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ISO RECOMMENDATION

R 271

TEXTILES
IMPLEMENTATION OF THE TEX SYSTEM FOR DESIGNATING THE SIZE OF TEXTILE FIBRES, YARNS AND SIMILAR STRUCTURES

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BRIEF HISTORY

The ISO Recommendation R 271, *Implementation of the Tex System for Designating the Size of Textile Fibres, Yarns and Similar Structures*, was drawn up by Technical Committee ISO/TC 38, *Textiles*, the Secretariat of which is held by the British Standards Institution (B.S.I.).

Work on this question by the Technical Committee began in 1948 and led, in 1957, to the adoption of a Draft ISO Recommendation.

In August 1958, this Draft ISO Recommendation (No. 391) was circulated to all the ISO Member Bodies for enquiry. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies:

Australia	India	Portugal
Austria	Iran	Republic of South Africa
Belgium	Ireland	Romania
Canada	Israel	Spain
Chile	Italy	Sweden
Czechoslovakia	Japan	Turkey
Denmark	Netherlands	U.S.A.
France	New Zealand	U.S.S.R.
Germany	Norway	
Greece	Poland	

One Member Body opposed the approval of the Draft : United Kingdom.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in September 1962, to accept it as an ISO RECOMMENDATION.

FOREWORD

It has long been customary to designate the size (coarseness or 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 size of the yarn is expressed in terms of the mass of yarn per unit length (*linear density*, often called yarn *number*);

(b) Indirect systems, in which the size 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 has become 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, Technical Committee ISO/TC 38, *Textiles*, agreed unanimously to recommend the Tex System for international adoption in place of the various traditional methods of numbering or counting. That system is direct and based on metric units. This decision has since been embodied in ISO Recommendation R 138, *Universal Yarn Count System*.

ISO Recommendation R 271 September 1962

TEXTILES

IMPLEMENTATION OF THE TEX SYSTEM FOR DESIGNATING THE SIZE OF TEXTILE FIBRES, YARNS AND SIMILAR STRUCTURES

1. SCOPE

This ISO Recommendation reaffirms the principles, given in ISO Recommendation R 138, *Universal Yarn Count System*, of the Tex System of numbering textile fibres, intermediate products (e.g. tops, rovings, etc.), yarns and similar structures. It provides for the conversion of counts or numbers expressed in other systems into tex values, both exact and rounded, and includes guidance on the gradual implementation of the Tex System in trade and industry.

2. UNIVERSAL YARN COUNT SYSTEM OR TEX SYSTEM

2.1 Definition and units

The recommended system for designating the count or number of textile fibres, yarns, intermediate and similar products is a direct, metric system in which the basic unit is the tex.

The linear density (*number*) of a yarn in tex expresses the mass in grammes of yarn having a length of one thousand metres. Thus a yarn designated 1 tex has a mass of one gramme per thousand metres of its length.

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

kilogramme per thousand metres, designated **kilotex;**

milligramme per thousand metres, designated **millitex;**

The unit tex is recommended for application to single and plied yarns and to monofilaments.

TABLE 1. — **Tex units**

Name of unit	Abbreviation	Size of unit (1)	Equivalent value
millitex	mtex	mg/1000 m	μg/m
tex	tex	g/1000 m	mg/m
kilotex	ktex	kg/1000 m	g/m

(1) The unit of length has been written as 1000 m instead of as 1 km, to avoid all confusion with kilotex (ktex).

2.2 Notation *

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

Examples :

Fibres	170 mtex
Tops and similar products	20 ktex
Rovings	500 tex
Single yarns	30 tex

If a symbol is needed to represent a linear density in the Tex System (e.g. in formulae), the abbreviation **Tt** is used.**

* Proposals for the notation of plied and cabled yarns are being developed by Technical Committee ISO/TC 38, *Textiles*.

** The abbreviation Tt is not used immediately before or after the value of linear density, as it does not indicate a unit, but the concept of linear density itself, as expressed in the Tex System.

3. CONVERSION

3.1 Conversion to exact tex values

Counts and linear densities (numbers), as expressed in other counting or numbering systems, are converted into tex values, or vice versa, as set out below.

The result is expressed to four significant figures, where necessary, to give an accuracy of 0.05 per cent.

If the other systems are

(a) *direct systems*, where size of yarns $= \dfrac{\text{mass of yarn}}{\text{unit of length}}$

Table 2 gives the conversion factors for multiplying the known linear density (number):

(b) *indirect systems*, where size of yarn $= \dfrac{\text{length of yarn}}{\text{unit of mass}}$

Table 3 gives the constant which is to be used as follows:
For conversion from an indirect system to the Tex System, the constant is divided by the count of the indirect system.

Example: The equivalent of yarn count $N_e 20$ in the Tex System is

$$\frac{885.8}{20}\ \text{tex} = 44.29\ \text{tex (rounded: 44 tex; see clause 3.2).}$$

For conversion from the Tex System to an indirect system, the constant is divided by the number of the Tex System.

Example: The equivalent of 44 tex in the worsted system is

$$N_e \frac{885.8}{44} = N_e 20.13, \text{ to three significant figures: } N_e 20.1.$$

TABLE 2. — **Conversion factors for direct systems**

Yarn number system	Symbolic abbreviation	Unit of mass used	Unit of length used	Unit of yarn number	Conversion factors * to yarn number from tex number	Conversion factors * to tex number from yarn number
Tex	**Tt**	1 gramme	1000 metres	g/1000 m	—	—
Denier	**Td**	1 gramme	9000 metres	g/9000 m	Td = 9 Tt	Tt = 0.1111 Td
Linen dry spun Hemp, Jute	**T_J**	1 pound	14 400 yards (spindle unit)	lb/14 400 yd	T_J = 0.029 03 Tt	Tt = 34.45 T_J
Numero en cuartos de onza	**To**	1/4 onza	500 cañas	0.25 onza/ 500 cañas	To = 0.0933 Tt	Tt = 10.71 To
Woollen (Aberdeen)	**T_a**	1 pound	14 400 yards	lb/14 400 yd	T_a = 0.029 03 Tt	Tt = 34.45 T_a
Woollen (American grain)	**Tg_a**	1 grain	20 yards	grain/20 yd	Tg_a = 0.2822 Tt	Tt = 3.543 Tg_a
Woollen (Catalonian)	**Tc_W**	1 gramme	504 metres	g/504 m	Tc_W = 0.504 Tt	Tt = 1.984 Tc_W

* See clause 3.1 (a).

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	Constants *
Asbestos (American)	N_{aA}	100 yards (cut)	1 pound	100 yd/lb	$4961 = Tt.N_{aA}$
Asbestos (English)	N_{eA}	50 yards	1 pound	50 yd/lb	$9921 = Tt.N_{eA}$
Cotton bump yarn	N_B	1 yard	1 ounce	yd/oz	$31\,000 = Tt.N_B$
Cotton (English)	N_{eC}	840 yards (hank)	1 pound	840 yd/lb	$590.5 = Tt.N_{eC}$
Cotton (Catalonian)	N_{cC}	500 cañas	1.1 libra catal.	500 cañas/ 1.1 lb. cat.	$565.9 = Tt.N_{cC}$
Glass (U.S.A. and U.K.)	N_G	100 yards	1 pound	100 yd/lb	$4961 = Tt.N_G$
Linen (wet or dry spun)	N_{eL}	300 yards (lea)	1 pound	300 yd/lb	$1654 = Tt.N_{eL}$
Metric	Nm	1 kilomètre	1 kilogramme	km/kg	$1000 = Tt.Nm$
Numero en puntos	Np	1320 mètres	1 libra de Alcoy	1320 m/lb de Alc.	$358.7 = Tt.Np$
Spun silk	N_S	840 yards	1 pound	840 yd/lb	$590.5 = Tt.N_S$
Typp	N_t	1000 yards	1 pound	1000 yd/lb	$496.1 = Tt.N_t$
Woollen (Alloa)	N_{al}	11 520 yards (spindle)	24 pounds	11 520 yd/24 lb	$1033 = Tt.N_{al}$
Woollen (American cut)	N_{ac}	300 yards	1 pound	300 yd/lb	$1654 = Tt.N_{ac}$
Woollen (American run)	N_{ar}	100 yards	1 ounce	100 yd/oz	$310 = Tt.N_{ar}$
Woollen (Cardado Covilhã)	N_{pW}	1 mètre	5 grammes	m/5 g	$5000 = Tt.N_{pW}$
Woollen (Dewsbury)	N_d	1 yard	1 ounce	yd/oz	$31\,000 = Tt.N_d$
Woollen (Galashiels)	N_g	300 yards (cut)	24 ounces	300 yd/24 oz	$2480 = Tt.N_g$
Woollen (Hawick)	N_h	300 yards (cut)	26 ounces	300 yd/26 oz	$2687 = Tt.N_h$
Woollen (Irish)	N_{iw}	1 yard	0.25 ounce	yd/0,25 oz	$7751 = Tt.N_{iw}$
Woollen (West of England)	N_{we}	320 yards (snap)	1 pound	320 yd/lb	$1550 = Tt.N_{we}$
Woollen (Yorkshire)	N_y	256 yards (skein)	1 pound	256 yd/lb	$1938 = Tt.N_y$
Woollen (Yorkshire)	N_y	1 yard	1 dram	yd/dram	$1938 = Tt.N_y$
Worsted	N_e	560 yards (hank)	1 pound	560 yd/lb	$885.8 = Tt.N_e$

* See clause 3.1 (b).

3.2 Conversion to rounded tex values

When nominal counts and linear densities (numbers) are converted into tex, decimal values are usually obtained, which may have to be rounded for practical purposes. To provide consistency in rounding, and for convenience during the initial stage of implementation of the Tex System (see clause 4), convenient rounded values have been evolved from those commonly used in the textile industry. These are listed in column 2 of Table 4. The range of exact values represented by each rounded value is also given in Table 4. The list of rounded values includes a minimum of decimals and uses even numbers as far as possible.

Use the following procedure to determine the rounded tex value corresponding with a yarn count or linear density (number) expressed in any other system:

(a) Determine the exact tex equivalent of the nominal count or linear density (number) by means of the appropriate formula, factor or constant given in Table 2 or 3.

Example 1 : Nm 17 corresponds with 58.82 tex.

Example 2 : 1.5 denier corresponds with 166.7 mtex.

(b) Find the range of values in column 1 of Table 4, which contains the tex number determined in accordance with *(a)* above.

Example 1 : 58.82 tex is contained in the range 58 to 62.

Example 2 : Multiplying by 10 the values in Table 4, 166.7 mtex is contained in the range 165 to 175 (corresponding with the range 16.5 to 17.5 of the same Table).

(c) Read off the rounded tex value given in column 2 of Table 4 for the range of values selected in accordance with *(b)* above.

Example 1 : For the range 58 to 62, the rounded tex number is 60.

Example 2 : For the range 165 to 175, the rounded tex number is 170 mtex (corresponding with 17 in Table 4).

The values in Table 4 are valid for the unit tex and for its multiples and sub-multiples, including kilotex and millitex units. The scope of the Table may be extended for coarser and finer linear densities by multiplying or dividing the values given by 10 or 100.

3.2.1 Where special circumstances necessitate the use of a finer grading of tex numbers than is provided by this Table 4 (e.g. for fine-spun cotton in the range <10 tex), this may be obtained by taking the arithmetical mean of two adjacent rounded values to represent half the value ranges given in column 1.

Example :

1		2
Value range		Corresponding rounded value *
from over	up to and including	
5.9	6.1	6.0
6.1	6.3	6.2
6.3	6.5	6.4
6.5	6.7	6.6

* Rounded values given in the Tables have been underlined in this example.

TABLE 4. — Ranges of values of linear density in tex, with their corresponding rounded value

1		2	3		
Value range		Corresponding rounded value	Value range		Corresponding rounded value
from over	up to and including		from over	up to and including	
. . .	. . .	. . .	31	33	32
> 9.4	⩽ 9.8	9.6	33	35	34
9.8	10.25	10	35	37	36
10.25	10.75	10.5	37	39	38
10.75	11.25	11	39	41	40
11.25	11.75	11.5	41	43	42
11.75	12.25	12	43	45	44
12.25	12.75	12.5	45	47	46
12.75	13.5	13	47	49	48
13.5	14.5	14	49	51	50
14.5	15.5	15	51	54	52
15.5	16.5	16	54	58	56
16.5	17.5	17	58	62	60
17.5	18.5	18	62	66	64
18.5	19.5	19	66	70	68
19.5	20.5	20	70	74	72
20.5	21.5	21	74	78	76
21.5	22.5	22	78	82	80
22.5	23.5	23	82	86	84
23.5	24.5	24	86	90	88
24.5	25.5	25	90	94	92
25.5	27	26	94	98	96
27	29	28	98	102.5	100
29	31	30	102.5	107.5	105
			. . .	. . .	. . .

4. IMPLEMENTATION OF THE TEX SYSTEM IN TRADE AND INDUSTRY

The introduction of the Tex System to replace others previously used will necessarily be a gradual process, during which trade and industry will require time to become familiar with the system, its application and advantages. To simplify the transition, three stages are envisaged, as described below.

The first stage is for immediate implementation; the second and third stages will be introduced as early as possible, at the discretion of individual sections of trade and industry insofar as their own activities are concerned, or by agreement between parties to commercial transactions.

4.1 First stage

While the existing yarn counting and numbering systems continue in use, a rounded tex value determined as described in clause 3.2 is put in brackets after the count or number; e.g. N_{eL} 25 (68 tex), N_{eC} 18 (32 tex), N_e 48 (18 tex). The inclusion of a rounded tex number does not affect commercial tolerances in any way, and every contract or commercial agreement will still refer to the count or linear density (number) in the traditional system and not to the value in brackets.

During this stage, the rounded tex number will facilitate comparison of count and linear densities (numbers) designated in different systems.

4.2 Second stage

The linear density expressed in tex is now put first, and its equivalent, expressed in the traditional system previously used, is put in brackets after it. This equivalent is obtained by calculation from the formulae given in Tables 2 and 3. Up to three significant figures should be used, giving an error of not more than 0.5 per cent. This provides the opportunity for spinners, weavers, etc., to eliminate unnecessary variety in the number of yarns spun. The trade authorities concerned with each type of yarn should, in good time, publish agreed lists in tex units of the yarns and fibres which are to be produced. The tex values for these lists should be chosen exclusively from the rounded values in Table 4, column 2. Spinners will then adjust their production from the traditional counting system to the Tex System in accordance with the appropriate list. Contracts or commercial agreements will now refer exclusively to the number in tex, and *not* to the traditional figure given in brackets.

Example : A linen yarn of 68 tex, corresponding with the English linen yarn count of 24.32, will be designated in this stage by 68 tex (N_{eL} 24.3).

A cotton yarn of 32 tex, corresponding with the English cotton yarn count of 18.45, is designated in this stage by 32 tex (N_{eC} 18.5).

A worsted yarn of 18 tex, corresponding with the English worsted yarn count of 49.21, is designated in this stage by 18 tex (N_e 49.2).

4.3 Third stage

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

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