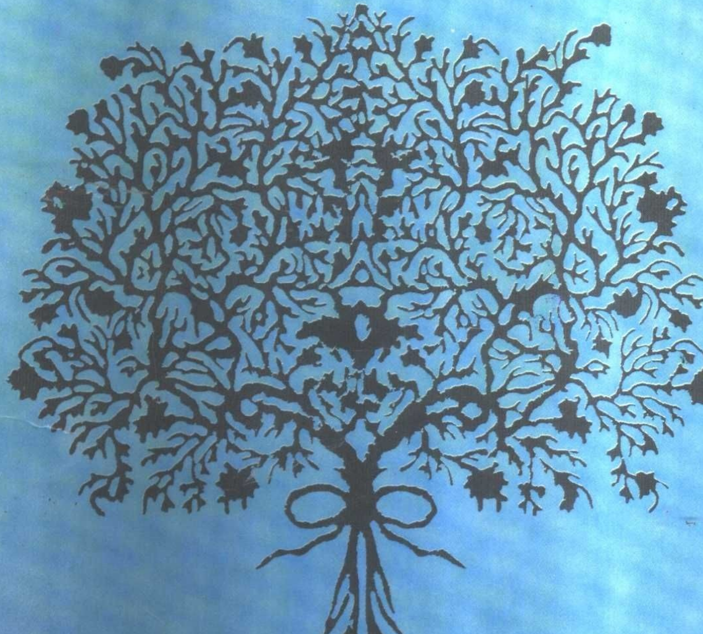
ENGLISH ON KNITTING

针织英语

汪黎明　王秋美　主编



中国纺织出版社

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内 容 提 要

本书从纬编、经编、成形编织及针织物的漂染整印等几个方面系统地介绍了针织的基本理论与常用基本知识，同时介绍了针织工业生产加工的基本原理，常见针织物结构，常规生产设备与工艺，产品质量控制与评定等方面的内容。

本书为高等纺织院校针织专业教材，亦可作为针织企业或从事针织品商贸与检验等方面技术与管理人员参考用书。

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前　言

随着我国针织工业的飞速发展，新设备、新技术、新产品的国际交流日趋频繁，产品的进出口贸易不断扩大，作为纺织学科的高等院校迫切需要提高针织专业学生的专业外语水平，以适应国家经济建设的高速发展，并且从事针织生产、检验、贸易等方面的技术与管理人员也迫切需要掌握一定水平的专业外语知识，从而更好地完成本职工作。为此受中国纺织出版社的委托，并经纺织高教委员会针织专业委员会讨论，由我校组织了长期从事专业教学的同志，根据社会需求，参考国内同类相关专业外语教学的经验，并结合我校多年来专业外语教学的体会，编写了《针织英语》一书。本书在内容的选择和安排上力求系统、全面，并兼顾教学与自学的特点，不仅适合作为针织专业学生的课堂教学用书，而且还可作为从事针织生产、商贸、检验等方面技术与管理人员的自学参考用书。

本书主编人员为青岛大学纺织服装学院汪黎明、王秋美、刘正芹、李显波、韩光亭。并由汪黎明作最后统稿。在本书的编写与修改过程中得到了中国纺织大学金玉燕教授、陈南樑副教授的大力支持，同时承蒙中国纺织出版社刘士弢同志仔细审阅和指导，特此致谢。

由于编者水平有限，错误和缺点在所难免，欢迎读者批评指正。

编　者

1997年5月于青岛

汪黎明　王秋美　主编

汪黎明　王秋美　刘正芹　编写
李显波　韩光亭

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LESSON 1

TEXT

KNITTING MATERIALS

Yarns are the raw materials manipulated during knitting, a yarn is defined as 'an assembly of substantial length and relatively small crosssection of fibres or filaments with or without twist' [1]. The term thread is loosely used in place of yarn and does not imply that it is as smooth, highly twisted and compact as a sewing thread.

Textile fibres are the raw materials of the yarns into which they are spun. There are two configurations of fibres: staple fibres and filament fibres. Staple fibres are of a comparatively short length, for example, cotton and wool fibres which require spinning and twisting together in order to produce a satisfactory length of yarn of suitable strength. A filament is a fibre of indefinite length, for example, silk, which requires combining with other filaments with some twist in order to produce a yarn of sufficient bulk.

Originally all textile fibres occurred naturally, for example, animal fibres such as wool and silk and vegetable fibres such as cotton and flax. The first artificially-produced fibres were the rayons developed by the regeneration of long chain cellulose polymers which occur naturally in wood pulp and cotton linters. Derivates such as cellulose acetate and triacetate were later produced by the acetylation of cellulose polymers. Nylon, the first truly synthetic fibre, was invented by Wallace H. Carothers in 1938, based on a synthetically built long chain polyamide polymer which previously did not occur naturally. A wide range of synthetic fibre polymers including polyesters and polyacrylics have since been developed. Many of the synthetic polymers may be converted into yarns in the continuous filament form in which they were extruded during manufacturing but they may also be cut or broken into the staple fibre form to be later spun on systems originally developed for natural fibres such as wool or cotton[2].

The introduction of synthetic fibres which can be heat set in a permanent configuration has led to the development of texturing processes which directly convert these filaments into bulked yarns thus by-passing the staple fibre spinning process[3]. During texturing, the filaments are disturbed from their parallel formation and are permanently set in configurations such as crimps or coils which help to entrap pockets of air and confer properties such as bulkiness, soft handle, porosity, drape, cover, opacity and if necessary elasticity, to the resultant yarn. Examples of yarns of this type include false twist nylon and Crimplene which is a registered trade name for a technique whereby the properties of the textured polyester yarn are modified during a second heat-setting operation so that the stitch clarity, handle and stability of the fabric is improved.

Yarn may be composed of one or more continuous filaments or of many noncontinuous and rather short fibres (staple). To overcome fibre slippage and to be formed into a functional yarn, staple fibres are usually given a great amount of twist or entanglement. Yarns made from staple fibre are often referred to as spun yarns. Two or more single yarns can be twisted together to form ply or plied yarns. Plied yarns can be further twisted into various multiples. Combination yarns are plies of dissimilar components such as staple and continuous-filament yarns. Through subsequent processing of a chemical or mechanical nature, basic staple or continuous-filament yarns can acquire substantially different structural features that can dramatically change the appearance and functional performance of the original yarns.

In a fabric, staple yarns categorically have excellent tactile qualities (hand, good covering power, and excellent comfort factor) and are aesthetically pleasing (a natural textured appearance). However, staple yarns as a group are not as strong or as uniform as continuous-filament yarns of equal linear density. Finally, because staple fibres are processed as a mass rather than individually, the number of fibres per yarn cross section varies considerably along the yarn length. This condition limits the fineness of staple yarn that can be spun on a commercial basis.

In the manufacture of man-made filaments, a solution is forced through very fine holes of a spinneret, at which point the solution solidifies by coagulation, evaporation, or cooling. Usually the number of holes in the spinneret determines the number of filaments in the yarn. Also, the size of each hole and the amount of drawing, if any, determine the diameter of each filament. As the individual filaments solidify, they are brought together with or without slight twist or entanglement to form a continuous-filament yarn.

If the filaments are to be processed on a staple yarn system, several thousand are brought together into a twistless linear assemblage known as tow, for subsequent crimping and cutting. One of the advantages of the man-made fibres is the control that it is possible to exercise over each step of the production process. Fibres can be tailored to fit a wide variety of end-uses that require physical or chemical properties not found in the parent fibre or in the natural fibres.

Continuous-filament yarns in fabric form usually have excellent strength and uniformity. As indicated by the fine monofilament and multifilament yarns that have found commercial acceptance, continuous-filament yarns can be made much finer in linear density and diameter than staple yarns. In an untextured form, however, continuous-filament yarns are not thought to possess a combination of good covering power, tactile qualities, comfort, and a pleasing appearance, except for limited apparel applications such as sheer hosiery and lingerie.

To properly describe a specific yarn for communicative purposes, a great deal of information is required. First, the fibre content must be identified generically, and in the case of a blend, by proportion of the total weight of the yarn. The physical properties of the constituent fibres (fibre length, fineness, crimp, cross-sectional shape, delusterant, etc.) should be described also. Second, the yarn constructional features (staple or continuous filament; singles, ply, or combination) should be indicated. In the case of a stretch or a bulky yarn the technique for texturizing should be made clear. Third, the linear density of the yarn should be expressed. If the yarn is a ply or combination yarn, the linear densities of the individual components and of the resulting structure should be stated. Furthermore, twist direction and frequency should be identified in singles yarn and in the individual components in the case of ply yarn. Certain performance characteristics should also be given. Whereas indications of strength and breaking extension might be appropriate for some yarn, industrial and special end-use yarns would require much more information relative to mechanical and chemical properties. Staple yarns usually require an expression of the evenness and appearance of the structure. Finally, it should be realized that the yarns that are dyed or finished before conversion into fabric or textile products require considerably more stated specifications in a description than do unfinished (greige) yarns.

Knitting requires a relatively fine, smooth, strong yarn with good elastic recovery properties. Since an object of knitting is to construct an elastic, porous fabric, the yarns are more loosely twisted than they are for weaving. Since some knitted fabrics must have napped surfaces, slackly twisted yarn is preferable. Yarn types include flat and textured filament, spun, and blends of natural and man-made fibres.

The knitting industry's consumption of fibres and yarns has changed considerably over the years. Today, the principal raw material of the knitting industry is textured polyester yarn. It is used primarily in circular-knit (largely double-knit) fabrics and to a somewhat more modest extent in warp-knit (principally tricot) fabrics. For sweaters, the prime raw material is acrylic fiber, followed by wool. In knit sport shirts, the major fibres are cotton and polyester/cotton, with the latter gradually displacing the former because it shrinks less, is stronger, and resists abrasion. Acrylic fibres are also used in this product area, in 100 percent form as well as in blends. In the manufacture of tricot fabrics, the major raw materials are acetate, nylon, polyester, and rayon. Polyester is now an established yarn in that field and is used in either flat or textured form.

In the construction of fabrics (on the Raschel machine) knitters employ a wide range of raw materials, both spun and filament, with the latter either flat or textured. The chief raw material in the manufacture of fine-gauge women's hosiery is textured nylon. Spandex is also used, particularly in the manufacture of support stockings and pantyhose and in the newer, more popular contour-top pantyhose. In half-hose and other similar types of casual hosiery, virtually all the previously mentioned fibres are used, with man-made fibres significantly more important than either cotton or wool. The worsted system has proved particularly suitable for spinning yarns used for knitwear, outwear and socks and the combed cotton system for underwear, sportwear and socks.

NEW WORDS AND EXPRESSIONS

1. configuration　结构，构形
2. cellulose　纤维素
3. pulp　浆粕
4. acetate　醋酯纤维，醋酸酯，醋酯纤维织物
5. acetylation　乙酰化(作用)
6. polyamide　聚酰胺
7. polyester　聚酯
8. polyacrylics　聚丙烯腈
9. texturing　合〔成〕纤〔维〕变形工艺
10. porosity　多孔性
11. drape　悬垂性
12. cover　密满性
13. opacity　不透明性
14. coagulation　凝结，凝固
15. lingerie　女式贴身内衣裤，女内衣
16. acrylic　聚丙烯腈系纤维
17. Spandex　斯潘德克斯(聚氨基甲

酸乙酯弹性纤维属名）　　　　　　18. support stocking　　护腿长袜

NOTES

[1] …, a yarn is defined as 'an assembly of substantial length and relatively small cross-section of fibres or filaments with or without twist.' …，纱线可定义为大量的有一定长度和截面积较小的纤维或长丝的集束。（它可以有捻度，也可以没有捻度。）

[2] Many of the synthetic polymers may be converted into yarns in the continuous filament form in which they were extruded during manufacturing but they may also be cut or broken into the staple fibre form to be later spun on systems originally developed for natural fibres such as wool or cotton. 许多合成聚合物在生产过程中可以被挤压喷射制成长丝纱，也可以把长丝剪断成短纤维，然后在原来用于纺制羊毛、棉等天然纤维的设备上纺成纱线。

[3] The introduction of synthetic fibres which can be heat set in a permanent configuration has led to the development of texturing processes which directly convert these filaments into bulked yarns thus by-passing the staple fibre spinning process. 合成纤维通过热定形能够固定形态，由此而导致了对合成纤维变形工艺的研究，这种变形工艺直接把合纤长丝转化为膨化变形纱，因此，可不经过短纤纱的纺纱过程。

READING MATERIAL

YARN COUNT NUMBERING SYSTEMS

A yarn count number indicates the linear density (yarn diameter or fineness) to which that particular yarn has been spun. The choice of yarn count is restricted by the type of knitting machine employed and the knitting construction, the count in turn influences the cost, weight, opacity, handle and drapability of the resultant structure. In general staple spun yarns tend to be comparatively more expensive the finer their count, because finer fibres and a more exacting spinning process are necessary in order to prevent the yarn from showing an irregular appearance.

Unfortunately, a number of differently based count numbering systems are still currently in use. Historically, most systems are associated with particular yarn-spinning systems, thus a yarn spun on the worsted system from acrylic fibres may be given a worsted count number. The worsted system is of the indirect type based on length per fixed unit mass, i.e. the higher the count number, the finer the yarn. The weight is fixed (1 lb) and the length unit (number of 560-yard hanks) varies. 1/24 's worsted (24×560-yard hanks weighing 1 lb) will be twice the cross-sectional area of 1/48 's worsted (48×560-yard hanks weighing 1 lb). 2/24 's worsted indicates that the yarn contains two ends of 1/24 's so that the resultant count is twice the cross-sectional area ($24 \div 2 = 12$'s).

The denier system is used in continuous filament silk spinning and when the silk throwsters began to process textured synthetic continuous filament yarns, these nylon and polyester yarns were given denier count numbers. The denier system is of the direct type based on mass per unit length, i.e. the higher the number, the heavier the yarn. The length unit is fixed (9000 metres) and the weight unit (in grams) is variable. 70-denier yarn (9000 metres weigh 70 grams) will be twice as fine as 140 denier yarn (9000 metres weigh 140 grams). 2/70 denier will give a resultant count of 140 denier.

The tex system was introduced as a universal system to replace all the existing systems. As tex sometimes produces a count number having a decimal point, it has been found more satisfactory to multiply the count number by 10 to give a deci-tex number. The tex system has not been universally accepted, particularly for spun yarns and on the continent of Europe the metric system is used for these yarns.

The main count systems with their continental abbreviations are as follows:

Indirect Systems

Bradford Worsted System	(NeK)	– the number of 560-yard hanks which weigh 1 lb (453. 6 gms).
English Woollen System	(NeW)	– the number of 256-yard hanks which weigh 1 lb.
English Cotton System	(NeB)	– the number of 840-yard hanks which weigh 1 lb.
Continental Metric System	(Nm)	– the number of 1000-metre (1 kilometre) hanks which weigh 1000 grams (1 kilogram).

Direct Systems

Denier System	(Td)	– the weight in grams of 9000 metres.
Tex System	(Tt)	– the weight in grams of a 1000 metres.
Deci-tex system	(dtex)	– the weight in grams of 10, 000 metres.

Tex counts may be obtained from count numbers in other systems using one of the following formulae:

$$\frac{886}{NeK} \qquad \frac{1938}{NeW} \qquad \frac{591}{NeB} \qquad \frac{1000}{Nm} \qquad \frac{Td}{9}$$

An interlock underwear fabric is weft knitted from 1/40 's NeB at a weight of 5 ounces per square yard. Convert the yarn count to deci-tex and the fabric weight to square metrage.

(a) The conversion for Tex is 591/NeB so it is necessary to also multiply by 10 to obtain deci-tex.

$$\text{The deci-tex count therefore} = \frac{591}{40} \times 10 = 148$$

(b) 1 oz = 28.35 g and 1 sq. yd = 0.836 m^2

Therefore 5 oz/yd^2 = $(5 \times 28.35) \div 0.836 = 170\ g/m^2$

LESSON 2

TEXT

PACKAGES AND WINDING

1. Packages

Most of the commoner packages are stated respectively as follows:

1 – Intended mainly for overend yarn withdrawal

(a) Cop – A tubeless package having a short, medium-quick traverse. The package is formed during mule spinning, as well as wound especially for use in a shuttle.

(b) Pirn – Short, medium-quick traverse, for use in a shuttle.

(c), (d), (e) Ring Bobbin – Produced during ring spinning in different builds, (c) cop build, (d) roving build (medium traverse rate), (e) combination build (medium traverse rate).

(f), (g) Filament Spinning Tube – A medium traverse rate is used for nylon (f) and Terylene (g).

(h), (i) Bottle Bobbin – Type (h) is produced on spinning and doubling machines with a medium traverse rate. Type (i) is used for hosiery yarns, having a medium-quick traverse rate.

(j), (k), (l) Cone – The most common package for continuous yarn supply of all types, wound with a quick traverse; (j) is used for hosiery yarns and has an increasing taper; (k) is used for most processes, while (l), termed a 'pineapple cone' is used for fine filament yarns, Cones are popular for package dyeing.

(m) Cone Bobbin – A slow traverse rate, sometimes used for filament yarns.

(n) Cake – A tubeless package produced with a medium traverse rate in a 'Topham's box' during filament spinning.

2 – Intended mainly for side yarn withdrawal

(o), (p) Double Flanged Bobbin – A slow traverse rate, suitable for all yarns, may be parallel sided or barrel shaped (p).

3 – Intended for either overend or side yarn withdrawal

(q), (r), (s) Cheese – A quick traverse rate, suitable for all yarns. (q) and (r) are essentially the same, (r) often being termed a 'spool'. The taper-ended cheese (s) is used for fine filament yarns.

(t) Conical Flanged Bobbin – A slow traverse rate suitable for all yarns.

2. Methods of Package Driving

On almost all winding and warping machines the package is rotated by one of three methods: (a) by package surface contact with a driving drum or roller, giving a constant surface speed; (b) by driving the package spindle at constant angular velocity; (c) by driving the package spindle at an angular velocity inversely proportional to the package radius, resulting in a constant surface speed.

Methods (a) and (c) give an approximately constant yarn speed during winding and method (b) gives a yarn speed proportional to the package radius. Method (a) is only suitable for yarns which are not easily abraded, while method (c) results in an expensive machine due to the variable spindle drive. In general, method (a) is used for common staple yarns, method (b) for expensive spun and cheaper filament yarns, and method (c) for expensive filament yarns.

3. Methods of Traversing

The to-and-fro movement of yarn on to a package is usually controlled by a guide which is said to 'traverse' the yarn. When winding flangeless packages such as cones and cheeses with right-angle edges the rate of traverse must be relatively fast if the yarn is not to slip over the edges. The minimum rate of traverse in these circumstances depends upon the static frictional properties of the yarn, but must generally not give a winding angle greater than 80°. A medium rate of traverse usually refers to a winding angle between approximately 70° and 77°.

The traverse rate affects the time available for reversing the yarn guide at the ends of the traverse[1]. The reversal must take place in a finite period of time, which in practice is during not more than 0.1 package revolution. If the cheese is wound at 1000 r.p.m. the linear velocity of theyarn guide in either direction is 1.54 ft. /sec., and the time for reversal is not more than 0.006 seconds so that if the change of velocity is uniform, the retardation is not less than 513 ft. $/sec.^2$, or approximately 16g[2]. If the cheese revolves at 2000 r.p.m. the retardation is approximately 64g. In other words, the minimum force which must be exerted on the yarn guide at reversal by the cam or other traversing device is 16 or 64 times the mass of the guides and its attached part.

To give quick traverse rates without cam wear, it is possible to design cams to act on the yarn directly without the interposition of a follower and guide, and this is considerably utilized on cone, cheese and pirn winding machines. Unfortunately, this grooved-roller rotary traverse may abrade delicate yarns, and requires a sufficiently high yarn tension to keep the yarn in the cam groove, which prevents the application of this type of traverse to most filament yarns.

4. Yarn Winding and Withdrawal

Yarn may be wound on to a package (1) by rotating the package, or (2) by rotating a yarn guide around the stationary package.

Method (1), which is utilized on most winding and warping machines, does not affect yarn twist. Method (2) inserts a little twist into the yarn, except in the unusual instance when the supply package is mounted on a turntable to rotate, together with the yarn guide, around the stationary package. Inserting twist while winding on a stationary package is a special case of flyer twisting.

Yarn may be withdrawn from a package either (a) from the side by rotating the package, or

(b) by overend (or axial) withdrawal from the stationary package.

Method (a) has no affect on yarn twist and was once very common in textile manufacture, but due to the difficulty of controlling packgae rotation at high speeds, is generally being replaced by method (b). However, method (b) inserts some twist into the yarn.

Of the four possible combinations of a method of winding with a method of withdrawal, all are feasible but the combination (1), (b) is the more common with modern machinery.

5. Yarn Tension of Withdrawal

Whichever method of withdrawing yarn from a package is used, some yarn tension must be introduced. With method (a), the torque to rotate the package provided by the yarn tension must overcome a variable retarding torque made up from three components:

(i) due to friction at the package bearings, and varying with the weight of yarn on the package;

(ii) due to package inertia, of importance during acceleration and retardation;

(iii) due to additional friction applied to increase yarn tension.

If this takes the form of a 'paddle' rubbing on the yarn surface, the effect on the yarn tension will be constant, but the method is unsuitable for easily abraded yarns. If the friction is applied to the package spindle, the retarding torque will increase the yarn tension directly as the package radius decreases. In brief, yarn tension cannot be kept low and reasonably regular at high speeds with method (a). The principal modern applications of rotating supply packages are to zero twist yarns (e.g. plastic monofilaments; metallic wire and strip) and to coarse industrial yarns where very high yarn tension is applied by (iii).

With method (b) withdrawal, yarn tension fluctuates considerably, but the maximum value is usually lower than that required by most preparation processes, and additional tension must be applied. At low unwinding speeds the yarn tension is due to dragging over the package surface, but as the speed is increased the yarn forms a 'balloon', throwing itself clear from the package, yarn tension being due to centrifugal, Coriolis and air drag forces[3]. The tension fluctuations are caused by changes in the shape and size of the yarn balloon. The overwhelming advantage of method (b) over method (a) occurs with changing yarn speed, particularly during acceleration and retardation.

NEW WORDS AND EXPRESSIONS

1. package 卷装
2. withdrawal 退绕
3. cop 管纱;纬管
4. mule spinning 走锭纺
5. pirn 纬纱管,纡子
6. ring bobbin 细纱管,(环锭细纱机的)纱管
7. roving 粗纱
8. cone bobbin 锥形筒子
9. Topham's box 托范式离心纺丝罐
10. cheese 管子纱;扁柱形筒子(通常直径大于高度)
11. double flanged bobbin 有边筒子

12. spool	有边筒子	17. inertia	惯性
13. reversal	换向，反向	18. paddle rubbing	搅拌式摩擦
14. guide	导向件，导纱件	19. spindle	锭子
15. flyer	锭翼	20. Coriolis force	哥氏力
16. torque	力矩		

NOTES

〔1〕The traverse rate affects the time available for reversing the yarn guide at the ends of the traverse. 导纱件横向往复运动的速率影响供导纱件在末端换向的时间。 available for 此处意为“适用于，供”。

〔2〕…, the retardation is not less than 513 ft./sec.^{2}, or approximately 16g. …，导纱件的减速度不小于 513 英尺/秒^2，即约为 16g。 g 此处为“acceleration of gravity”的缩写，意为重力加速度。

〔3〕At low unwinding speeds the yarn tension is due to dragging over the package surface, but as the speed is increased the yarn forms a ‘ballon’, throwing itself clear from the package, yarn tension being due to centrifugal, Coriolis and air drag forces. 纱线以低速退绕时，张力由纱线在筒子表面上拖移而产生，但随着退绕速度增加，纱线形成气圈，完全从筒子上摆离，纱线张力则由离心力、哥氏力和空气阻力所产生。

READING MATERIAL

1. SPECIFICATION OF YARN STRUCTURAL FEATURES

The major constructional features that must be specified when describing a yarn are an indication of whether the yarn is basically staple or filament in composition, the amount and direction of yarn twist, and whether the yarn is a singles or plied structure.

If the yarn is a staple structure, the system of spinning should be designated (e. g., carded cotton, combed cotton, woolen, worsted), although this is conveniently indicated to an extent by notation in the expression of yarn count. For example, on cotton counts, the singles yarn number is stated first, followed by the ply number. (Example: 30/1 means 30s or a single 30s count cotton system yarn; 30/2 means two single 30s count cotton system yarns were plied together resulting in a linear density similar to that of a 15s cotton count yarn, approximately). It is conventional practice in the case of spun yarn designation to use the solidus (/) to separate the singles yarn count from the number of plies. In filament yarns, the ply number is usually placed before the singles component. (Example: 2×70 denier or 2/70 denier indicates that two 70-denier filament yarns were combined resulting in a linear density equivalent to a 140-denier filament yarn, approximately).

In the case of plied yarns, it is necessary to know the resultant yarn number (R), which is also referred to as the singles equivalent (SE). The resultant yarn number or singles equivalent is the observed linear density of the plied yarn, cord, or yarn whose original number has been changed significantly by twisting or texturing. In plied staple yarns that are normally numbered on the indirect systems, the resultant is estimated by dividing the singles number by the product