

**ISO** *transforme'*

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION  
R 701

INTERNATIONAL GEAR NOTATION

SYMBOLS FOR GEOMETRICAL DATA

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1st EDITION  
March 1968

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## BRIEF HISTORY

The ISO Recommendation R 701, *International gear notation – Symbols for geometrical data*, was drawn up by Technical Committee ISO/TC 60, *Gears*, the Secretariat of which is held by the Institut Belge de Normalisation (IBN).

Work on this question by the Technical Committee began in 1950 and led, in 1962, to the adoption of a Draft ISO Recommendation.

In December 1965, this Draft ISO Recommendation (No. 889) 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 :

Argentina	Israel	Spain
Australia	Italy	Sweden
Austria	Japan	Switzerland
Belgium	Netherlands	Turkey
Chile	New Zealand	United Kingdom
France	Norway	Yugoslavia
Germany	Poland	
Hungary	South Africa,	
India	Rep. of	

One Member Body opposed the approval of the Draft :

Czechoslovakia

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in March 1968, to accept it as an ISO RECOMMENDATION.

INTERNATIONAL GEAR NOTATION  
SYMBOLS FOR GEOMETRICAL DATA

INTRODUCTION

This ISO Recommendation aims to unify the symbols used in different countries for the international notation of gears with regard to the principal geometrical data defined in ISO Recommendation R ..., (1) *International vocabulary of gears – Part I : Geometrical definitions*.

These symbols have been chosen after detailed comparative study, taking into account the necessity of retaining a certain number of letters for standardization of other notations at a later date, such as those dealing with gear accuracy.

Consequently it is important

- (1) to bring national standards into line with this ISO Recommendation, so that in future a real international language of notations will facilitate the exchange of documents between one country and another;
- (2) to use for geometrical data only combinations of letters or signs appearing in the alphabetical Annex, in order to avoid any risk of confusion with notations to be determined later with regard to other gear data.

This ISO Recommendation consists essentially of two parts :

- on the one hand, the *principal symbols*, composed either of a single basic letter, or of a basic letter and suffix or sign which are generally inseparable for the given term (see Table 1);
- on the other hand, *additional suffixes or signs* which may be added if necessary to the principal symbols, in order to imply a particular qualification of the given term (see Table 2).

The Annex gives lists classified in alphabetical order according to the Roman and Greek alphabets, on the one hand of the basic letter symbols, and on the other hand of the suffixes and signs which have been used in the establishment of this ISO Recommendation and a combination of which may possibly be used for the notation of any other term of geometrical data not explicitly mentioned in this ISO Recommendation.

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(1) At present Draft ISO Recommendation No. 888.

TABLE 1 – Principal symbols<sup>(1)</sup>

No.	Terms	Symbols	No.	Terms	Symbols
1	Centre distance	$\alpha$	32	Pitch	$p$
2	Shaft angle	$\Sigma$	33	Module	$m$
3	Linear speed	$v$	34	Diametral pitch	$P$
4	Angular speed	$\omega$	35	Angular pitch of crown gear	$\tau$
5	Number of revolutions	$n$	36	Tooth thickness	$s$
6	Gear ratio	$u$	37	Spacewidth	$e$
7	Transmission ratio	$i$	38	Tooth thickness half-angle	$\psi$
8	Number of teeth	$z$	39	Spacewidth half-angle	$\eta$
9	Facewidth	$b$	40	Chord	$\bar{s}$
10	Cone distance	$R$	41	Chordal height	$\bar{h}_a$
11	Radius	$r$	42	Constant chord	$\bar{s}_c$
12	Diameter	$d$	43	Constant chord height	$\bar{h}_c$
13	Reference diameter	$d$	44	Base tangent length (e.g. : $W_3$ for 3 teeth)	$W$
14 <sup>(2)</sup>	Pitch diameter	$d'$	45	Bottom clearance	$c$
15	Tip diameter	$d_a$	46	Circumferential backlash	$j_t$
16	Root diameter	$d_f$	47	Normal backlash	$j_n$
17	Reference cone angle	$\delta$	48	Addendum modification coefficient	$x$
18 <sup>(2)</sup>	Pitch angle	$\delta'$	49	Centre distance modification coefficient	$y$
19	Tip angle	$\delta_a$	50	Length of approach path	$g_f$
20	Root angle	$\delta_f$	51	Length of recess path	$g_a$
21	Tooth depth	$h$	52	Length of path of contact	$g_\alpha$
22	Addendum	$h_a$	53	Overlap length	$g_\beta$
23	Dedendum	$h_f$	54	Transverse angle of transmission	$\varphi_\alpha$
24 <sup>(3)</sup>	Addendum angle	$\theta_a$	55	Overlap angle	$\varphi_\beta$
25 <sup>(3)</sup>	Dedendum angle	$\theta_f$	56	Total angle of transmission	$\varphi_\gamma$
26	Helix angle	$\beta$	57	Transverse contact ratio	$\epsilon_\alpha$
27	Lead angle	$\gamma$	58	Overlap ratio	$\epsilon_\beta$
28	Lead	$p_z$	59	Contact ratio	$\epsilon_\gamma$
29	Involute $\alpha$ ( $=\text{tg}\alpha - \alpha$ )	$\text{inv } \alpha$			
30	Profile radius	$\rho$			
31	Pressure angle	$\alpha$			

(1) To be completed if necessary by additional suffixes or signs from Table 2.

(2) The apostrophe may if desired be replaced by the suffix w.

(3) Small theta may be written  $\theta$  or  $\vartheta$ .

TABLE 2 - Additional suffixes or signs

No.	Terms	Suffixes or signs
<b>Suffixes</b>		
1	Tip	a
2	Root	f
3	Transverse	t
4	Normal	n
5	Axial	x
6	Radial	r
7	Tangential	t
8	Mean	m
9	Base	b
10	On any cone or cylinder	y
11	On back cone (or virtual cylindrical gear)	v
12	External	e
13	Internal	i
14	Right hand; right	R
15	Left hand; left	L
16	Of approach	f
17	Of recess	a
18	Of transverse contact	$\alpha$
19	Overlap	$\beta$
20	Total of contact	$\gamma$
21	Relating to the tool	0
22	Relating to the pinion	1
23	Relating to the wheel	2
<b>Other signs</b>		
24	Reference	(no signs)
25 <sup>(1)</sup>	Working	' (apostrophe)
26	Coefficient (of a dimension other than addendum or centre distance modification)	* (asterisk)

(1) The apostrophe may if desired be replaced by the suffix w.

ANNEX

RECAPITULATIVE INDEX OF LETTERS AND SIGNS  
USED IN THIS ISO RECOMMENDATION

TABLE 3 – Basic letters

Symbols	Terms	Symbols	Terms
<b>Small Roman letters</b>		<b>Small Greek letters</b>	
<i>a</i>	Centre distance	$\alpha$	Pressure angle
<i>b</i>	Facewidth	$\beta$	Helix angle
<i>c</i>	Bottom clearance	$\gamma$	Lead angle
<i>d</i>	Diameter	$\delta$	Cone angle
<i>e</i>	Spacewidth	$\epsilon$	Ratio (contact, overlap, etc.)
<i>g</i>	Length (of path of contact, overlap, etc.)	$\eta$	Spacewidth half-angle
<i>h</i>	Tooth depth either addendum or dedendum	$\theta$	Angle (addendum or dedendum) <sup>(1)</sup>
<i>i</i>	Transmission ratio	$\rho$	Profile radius
<i>j</i>	Backlash	$\tau$	Angular pitch of crown gear
<i>m</i>	Module	$\varphi$	Angle (transmission, overlap, etc.)
<i>n</i>	Number of revolutions	$\psi$	Tooth thickness half-angle
<i>p</i>	Pitch	$\omega$	Angular speed
<i>r</i>	Radius	<b>Capital Greek letters</b>	
<i>s</i>	Tooth thickness	$\Sigma$	Shaft angle
<i>u</i>	Gear ratio		
<i>v</i>	Linear speed		
$\bar{x}$	Addendum modification coefficient		
<i>y</i>	Centre distance modification coefficient		
<i>z</i>	Number of teeth		
inv $\alpha$	Involute $\alpha$		
<b>Capital Roman letters</b>			
<i>P</i>	Diametral pitch		
<i>R</i>	Cone distance		
<i>W</i>	Base tangent length		

(1) Small theta may be written  $\theta$  or  $\vartheta$ .

TABLE 4 – Suffixes and signs

Suffixes or signs	Terms	Suffixes or signs	Terms
	<b>Small Roman letters</b>		<b>Small Greek letters</b>
a	Tip; of recess	$\alpha$	Of transverse contact
b	Base	$\beta$	Overlap
c	Relating to constant chord	$\gamma$	Total of contact
e	External		<b>Figures</b>
f	Root; of approach	0	Relating to the tool
i	Internal	1	Relating to the pinion
m	Mean	2	Relating to the wheel
n	Normal		<b>Various signs</b>
r	Radial	*	(asterisk) Coefficient (of a dimension other than addendum or centre distance modification)
t	Transverse; tangential	$\bar{\quad}$	(overlined) Relating to the chord (e.g. : $\bar{s}$ )
v	On back cone (or virtual cylindrical gear)	'	(apostrophe) Working
(w)	Working <sup>(1)</sup>		<b>Neither suffix nor sign</b>
x	Axial	(no signs)	Reference
y	On any cone or cylinder		
z	Of a helix ( $p_z = \text{lead}$ )		
	<b>Capital Roman letters</b>		
L	Left hand; left		
R	Right hand; right		

(1) This suffix may, if desired, replace the apostrophe indicating the word "working".