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Table 1-3A The Linear Dimensions and Circular Dimensions

Terms	Symbols
Center Distance	a
Circular Pitch (General)	p
Standard Circular Pitch	p
Radial Circular Pitch	p_t
Circular Pitch Perpendicular to Tooth	p_n
Axial Pitch	p_x
Normal Pitch	p_b
Radial Normal Pitch	p_{bt}
Normal Pitch Perpendicular to Tooth	p_{bn}
Whole Depth	h
Addendum	h_a
Dedendum	h_f
Caliper Tooth Height	$\overline{h}$
Working Depth	h' h_w
Tooth Thickness (General)	s
Circular Tooth Thickness	s
Base Circle Circular Tooth Thickness	s_b
Chordal Tooth Thickness	$\overline{s}$
Span Measurement	W
Root Width	e
Top Clearance	c
Circular Backlash	j_t
Normal Backlash	j_n
Blank Width	b
Working Face Width	b' b_w

Terms	Symbols
Lead	p_z
Contact Length	g_a
Contact Length of Approach	g_f
Contact Length of Recess	g_a
Contact Length of Overlap	g_b
Diameter (General)	d
Standard Pitch Diameter	d
Working Pitch Diameter	d' d_w
Outside Diameter	d_a
Base Diameter	d_b
Root Diameter	d_f
Radius (General)	r
Standard Pitch Radius	r
Working Pitch Radius	r' r_w
Outside Radius	r_a
Base Radius	r_b
Root Radius	r_f
Radius of Curvature	ρ
Cone Distance (General)	R
Cone Distance	R_e
Mean Cone Distance	R_m
Inner Cone Distance	R_i
Back Cone Distance	R_v
Mounting Distance	$*A$
Offset Distance	$*E$

* These terms and symbols are specific to JIS Standard

Table 1-3B Angular Dimensions

Terms	Symbols
Pressure Angle (General)	α
Standard Pressure Angle	α
Working Pressure Angle	α' or α_w
Cutter Pressure Angle	α_0
Radial Pressure Angle	α_t
Pressure Angle Normal to Tooth	α_n
Axial Pressure Angle	α_x
Helix Angle (General)	β
Standard Pitch Cylinder Helix Angle	β
Outside Cylinder Helix Angle	β_a
Base Cylinder Helix Angle	β_b
Lead Angle (General)	γ
Standard Pitch Cylinder Lead Angle	γ
Outside Cylinder Lead Angle	γ_a
Base Cylinder Lead Angle	γ_b

Terms	Symbols
Shaft Angle	Σ
Cone Angle (General)	δ
Pitch Cone Angle	δ
Outside Cone Angle	δ_a
Root Cone Angle	δ_f
Addendum Angle	θ_a
Dedendum Angle	θ_f
Radial Contact Angle	ϕ_a
Overlap Contact Angle	$\phi\beta$
Overall Contact Angle	ϕ_r
Angular Pitch of Crown Gear	τ
Involute Function	inv α

Continued on the next page

Table 1-3C Size Number, Ratios & Speed Terms

Terms	Symbols
Number of Teeth	z
Equivalent Spur Gear Number of Teeth	z_v
Number of Threads in Worm	z_w
Number of Teeth in Pinion	z_l
Number of Teeth Ratio	u
Speed Ratio	i
Module	m
Radial Module	m_t
Normal Module	m_n
Axial Module	m_x

Terms	Symbols
Contact Ratio	ε
Radial Contact Ratio	ε_α
Overlap Contact Ratio	ε_β
Total Contact Ratio	ε_γ
Specific Slide	*σ
Angular Speed	ω
Linear or Tangential Speed	v
Revolutions per Minute	n
Coefficient of Profile Shift	x
Coefficient of Center Distance Increase	y

NOTE: The term "Radial" is used to denote parameters in the plane of rotation perpendicular to the axis.

Table 1-3D Accuracy / Error Terms

Terms	Symbols
Single Pitch Error	f_{pt}
Pitch Variation	*f_u or f_{pu}
Partial Accumulating Error (Over Integral k teeth)	F_{pk}
Total Accumulated Pitch Error	F_p

Terms	Symbols
Normal Pitch Error	f_{pb}
Involute Profile Error	f_f
Runout Error	F_r
Lead Error	F_b

*These terms and symbols are specific to JIS Standards

Table 1-4 Equivalence Of American And Japanese Symbols

American Symbol	Japanese Symbol	Nomenclature
B	j	backlash, linear measure along pitch circle
B_{LA}	j_t	backlash, linear measure along line-of-action
B_a	j_n	backlash in arc minutes
C	a	center distance
ΔC	Δa	change in center distance
C_o	a_w	operating center distance
C_{std}		standard center distance
D	d	pitch diameter
D_b	d_b	base circle diameter
D_o	d_a	outside diameter
D_R	d_f	root diameter
F	b	face width
K	K	factor, general
L	L	length, general; also lead of worm
M		measurement over-pins
N	z	number of teeth, usually gear
N_c	z_c	critical number of teeth for no undercutting

American Symbol	Japanese Symbol	Nomenclature
N_v	z_v	virtual number of teeth for helical gear
P_d	p	diametral pitch
P_{dn}	p_n	normal diametral pitch
P_t		horsepower, transmitted
R	r	pitch radius, gear or general use
R_b	r_b	base circle radius, gear
R_o	r_a	outside radius, gear
R_T		testing radius
T	s	tooth thickness, gear
W_b		beam tooth strength
Y		Lewis factor, diametral pitch
Z	i	mesh velocity ratio
a	h_a	addendum
b	h_f	dedendum
c	c	clearance
d	d	pitch diameter, pinion
d_w	d_p	pin diameter, for over-pins measurement
e		eccentricity
h_k	h_w	working depth

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Table 1-4 (Cont.) Equivalence of American and Japanese Symbols

American Symbol	Japanese Symbol	Nomenclature
h_t	h	whole depth
m_p	e	contact ratio
n	z_1	number of teeth, pinion
n_w	z_w	number of threads in worm
p_a	p_x	axial pitch
p_b	p_b	base pitch
p_c	p	circular pitch
p_{cn}	p_n	normal circular pitch
r	r	pitch radius, pinion
r_b	r_b	base circle radius, pinion
r_f	r_f	fillet radius
r_o	r_a	outside radius, pinion
t	s	tooth thickness, and for general use, for tolerance
y_c		Lewis factor, circular pitch
γ	δ	pitch angle, bevel gear
θ		rotation angle, general
λ	γ	lead angle, worm gearing
μ		mean value
ν		gear stage velocity ratio
ϕ	α	pressure angle
ϕ_o	α_w	operating pressure angle
Ψ	β	helix angle (b_b=base helix angle; b_w = operating helix angle)
ω		angular velocity
inv ϕ	inv α	involute function

1.3.3 Terminology

Terms used in metric gearing are identical or are parallel to those used for inch gearing. The one major exception is that metric gears are based upon the module, which for reference may be considered as the inversion of a metric unit diametral pitch.

Terminology will be appropriately introduced and defined throughout the text.

There are some terminology difficulties with a few of the descriptive words used by the Japanese JIS standards when translated into English. One particular example is the Japanese use of the term "radial" to describe measures such as what Americans term circular pitch. This also crops up with contact ratio. What Americans refer to as contact ratio in the plane of rotation, the Japanese equivalent is called "radial contact ratio". This can be both confusing and annoying. Therefore, since this technical section is being used outside Japan, and the American term is more realistically descriptive, in this text we will use the American term "circular" where it is meaningful. However, the applicable Japanese symbol will be used. Other examples of giving preference to the American terminology will be identified where it occurs.

1.3.4 Conversion

For those wishing to ease themselves into working with metric gears by looking at them in terms of familiar inch gearing relationships and mathematics, **Table 1-5** is offered as a means to make a quick comparison.

Table 1-5 Spur Gear Design Formulas

To Obtain	From Known	Use This Formula*
Pitch Diameter	Module	$D = mN$
Circular Pitch	Module	$p_c = m\pi = \frac{D}{N}\pi$
Module	Diametral Pitch	$m = \frac{25.4}{P_d}$
Number of Teeth	Module and Pitch Diameter	$N = \frac{D}{m}$
Addendum	Module	$a = m$

* All linear dimensions in millimeters
Symbols per **Table 1-4**

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