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Textiles — Universal system for designating linear density (Tex System)

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up has the right to be represented on that Committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

Prior to 1972, the results of the work of the Technical Committees were published as ISO Recommendations; these documents are now in the process of being transformed into International Standards. As part of this process, International Standard ISO 1144 replaces ISO Recommendation R 1144-1969 drawn up by Technical Committee ISO/TC 38, *Textiles*.

The Member Bodies of the following countries approved the Recommendation :

Australia	Iran	South Africa, Rep. of
Belgium	Ireland	Spain
Canada	Israel	Sweden
Cuba	Italy	Switzerland
Czechoslovakia	Japan	Thailand
Denmark	Netherlands	Turkey
Egypt, Arab Rep. of	New Zealand	United Kingdom
France	Norway	U.S.A.
Germany	Poland	U.S.S.R.
Hungary	Portugal	
India	Romania	

The Member Body of the following country expressed disapproval of the Recommendation on technical grounds :

Brazil

Printed in Switzerland

Textiles — Universal system for designating linear density (Tex System)

0 INTRODUCTION

It has long been customary to designate the coarseness or the fineness of textile yarns by numbering or counting systems. Many branches of the textile industry employ systems of their own for this purpose, and those in current use may be classified in two groups :

a) direct systems, in which the coarseness or the fineness of the yarn is expressed in terms of the mass of yarn per unit length (linear density, often called yarn number or yarn *titre*).

b) indirect systems, in which the coarseness or the fineness of the yarn is expressed in terms of the length of yarn per unit mass (usually called yarn *count*).

With the growing use of yarns containing more than one kind of fibre, and of fabrics containing these yarns, it became increasingly evident that the general adoption of a single system of numbering or counting would avoid confusion and save time.

In 1956, after detailed studies, it was agreed that the Tex System be recommended for international adoption in place of the various traditional methods of numbering or counting. That system is direct and based on metric units : originally grams per kilometre (tex), milligrams per kilometre (millitex), and kilograms per kilometre (kilotex), with the addition of decigrams per kilometre (decitex) agreed in 1967.

1 SCOPE AND FIELD OF APPLICATION

This International Standard gives the principles and recommended units of the Tex System for the expression of linear density and includes conversion tables for calculating the tex values of numbers or counts in other systems together with a statement of the procedure for the implementation of the Tex System in trade and industry.

The Tex System is applicable to all kinds of textile fibres, intermediate products (for example tops, slivers and rovings), yarns and similar structures.

2 REFERENCE

ISO 1139, *Textiles — Designation of yarns.*

3 CHARACTERISTICS OF THE SYSTEM

3.1 This system, called the Tex System, is a *direct system.* It expresses the linear density, that is to say the mass of a certain length of the textile material.

3.2 The system is decimal and employs metric units.

3.3 The basic unit is the "tex". The linear density in "tex" expresses the mass, in grams, of one kilometre of yarn[1].

NOTE — It is realized that, at present, usage of the term *linear density* is limited to scientific and laboratory applications but every effort should be made to ensure greater currency of it.

1) The term "yarn", which is used here for simplicity, is as defined in ISO 1139. It does not exclude the other textile applications mentioned in section 1.

4 UNITS

The multiple and sub-multiples of the tex unit recommended for use in preference to other possible combinations are

- kilogram per kilometre, designated **kilotex;**
- decigram per kilometre, designated **decitex;**
- milligram per kilometre, designated **millitex.**

TABLE 1 — **Tex System — Recommended units**

Name	Symbol	Definition
millitex	mtex	1 mtex = 1 mg/km = 1 μg/m
decitex	dtex	1 dtex = 1 dg/km = 0,1 mg/m
tex	tex	1 tex = 1 g/km = 1 mg/m
kilotex	ktex	1 ktex = 1 kg/km = 1 g/m

NOTE — To indicate linear density in the Tex System as a quantity in formulae, tables, and preprinted forms, irrespective of units, the symbol **Tt** is used. It should never be used with a numerical value of linear density because it is not a unit. It is equivalent in fact to the expression "linear density expressed in the Tex System". In a general formula, without a numerical value in which the linear density of a yarn (or other product) occurs, the symbol **Tt** serves to indicate that in a numerical application of the formula, this linear density is expressed in a unit of the Tex System.

5 NOTATION[1)]

The linear density in the Tex System is indicated by the numerical value followed by the name of the unit used.

Examples :

100 mtex
60 dtex
20 tex
15 ktex

1) More detailed specifications for the designation of folded and cabled yarns are given in ISO 1139.

APPENDIX Y

CONVERSION AND ROUNDING

Y.0 INTRODUCTION

This Appendix is intended to facilitate the implementation of the Tex System by describing the rational development of tex equivalents and giving guidance on the choice of rounded tex values.

Three possibilities are given for the choice of tex equivalent :

- calculated tex equivalent;
- rounded tex value;
- recommended tex value.

The recommended tex values given in Table 5 will serve as guide and should be used whenever practicable.

Y.1 CALCULATION OF TEX EQUIVALENTS

Counts and numbers (titres), as expressed in other counting or numbering systems, are converted into tex values as set out below. The multiplying factors in Table 2 and the constants in Table 3 are expressed to four significant figures to give an accuracy of 0,05 %.

The equivalent values, calculated to four significant figures, are rounded to three significant figures to obtain an accuracy within 0,5 % with respect to the value in the traditional system.

Y.1.1 Conversion from direct systems

In direct systems, the coarseness or fineness of yarn (linear density) equals mass of yarn per unit of length.

Table 2 gives the multiplying factors for multiplying the known number (or titre).

Example : The equivalent of 840 denier in tex is

$$840 \times 0{,}111\,1 = 93{,}32 \text{ tex or } 933{,}2 \text{ dtex}$$

$$= 933 \text{ dtex to three significant figures}$$

TABLE 2 – **Multiplying factors for direct systems**

Yarn number system	Symbolic abbreviation	Unit of mass used	Unit of length used	Unit of yarn number	Multiplying factor, yarn number to tex value
Tex	Tt	1 gram	1 kilometre	g/km	–
Denier	Td	1 gram	9 000 metres	g/9 000 m	0,111 1
Linen dry spun Hemp Jute	Tj	1 pound	14 400 yards (spyndle unit)	lb/14 400 yd	34,45
Número en cuartos de onza	To	1/4 onza	500 cañas	0,25 onza/500 cañas	10,71
Woollen (Aberdeen)	Ta	1 pound	14 400 yards	lb/14 400 yd	34,45
Woollen (Catalonian)	Tc_W	1 gram	504 metres	g/504 m	1,984

Y.1.2 Conversion from indirect systems

In indirect systems, coarseness or fineness of yarn equals length of yarn per unit of mass.

Table 3 gives the constants which are to be divided by the count in the indirect system.

Example : The equivalent of yarn count $Ne_W 20$ in tex is

$$\frac{885,8}{20} = 44,29 \text{ tex}$$

$$= 44,3 \text{ tex to three significant figures}$$

TABLE 3 — **Constants for conversion of indirect systems**

Yarn count system	Symbolic abbreviation	Unit of length used	Unit of mass used	Unit of yarn count	Constant for conversion to tex values
Asbestos (American)	Na_A	100 yards (cut)	1 pound	100 yd/lb	4 961
Asbestos (English)	Ne_A	50 yards	1 pound	50 yd/lb	9 921
Cotton bump yarn	N_B	1 yard	1 ounce	yd/oz	31 000
Cotton (English)	Ne_C	840 yards (hank)	1 pound	840 yd/lb	590,5
Cotton (Catalonian)	Nc_C	500 cañas	1,1 libra catalana	500 cañas/1, 1 lb cat.	565,9
Glass (U.S.A. and U.K.)	N_G	100 yards	1 pound	100 yd/lb	4 961
Linen (wet or dry spun)	Ne_L	300 yards (lea)	1 pound	300 yd/lb	1 654
Metric	Nm	1 kilometre	1 kilogram	km/kg	1 000
Numero en puntos	Np	1 320 metres	1 libra de Alcoy	1 320 m/lb de Alc.	358,7
Spun silk	N_S	840 yards	1 pound	840 yd/lb	590,5
Typp	Nt	1 000 yards	1 pound	1 000 yd/lb	496,1
Woollen (Alloa)	Nal	11 520 yards (spindle)	24 pounds	11 520 yd/24 lb	1 033
Woollen (American cut)	Nac	300 yards	1 pound	300 yd/lb	1 654
Woollen (American run)	Nar	100 yards	1 ounce	100 yd/oz	310
Woollen (Cardado Covilhã)	Np_W	1 metre	5 gram	m/5 g	5 000
Woollen (Dewsbury)	Nd	1 yard	1 ounce	yd/oz	31 000
Woollen (Galashiels)	Ng	300 yards (cut)	24 ounces	300 yd/24 oz	2 480
Woollen (Hawick)	Nh	300 yards (cut)	26 ounces	300 yd/26 oz	2 687
Woollen (Irish)	Ni_W	1 yard	0.25 ounce	yd/0.25 oz	7 751
Woollen (West of England)	Nwe	320 yards (snap)	1 pound	320 yd/lb	1 550
Woollen (Yorkshire)	Ny	256 yards (skein)	1 pound	256 yd/lb	1 938
Woollen (Yorkshire)	Ny	1 yard	1 dram	yd/dram	1 938
Worsted	Ne_W	560 yards (hank)	1 pound	560 yd/lb	885,8

Y.2 CHOICE OF ROUNDED TEX VALUES

When counts and numbers (titres) are converted into tex, decimal values are usually obtained, which may be used as they are or rounded for practical purposes.

Where trade authorities concerned with each type of product have not published agreed lists in tex values of the yarns and fibres to be produced, the values in tex to three significant figures obtained according to section Y.1 and rounded using one of the alternatives given in Y.2.1 may be used. Examples of the rounded values are given in Table 4.

Y.2.1 For selecting rounded tex values, two possibilities are given :

a) rounding to the nearest two significant figures;

b) rounding in the direction of the recommended values of Table 5, using two significant figures or three significant figures when the last figure is 5.

(See the examples in a) and b) of column 3 in Table 4.)

Y.2.2 Care should be taken to ensure that rounding is applied consistently so that the rounded tex values for two traditional counts of which one is ten times the other should consist of the same digits and vary only in the position of the decimal point.

Y.2.3 When rounded values are chosen certain cases will arise where the difference between a yarn according to a traditional count and according to the value of the corresponding rounded tex value will be sufficient to necessitate some adjustment to the yarn being spun.

TABLE 4 — **Choice of rounded values**

1		2	3		4
Traditional yarn count		**Equivalent tex value in three figures**	**Rounded tex value**		**Recommended tex value according to Table 5**
system	value		a)[1]	b)[1]	
Nm	15	66,7	67	67	68
Nm	30	33,3	33	33,5	34
Nm	60	16,7	17	17	17
Ne_C	12	49,2	49	49,5	50
Ne_C	24	24,6	25	25	25
Ne_C	48	12,3	12	12,5	12,5
Ne_C	120	4,92	4,9	4,9	5
Td	60	6,67	6,7	6,7	6,8
Td	120	13,3	13	13	13
Td	480	53,3	53	53	52
Td	600	66,7	67	67	68
Ne_W	18	49,2	49	49,5	50
Ny	24	80,7	81	80,5	80
Ne_L	25	66,1	66	66,5	68
N_G	75	33,3	33	33,5	34
Na_A	75	33,3	33	33,5	34

NOTE – This table can be extended in national standards by including figures from lists published by accepted trade authorities.

1) See Y.2.1.

Y.3 CHOICE OF RECOMMENDED VALUES

The decision to use recommended tex values may be taken before changing over to the Tex System or deferred until after the Tex System has come into use.

The use of recommended values is not obligatory : Table 5 is only intended to provide a rational system of selecting rounded values, based on a nearly equal increase of the linear density of yarns and with the additional objective of arriving in the future at a systematic reduction in the total range of linear densities. The recommended values are listed in column 2 of Table 5. The range of exact values represented by each recommended value is also given in Table 5. The list of recommended values includes a minimum of decimals and uses even numbers as far as possible.

Use the following procedure to determine the recommended tex value corresponding to a yarn count or linear density expressed in any other system or corresponding with the rounded values of column 3 of Table 4.

Y.3.1 Determine the calculated tex equivalent of the nominal count or number by means of the appropriate multiplying factor or constant given in Table 2 or 3.

Example 1 : Nm17 corresponds to 58,82 tex.

Example 2 : 1,5 denier corresponds to 166,7 mtex.

Y.3.2 Find the range of values in column 1 of Table 5 which contains the tex value determined in accordance with Y.3.1 or values already rounded, in accordance with Y.2.1.

Example 1 : 58,82 tex is contained in the range 58 to 62.

Example 2 : Multiplying by 10 the values in Table 5, 166,7 mtex is contained in the range 165 to 175 (corresponding to the range 16,5 to 17,5 of the same Table).

Y.3.3 Read off the recommended tex value given in column 2 of Table 5 for the range of values selected in accordance with Y.3.2.

Example 1 : For the range 58 to 62, the recommended tex value is 60.

Example 2 : For the range 165 to 175, the recommended tex value is 170 mtex (corresponding to 17 in Table 5).

The values in Table 5 are valid for the unit tex and for its multiples and sub-multiples, including kilotex, decitex and millitex units. The scope of the table may be extended for coarser and finer values by multiplying or dividing the values given by 10 or 100.

TABLE 5 — **Ranges of values of linear density in tex with their corresponding recommended tex values**

1		2
Value range		Recommended tex value
over	up to and including	
...	...	...
9,4	9,8	9,6
9,8	10,25	10
10,25	10,75	10,5
10,75	11,25	11
11,25	11,75	11,5
11,75	12,25	12
12,25	12,75	12,5
12,75	13,5	13
13,5	14,5	14
14,5	15,5	15
15,5	16,5	16
16,5	17,5	17
17,5	18,5	18
18,5	19,5	19
19,5	20,5	20
20,5	21,5	21
21,5	22,5	22
22,5	23,5	23
23,5	24,5	24
24,5	25,5	25
25,5	27	26
27	29	28
29	31	30
31	33	32
33	35	34
35	37	36
37	39	38
39	41	40
41	43	42
43	45	44
45	47	46
47	49	48
49	51	50
51	54	52
54	58	56
58	62	60
62	66	64
66	70	68
70	74	72
74	78	76
78	82	80
82	86	84
86	90	88
90	94	92
94	98	96
98	102,5	100
102,5	107,5	105
...	...	...

APPENDIX Z

IMPLEMENTATION OF THE TEX SYSTEM IN TRADE AND INDUSTRY

Z.0 INTRODUCTION

This Appendix is intended to facilitate the implementation of the Tex System in trade and industry. For this purpose three stages may be used, but the several units or sections of industry are free to omit the first and/or the second stage if they wish.

No procedure is given as obligatory for the kind of tex value to be used (equivalent, rounded, or recommended tex value).

However, it is recommended that, in the first and second stages, the same numerical value for tex, mtex, dtex or ktex be used as is intended to be used in the third stage.

Z.1 PREPARATORY STEPS

The trade authorities concerned with each type of product should, as quickly as possible, publish agreed lists in tex units of the yarns and fibres which are to be produced, and give some indication of the time-table for the adoption of the three stages. The tex values of these lists may be equivalent, rounded, or recommended values.

Z.2 FIRST STAGE

While the tables are being prepared and the existing yarn counting and numbering systems continue in use, the equivalent, rounded, or recommended tex value (see section Z.1) is put in brackets after the count or number in the traditional system. The inclusion of the tex value does not affect commercial tolerances in any way, and every contract or commercial agreement will still refer to the count or number in the traditional system and not to the value in brackets. During this stage, the tex values will facilitate comparison of counts and linear densities designated in different systems.

Examples :

Ne_L	25 (68 tex)	Nm	4 500 (220 mtex)
Ne_C	18 (30,5 tex)	Td	840 (940 dtex)
Ne_W	48 (18 tex)	Tj	192 (6,6 ktex)

Z.3 SECOND STAGE

The tex value of linear density in tex is now put first and the original nominal number or count is put in brackets after it.

If necessary, spinners will now adjust their production from the traditional counting system to the Tex System in accordance with the appropriate list (see section Z.1).

Contracts or commercial agreements will now refer specifically to the value of the linear density in tex and not to the traditional figure given in brackets.

Examples :

68 tex (Ne_L 25)	220 mtex (Nm 4 500)
30,5 tex (Ne_C 18)	940 dtex (Td 840)
18 tex (Ne_W 48)	6,6 ktex (Tj 192)

Z.4 THIRD STAGE

The designation in brackets is deleted and the Tex System is the only system used.