tabular arrangement.

Example:

R 159 tex S 180 tpm	{Z 200 tpm 40 tex Z 500tpm	{60 tex S 600 tpm/ 3 S 700 tpm 34 tex S 600 tpm	(35)

13. Omission of Symbols

13.1 If required, omit the symbols designating the direction and amount of twist or the description of the fiber, or both, to show only the number of ends and the yarn number of the yarns

used whenever there is no doubt as to the omitted parts of the notation. The resultant yarn number in a single-to-ply notation or the single yarn number in a ply-to-single notation may also be omitted, if not required. The omissions result in a simplified notation which corresponds to the notation commonly encountered in mill practice. While the simplified notation is frequently sufficient for within-mill use, use the full description in all external communications and in publications or trade documents.

Example:

24 Ne_c Z15 tpi (cotton 1 1/16 in., SLM, 4.3 Micronaire)	(2)
24 Ne_c	(2a)
11 tex f40 S 2.5 tpi (nylon, 2.78 dtex)	(9)
11 tex f40	(9a)
25 tex Z15 tpi (cotton) × 3 S 7 tpi; R 83 tex	(16)
25 tex × 3	(16a)
24 Ne_c Z15 tpi (cotton)/5 S 9 tpi; R 4.4 Ne_c	(17)
24 Ne_c/5	(17a)
{24 Ne_c Z 15 tpi (cotton) + 10 Ne_c Z 23 tpi (cotton)} S 8 tpi; R7 Ne_c	(20)
{24 Ne_c + 10 Ne_c}	(20a)
25 tex Z15 tpi (cotton) × 3 S 7 tpi × 2 Z 4 tpi; R 160 tex	(22)
25 tex × 3 × 2	(22a)
24 Ne_c Z 15 tpi (cotton)/5 S 9 tpi/3 Z 7 tpi; R 1.4 Ne_c	(23)
24 Ne_c/5/3	(23a)
24 Ne_c Z15 tpi (cotton)/5 S 9 tpi + 10 Ne_c Z 12 tpi cotton) Z 8 tpi; R 3 Ne_c	(25)
24 Ne_c/5 + 10 Ne_c	(25a)
R 83 tex S 7 tpi (cotton)/3 Z 15 tpi; 25 tex	(31)
R 83 tex/3	(31a)
R 24 tex S 12 tpi/{f60 Z 50 tpi (rayon) + f40 S 3 tpi (acetate);} 11 tex + 12 tex	(32)
R 24 tex/{11 tex + 12 tex}	(32a)
R 132 tex Z 200 tpm (cotton)/3 S 400 tpm/2 Z 700 tpm; 20 tex	(33)
R 132 tex/3/2	(33a)
R 96 tex Z 5 tpi (cotton)/{S 15 tpi + [S 10 tpi/3 S17 tpi]}; 34 tex + 20 tex + 3	(34)
R 96 tex/{34 tex + 20 tex × 3}	(34a)

14. Keywords

14.1 construction; yarn