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ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION

R 240

INTERCHANGEABILITY DIMENSIONS FOR MILLING CUTTERS AND CUTTER ARBORS OR CUTTER MANDRELS

METRIC SERIES AND INCH SERIES

2nd EDITION

October 1969

This second edition supersedes the first edition.

For each individual country the only valid standard is the national standard of that country.

Printed in Switzerland

Also issued in French and Russian. Copies to be obtained through the national standards organizations.

BRIEF HISTORY

The ISO Recommendation R 240, *Interchangeability dimensions for milling cutters and cutter arbors – 1. Metric series – 2. Inch series*, was drawn up by Technical Committee ISO/TC 29, *Small tools*, the Secretariat of which is held by the Association Française de Normalisation (AFNOR).

Work on this question led to the adoption of a Draft ISO Recommendation.

In September 1959, this Draft ISO Recommendation (No. 306) was submitted to all the ISO Member Bodies for enquiry. It was approved by 20 Member Bodies. One Member Body opposed the approval of the Draft.

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in December 1961, to accept it as an ISO RECOMMENDATION.

BRIEF HISTORY RELATING TO THE 2nd EDITION

Further to a proposal made by a Working Group of Technical Committee ISO/TC 29, it was decided to prepare a revision of ISO Recommendation R 240-1961 and a Draft ISO Recommendation was prepared on this subject.

In June 1968, this Draft ISO Recommendation (No. 1632) 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	Israel	Switzerland
Austria	Italy	Thailand
Belgium	Netherlands	Turkey
Czechoslovakia	Peru	U.A.R.
France	Poland	United Kingdom
Germany	Portugal	U.S.S.R.
Hungary	South Africa, Rep. of	Yugoslavia
India	Spain	
Ireland	Sweden	

Two Member Bodies opposed the approval of the Draft :

Japan
U.S.A.

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in October 1969, to accept it as the second edition of ISO Recommendation R 240-1961, the title of which has been modified as follows : *Interchangeability dimensions for milling cutters and cutter arbors or cutter mandrels – Metric series and inch series.*

This edition (2nd edition) cancels and replaces the first edition of ISO Recommendation R 240-1961.

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INTERCHANGEABILITY DIMENSIONS FOR MILLING CUTTERS AND CUTTER ARBORS OR CUTTER MANDRELS

METRIC SERIES AND INCH SERIES

1. SCOPE

This ISO Recommendation applies to all types of milling cutters mounted on cutter arbors or mandrels.

It gives the dimensions for interchangeability between the cutter and the arbor or mandrel, i.e. the diameter of the bore and the arbor or mandrel and elements of the drive, whether by keying or tenon.

It comprises two completely distinct series* designated respectively :

– Metric Series	Tables	1 and 2 3 and 4
– Inch Series	Tables	5 and 6 7 and 8

For each of the two series, two groups of tables have been established, relating respectively to

– key drive,

– tenon drive.

For each table giving original dimensions of the series in question, there is a corresponding table giving the conversion into the other system of measurement.

2. INTERCHANGEABILITY

The Metric Series and the Inch Series are not interchangeable. In any one series there is complete interchangeability between elements whether their dimensions are expressed in inches or in millimetres, the first being a straightforward conversion of the second and vice versa.

There is, however, no possibility of interchangeability between the metric series and the inch series, and there is thus not one universal series, but two completely distinct series.

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* As it was not possible to achieve unanimous international agreement on a single universal series, each national Member Body will therefore have to choose only one of these two series for its national standard, the second being reserved for use in exporting to those countries which have chosen the alternative series.

3. METRIC SERIES

3.1 Key drive

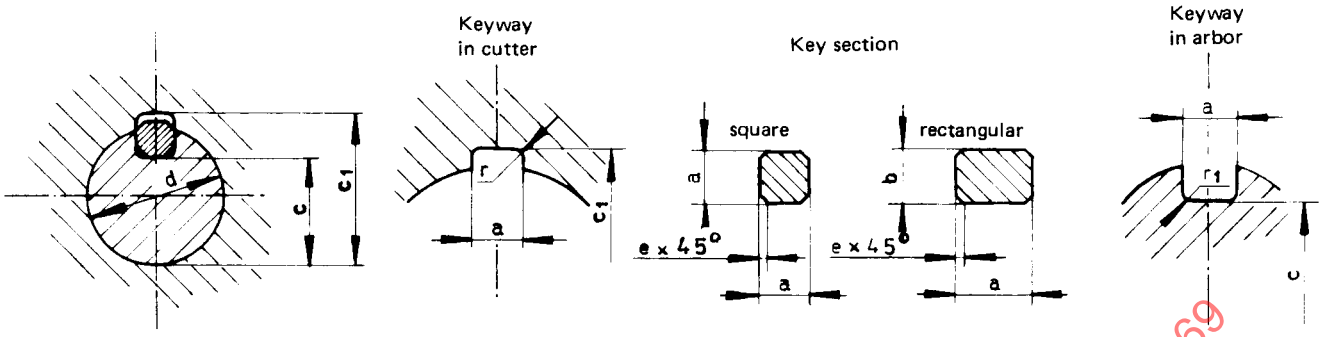

TABLE 1 – **Original dimensions in millimetres**

d	*a*	*b*	*c*		*c*1		*e*		*r*		*r*1	
			Dimension	Tolerance	Dimension	Tolerance	Dimension	Tolerance	Dimension	Tolerance	Dimension	Tolerance
8	2		6.7		8.9							
10	3		8.2		11.5		0.16	+ 0.09 0	0.4	0 – 0.1	0.16	0 – 0.08
13	3		11.2	0 – 0.1	14.6	+ 0.1 0						
16	4		13.2		17.7				0.6	0 – 0.2		
19	5		15.6		21.1				1.0			
22	6		17.6		24.1		0.25	+ 0.15 0		0 – 0.3	0.25	0 – 0.09
27	7		22.0		29.8				1.2			
32	8	7	27.0		34.8							
40	10	8	34.5		43.5							
50	12	8	44.5	0 – 0.2	53.5	+ 0.2 0			1.6			
60	14	9	54.0		64.2		0.40	+ 0.20 0		0 – 0.5	0.40	0 – 0.15
70	16	10	63.5		75.0				2.0			
80	18	11	73.0		85.5							
100	25*	14	91.0		107.0		0.60		2.5		0.60	0 – 0.20

* The 24 X 14 key for a diameter of 100 has been replaced by the 25 X 14 key specified in ISO Recommendation R 773, *Rectangular or square parallel keys and their corresponding keyways (Dimensions in millimetres).*

TABLE 2 – **Conversion into inches**

Designation	d	a	b	c		c_1		e		r		r_1	
				Dimension	Tolerance	Dimension	Tolerance	Dimension	Tolerance	Dimension	Tolerance	Dimension	Tolerance
8	0.3149	0.079		0.264		0.350							
10	0.3937	0.118		0.323		0.453		0.006	+ 0.004 0	0.016	0 - 0.004	0.006	0 - 0.003
13	0.5118	0.118		0.441	0 - 0.004	0.575	+ 0.004 0						
16	0.6299	0.157		0.520		0.697				0.024	0 - 0.008		
19	0.7480	0.197		0.614		0.831				0.039			
22	0.8661	0.236		0.693		0.949		0.010	+ 0.006 0		0 - 0.012	0.010	0 - 0.004
27	1.0630	0.276		0.866		1.173				0.047			
32	1.2598	0.315	0.276	1.063		1.370							
40	1.5748	0.394	0.315	1.358		1.713							
50	1.9685	0.472	0.315	1.752	0 - 0.008	2.106	+ 0.008 0			0.063			
60	2.3622	0.551	0.354	2.126		2.528		0.016	+ 0.008 0			0.016	0 - 0.006
70	2.7559	0.630	0.394	2.500		2.953				0.079	0 - 0.020		
80	3.1496	0.709	0.433	2.874		3.366							
100	3.9370	0.984	0.551	3.583		4.213		0.024		0.098		0.024	0 - 0.008

NOTE relating to Tables 1 and 2

Tolerances

– on d (except for gear hobs *) :

on the arbor h6

on the cutter H7

– on a :

for keyway in arbor :

free keying H9

close keying N9

for keyway in cutter C11

key h9

– on b h11

For dimensions in inches, direct conversion into inches of the metric values of h6, h9, h11, H7, H9, N9 and C11 **.

* These tolerances will be established later.

** See ISO Recommendation R 286, *ISO System of limits and fits – Part I : General, tolerances and deviations.*

3.2 Tenon drive

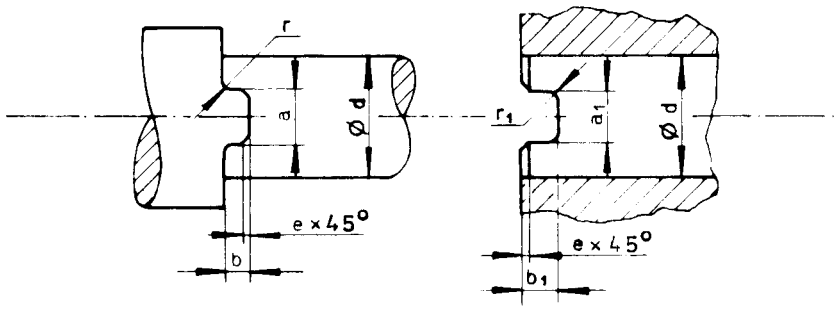

TABLE 3 – **Original dimensions in millimetres**

d	Arbor			Cutter			e		$z^{(1)}$
	a	b	r max.	a_1	b_1	r_1 max.	Dimension	Tolerance	
5	3	2.0	0.3	3.3	2.5	0.6	0.3	+ 0.1 0	0.075
8	5	3.5	0.4	5.4	4.0		0.4		0.100
10	6	4.0	0.5	6.4	4.5	0.8	0.5		
13	8	4.5		8.4	5.0	1.0			
16		5.0	0.6		5.6		0.6	+ 0.2 0	
19	10	5.6		10.4	6.3	1.2			
22									
27	12	6.3	0.8	12.4	7.0		0.8		
32	14	7.0		14.4	8.0	1.6			
40	16	8.0	1.0	16.4	9.0	2.0	1.0	+ 0.3 0	
50	18	9.0		18.4	10.0				
60	20	10.0		20.5	11.2				0.125

(1) $+z$ = maximum permissible deviation between the axial plane of the tenon and the axis of the arbor of diameter d.

TABLE 4 – **Conversion into inches**

Designation	d	Arbor			Cutter			e		$z^{(1)}$
		a	b	r max.	a_1	b_1	r_1 max.	Dimension	Tolerance	
5	0.1968	0.118	0.079	0.012	0.130	0.099	0.020	0.012	+ 0.004 0	0.003
8	0.3149	0.197	0.138	0.016	0.213	0.158		0.016		0.004
10	0.3937	0.236	0.157	0.020	0.252	0.177	0.030	0.020		
13	0.5118	0.315	0.177		0.331	0.197	0.040			
16	0.6299		0.197	0.024		0.220		0.024	+ 0.008 0	
19	0.7480	0.394	0.220		0.410	0.248	0.050			
22	0.8661									
27	1.0630	0.472	0.248	0.031	0.488	0.276		0.031		
32	1.2598	0.551	0.276		0.567	0.316	0.060			
40	1.5748	0.630	0.315	0.039	0.646	0.355	0.080	0.039	+ 0.012 0	
50	1.9685	0.709	0.354		0.725	0.394				
60	2.3622	0.787	0.394		0.807	0.441				0.005

(1) $+z$ = maximum permissible deviation between the axial plane of the tenon and the axis of the arbor of diameter d.

NOTE relating to Tables 3 and 4.

Tolerances

– on d (except for gear hobs *) :
  on the arbor h6
  on the cutter H7

– on a and b h11

– on a_1 . . . . . H11

– on b_1 . . . . . H13

For dimensions in inches, direct conversion into inches of the metric values of h6, h11, H7, H11 and H13 **.

* These tolerances will be established later.

** See ISO Recommendation R 286, *ISO System of limits and fits – Part I : General, tolerances and deviations.*

4. INCH SERIES

4.1 Key drive

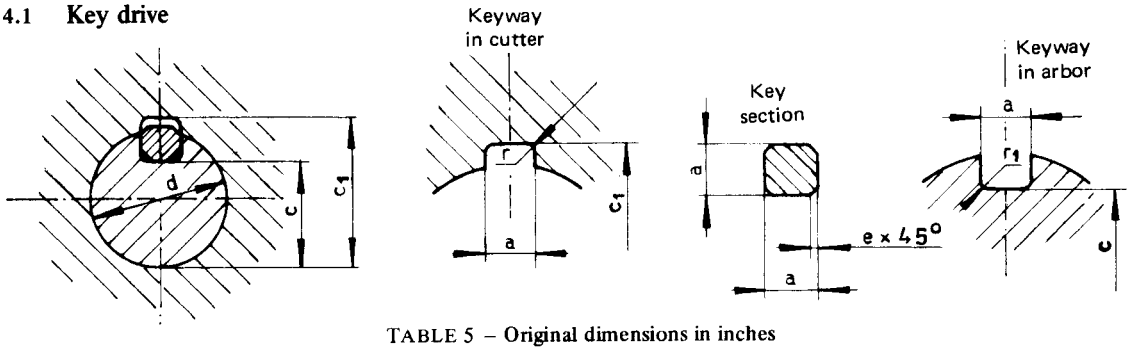

TABLE 5 – Original dimensions in inches

d	$a \times a$	c	c_1	e min.	r max.	r_1 max.
$\frac{3}{8}$	0.094	0.328	0.432	0.020	0.020	0.020
$\frac{1}{2}$		0.453	0.557			
$\frac{5}{8}$	0.125	0.563	0.698	$\frac{1}{32}$	$\frac{1}{32}$	$\frac{1}{32}$
$\frac{3}{4}$		0.687	0.822			
$\frac{7}{8}$		0.813	0.948			
1	0.250	0.844	1.104	$\frac{3}{64}$	$\frac{3}{64}$	$\frac{3}{64}$
$1\frac{1}{4}$	0.312	1.063	1.385	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$
$1\frac{1}{2}$	0.375	1.281	1.666			
$1\frac{3}{4}$	0.438	1.500	1.948			
2	0.500	1.688	2.198			
$2\frac{1}{2}$	0.625	2.093	2.733			
3	0.750	2.500	3.265	$\frac{3}{32}$	$\frac{3}{32}$	$\frac{3}{32}$
$3\frac{1}{2}$	0.875	3.000	3.890			
4	1.000	3.375	4.390			

NOTE

Tolerances

– on d (except for gear hobs*) :

on the arbor . . . . . $\begin{matrix}-0.0005\\-0.0010\end{matrix}$ in

on the cutter . . . . . $\begin{matrix}+0.00075\\+0.00025\end{matrix}$ in

– on a :

for keyway in arbor . . . . . $\begin{matrix}0\\-0.001\end{matrix}$ in

for keyway in cutter C11

for key . . . . . $\begin{matrix}0\\-0.005\end{matrix}$ in

– on c . . . . . $\begin{matrix}0\\-0.005\end{matrix}$ in

– on c_1 . . . . . $\begin{matrix}+0.015\\0\end{matrix}$ in

For dimensions in inches, direct conversion into inches of the metric values of C11**.

* These tolerances will be established later.

** See ISO Recommendation R 286, *ISO System of limits and fits – Part I : General, tolerances and deviations.*