OMNIGEAR
& Machine Corp

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Symbol for Rules and Formulas

a	Addendum	*Pb*	Base Pitch	*Vs*	Spacing Variation
ac	Chordal Addendum	*Pm*	True Position Pitch	*Vx*	Index Variation
anc	Normal Chordal Addendum	*Pn*	Normal Circular Pitch	*VΦ*	Profile Variation
B	Backlash	*PN*	Normal Base Pitch	*VΦT*	Profile Tolerance
b	Dedendum	*Pt*	Transverse Circular Pitch	*VΨ*	Tooth Alignment Variation
C	Center Distance	*Px*	Axial Pitch	*VΨT*	Tooth Alignment Tolerance
c	Clearance	*PX*	Axial Base Pitch	*Z*	Length of Action
D	Reference Standard Pitch Diameter	*Q*	Quality Number	*α*	Addendum Angle
Db	Base Diameter	*Qa*	Arc of Approach	*Γ*	Pitch Angle
Dc	Datum Circle	*Qr*	Arc of Recess	*ΓR*	Root Angle
Di	Internal Diameter	*Qt*	Arc of Action	*Σ*	Shaft Angle
DR	Root Diameter	*Rr*	Test Radius	*ε*	Involute Roll Angle
Dt	Throat Diameter	*rf*	Fillet Radius, (when constant)	*ϑ*	Involute Polar Angle
DO	Out side diameter	*rt*	Throat-form Radius	*ΘN*	Angular Pitch
dp	Operating Pitch Diameter	*rr*	Tip or Edge Radius of Tool	*λ*	Lead Angle
F	Face Width	*t*	Circular Tooth Thickness	*λb*	Base Lead Angle
Fe	Effective or Active Face Width	*tb*	Base Circular Thickness	*λo*	Outside Lead Angle
Ft	Total Face Width	*tc*	Chordal Thickness	*λp*	Pitch Lead Angle
hk	Working Depth	*tn*	Normal Circular Thickness	*p*	Profile Radius of Curvature
ht	Whole Depth (tooth depth)	*tnc*	Normal Chordal Thickness	*Φ*	Pressure Angle

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Symbol for Rules and Formulas (cont)

L	Lead	*tr*	Tooth Thickness Tolerance	*Φn*	Normal Pressure Angle
m	Module	*tt*	Transverse Circular Thickness	*Φt*	Transverse Pressure Angle
mc	Contact Ratio	*tx*	Axial Thickness	*Φx*	Axial Pressure Angle
mF	Face Contact Ratio	*Vap*	Total Accumulated Pitch Variation	*Ψ*	Helix Angle, Spiral Angle
mG	Gear Ratio	*Vapk*	Total Accumulated Pitch Variation within a sector of k pitches	*Ψb*	Base Helix Angle
mn	Normal Module	*Vcq*	Total Composite Variation (double flank)	*A*	Allowable Variation
mo	Modified Contact Ratio	*VcqT*	Total Composite Tolerance (double flank)	*G*	Features on a gear
mp	Transverse Contact Ratio	*Vp*	Pitch Variation	*K*	A Variable
mt	Total Contact Ratio	*VpA*	Allowable Pitch Variation	*n*	Normal Plane
N	Number of teeth or threads	*Vpn*	Normal Pitch Variation	*P*	Features on a pinion
Ne	Equivalent Number of teeth	*Vq*	Tooth-to-Tooth Composite Variation (double flank)	*T*	Tolerance
Pd	Diametral Pitch (transverse)	*VqT*	Tooth-to-Tooth Composite Tolerance (double flank)	*t*	Transverse Plane
Pnd	Normal Diametral Pitch	*Vr*	Radial Runout	*W*	Features on a Worm
P	Circular Pitch	*VrT*	Radial Runout Tolerance		

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Diametral PitchSpur Gears

TO GET	HAVING	RULE	FORMULA
Module	Diametral pitch	Divide 25.4 by the diametral pitch	m=25.4/Pd
Diametral pitch	Module	Divide 25.4 by the module	Pd=25.4/m
	Circular pitch	Divide ? by the circular pitch	Pd=π/P
	Pitch diameter and number of teeth	Divided the number of teeth by pitch diameter	Pd=N/D
	Outside of gear and number of teeth	Divide number of teeth plus 2 by the outside diameter	Pd=N+2/Do
	Base pitch and pressure angle	Divide the base pitch by the cosine of the pressure angle then divide by ?	Pd=(Pb/cos.Φ)/ π
Operating diametral pitch	Center distance between 2 gears and no. of teeth in both	Add the no. of teeth in both gears and divide by 2, then divide by center distance	dp= (n1+n2/2)/C
Pressure angle	Base diam.. and pitch diam.	Divide the base diameter by the pitch diam.	cos. Φ=Db/D
	Base pitch and diametral pitch	Divide π by the diametral pitch, then divide by the base pitch	cos. Φ=Pb/(π/Pd)
	Base pitch and circular pitch	Divide the base pitch by the circular pitch= cosine pressure angle	cos. Φ=Pb/P

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Diametral PitchSpur Gears

Pitch Diameter	Number of teeth and diametral pitch	Divide the no. of teeth by the diametral pitch	D=N/Pd
	Number of teeth and outer diameter	Divide the product of the outer diam.. and number of teeth by number of teeth +2	D=NoDo/n+2
	Outside diameter and diametral pitch	Subtract from the outside diameter, the quotient of 2 divided by the diametral pitch	D=Do-2/pd
	Addendum and no. of teeth	Multiply addendum by the no. of teeth	D=a●n
	Base diameter and pressure angle	Divide the base diameter by the cosine of the pressure angle	dp=Db/cos.f
Outside Diameter	Number of teeth and diametral pitch	Divide no. of teeth plus two by the diametral pitch	Do=N+2/Pd
	Pitch diameter and diametral pitch	Add the pitch diameter to the quotient of 2 divided by the diametral pitch	Do=D+2/Pd
	Pitch diameter and number of teeth	Divide the no. of teeth plus 2 by the quotient of no. of teeth divided by the pitch diameter	Do=N+2/N/D
	Number of teeth and addendum	Multiply the no. of teeth plus 2 by addendum	Do=(N+2)a
Number of teeth	Pitch diameter and diametral pitch	Multiply pitch diameter by the diametral pitch	N=D●Pd
	Outside diameter and diametral pitch	Multiply outside diameter by the diametral pitch and subtract 2	N=Do●Pd-2
Std. thickness of tooth	Diametral pitch	Divide 1.5708 by the diametral pitch	t=1.5708/Pd

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Diametral PitchSpur Gears

Std. addendum	Diametral pitch	Divide 1 by the diametral pitch	a=1/Pd
Std. Dedendum	Diametral pitch	Divide 1.157 (or 1.25) by the diametral pitch	b=1.157/Pd
Std. whole depth	Diametral pitch	Divide 2.157 (or 2.25) by the diametral pitch	ht=2.157/Pd
Clearance	Diametral pitch	Divide .157 or (.250) by the diametral pitch	c= .157/Pd
	Thickness of tooth	Divide thickness of tooth at pitch line by 10	c=t/10
Center distance	Normal diametral pitch and no. of teeth in both gears	Add no. of teeth in both gears and divide by 2, then divide result by the normal diametral pitch	dp=((n1+n)2/2)/Pnd
Operating center distance	Operating diametral pitch and no. of teeth in both gears	Add the no. of teeth in both gears together and divide results by 2, then divide results by operating diametral pitch	dp=(n1+n2/2)/Pod
Base diameter	Pitch diameter and pressure angle	Multiply the pitch diameter by cosine of the pressure angle	Db=D●cos Φ
Base pitch	Diametral pitch and pressure angle	Divide the diametral pitch by ?, then multiply by cosine of pressure angle	Pb=cos. Φ●π/Pd

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CIRCULAR PITCH SPUR GEARS

To Get	Having	Rule	Formula
Module	Circular pitch	Divide the circular by .12368	m=P/.12368
Circular pitch	Diametral pitch	divide π by the diametral pitch	P=π/Pd
	Module	Multiply the modules by .12368	P-m*.12368
	Pitch diameter and number of teeth	Divide pitch diameter by the product of .3183 and number of teeth	P=D/0.3183 N
	Outside diameter and number of teeth	Divide outside diameter by the product of .3183 and number of teeth plus 2	P=D/0.3183 (N+2)
Pitch diameter	Number of teeth and circular pitch	The continued product of the number of teeth, the circular pitch and .3183	D=NO.3183p
	Outside diameter and circular pitch	Subtract from the outside diameter the product of the circular pitch and .6366	D=D-(0.6366p)
Outside diameter	Number of teeth and circular pitch	Divide number of teeth plus 2 by π divided by circular pitch	D_o=(N+2)+π/p
	Pitch diameter and circular pitch	Add to the pitch diameter the product of the circular pitch and .6336	D_o=D+0.6336p
Number of teeth	Pitch diameter and circular pitch	Divide the product of pitch diameter and π by the circular pitch	N=π•D/p
Circular tooth thickness	Circular pitch	One-half the circular pitch	t=p/2
Std. addendum	Circular pitch	Multiply the circular pitch by .3183	a=0.3183•p
Std. dedendum	Circular pitch	Multiply the circular pitch by .3683	b=.3683•p
whole depth (2.157/DP)	Circular pitch	Multiply circular pitch by .6366	h_1=0.6366p

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WORM GEARS

To Get	Having	Rule	Fromula
Linear pitch (circular axial)	Lead & number of threads in worm	Divide the lead by the no. of threads in worm	Px=L/Nw
Normal diametral pitch	Axial diametral pitch & worm gear helix angle	Divide the axial diametral pitch by the cosine of the worm helix angle	Pnd=Pxd/Cos.Ψ
Axial diametral pitch	Normal diametral pitch & worm helix angle	Multiply normal diametral pitch by the cosine of the worm helix angle	Pxd=PndCos.Ψ
	No. of teeth in wormwheel& pitch diameter of wormwheel	Multiply the no. of teeth in the wormwheel by pitch diameter of the wormwheel	Pxd=NG/D
Helix angle of worm	Worm pitch diameter & lead	Multiply the worm pitch kiameter by π, & divide the product by the lead. The quotient is the co-tangent of the helix angle of the worm	CoTanΨ=π•Dw/L
	Normal diametral pitch & axial diametral pitch	Divide the axial diametral pitch by the normal diametral pitch	cosΨ=Pxd/Pnd
Pitch diameter of worm	Pitch diameter of wormwheel& center distance	Subtract the pitch diameter of the wormwheel from twice the center distance	Dw=2C-DG
	Outside diameter & addendum	Subtract twice the addendum from the outside diameter	Dw=D-2α
Pitch diameter of wormwheel	Linear pitch & number of teeth	Multiply the no. of teeth in the wheel by the linear pitch of the worm, then divide by π	DG-NG•PG/π
	Pitch diameter of worm & center distance	Divide the worm pitch diameter by 2 minus the center distance, multiplied by 2	DG=C•2-Dw
Center distance between worm &wormwheel	Pitch diameter of worm &wormwheel	Add pitch diameter of worm &wormwheel, then divide the sum by 2	C=Dwt•DG/2
Addendum of worm tooth	Linear pitch & number of teeth	Multiply the pitch by 0.318	α=.3183•Px
Whole depth of worm tooth	Linear pitch & number of teeth	Multiply linear pitch by 0.6866	W=0.6866•P

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WORM GEARS

Bottom diameter of worm	Whole depth and O.D.	Subtract twice the whole depth of tooth from the outside diameter	B=0-2(WD)
End width of thread tool	Linear pitch & number of teeth	Multiply the linear pitch by .31	T=0.31•P
Throat diameter of worm wheel	Wormwheel P.D. and worm addendum	add twice the addendum of the worm tooth to the pitch diameter of the wormwheel	0”N=D•2S
Radius of worm wheel throat	Worm O.D. and addendum	Subtract the addendum of the worm tooth from half the outside diameter of the worm	U=0/2-2(ADD)
Outside diameter of worm	Pitch diameter and addendum	Add together the pitch diameter and two times and addendum	$0=D_1+2(ADD)$
Diameter of worm wheel to sharp corners	Radius of curvature face angle and throat diameter	Multiply the radius curvature of the wormwheel throat by the cosine of half the face angle. Subtract this quantity from the radius of curvature, multiply the remainder by 2. Then add the product to the worm wheel throat diameter	0=2u-ux cos A+01’
Wormwheel helix angle	worm lead and circumference of the pitch circle of worm	Divide the lead of the worm by the circumference fo the pitch circle. The result will be the tangent of the angle	$TAN (HA)=L/D_1$
Lead of worm	Linear pitch and number of threads in worm	Multiply the linear pitch by the number of threads in worm	L=Px•Nw
Worm PD	Lead and helix angle of worm	Divide the lead of worm by the tangent of the helix angle and then divide by π	$D^w=(L/tan\Psi)/\pi$
Lead of worm	Worm PD and helix angle of worm	Multiply the worm PD by π then multiply by the tangent of the helix angle	$L=D^w•\pi Tan\Psi$
No. of threads in worm	Lead and axial circular pitch	Divide the lead by the axial circular pitch	$N^w=L/P_x$
	No. of teeth in wormwheel and ratio	Divide the no. of teeth in the wormwheel by the ratio	$N^w=N_G/mG$
No of teeth in wormwheel	Ratio and no. of threads in wheel	Multiply the no. of teeth in the worm by ratio	$N_G=mG•Nw$
Ratio	No. of teeth in wormwheel and number of threads in worm	Divide the no. of teeth in the wormwheel by the no. of teeth in the worm	mG=NG/NW

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HELICAL GEARS

To Get	Having	Rule	Formula
Normal D.P.	Transverse D.P. and helix angle	Divide the transverse D.P. by the cosine of the helix angle	Pnd=Pd/cos Ψ
Transverse D.P.	Normal D.P. and helix angel	Multiply normal D.P. by the cosine of the helix angle	Pd=Pnd/cos Ψ
Normal P.A.	Transverse P.A. and helix angle of gear	Multiply the tan of the transverse P.A. by the cosine of the helix angle =IN/tan normal P.A.	tanΦtcosΨ=inv/tan Φn
Transverse P.A.	Normal P.A. and helix angle of gear	Divide the tan of NPA by the cosine of the helix angle = TAN trans. P.A.	tanΦt = tanΦn/cosΨ
Pitch diameter	No. of teeth, normal pitch and tooth angle	Divide the number of teeth by the product of the normal pitch and the cosine of the tooth angle.	D=NG/Pndcos y
Pitch diameter	No. of teach plus transverse diameter pitch	Divide the number of teeth in the gear by the transverse diametral pitch	D=N/Pd
Normal circular path	Transverse CP and helix angle	Multiply the transverse CP by the cosine of the helix angle	$Pn=P_1$ cosΨ
Lead of helical gear	Pitch circumference and helix angle	Divide the pitch circumference by the tangent of the helix angle	L=π●Dw/tanΨ
	Normal CP, no. of teeth and helix angle	Divide the product of the number of teeth times the norm. CP by the sine of the helix angle	L=N●Pn/sinΨ
Helix angle	Normal CP and transverse circular pitch	Divide thenormal CP by the transverse circular pitch; the quotient will be the cosine of the helix angle	cosΨ=Pn/Pt
	Pitch diameter plus lead	Multiply the pitch diameter by π divide the results by the lead	cosΨ=D-π/L
	Normal and trans. P.A.	Divide the tangent of the normal P.A. by the tangent of the trans. P.A. = cos HA	cosΨ=tan Φ/tanΦt
Outside diameter	Pitch diameter and addendum	Add twice the addendum to the pitch diameter	D_o=2●α+D
Center distance	Pitch diameters of both gears	Add together the pitch diameter for the two gears and divide the sum by 2	$C=(D_1+D_2)/2$

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HELICAL GEARS

Number of teeth for which to select from cutter	Number of teeth and tooth angle	Divide the number of teeth in the gear by the cube of the cosine of the tooth angle	$Nc=N/(\cos y)^3$
Lead of tooth helix	Pitch diameter and helix angle	Multiply the pitch diameter by π times the cotangent of the tooth angle	$L=\pi \bullet D \cot \Psi$
Addendum	Normal D.P. and helix	Divide 1 by the normal diametral pitch	$\alpha = 1/Pnd$
Whole depth of tooth	Normal D.P. and helix	Divide 2.157 (or 2.25) by the normal diametral pitch	$Ht=2.15/Pnd$
Normal tooth thickness at pitch line	Normal D.P. and helix	Divide 1.571 by the normal diametral pitch	$Tn=1.571/Pnd$
Operating transverse diametral pitch	No. of teeth in both gears plus operating center distance	Add the no. of teeth in both gears together, divide by two, then divide by the operating center distance	$Pod=[(N1+N2)/2]/Co$
Operating center distance	No. of teeth in both gears plus the operating transverse diametral pitch	Add the no. of teeth in both gears together, divide by two, then divide by the operating transverse diametral pitch	$Co=[(N1+N2)/2]/Pod$
No. of teeth in gear	Pitch diameter plus transverse diametral pitch	Multiply the pitch diameter by the transverse diametral pitch	$N=D \bullet Pd$
Transverse DP	Pitch diameter and no. of teeth	Divide TPD by # of teeth	$Pd=N/D$
Base diameter	Pitch diameter and trans. P.A.	Multiply the Pd by trans. PA	$Db=D \bullet \cos.\Phi t$

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INVOLUTE SPLINES AND SERRATIONS 30° PA

To Get	Having	Rule	Formula
Diametral Pitch	Outer diameter and number of teeth	Divide number of teeth plus 1 by the outer diameter	Pd=N+1/Do
Pitch diameter	Outer diameter and number of teeth	Divide the product of outer diameter and number of teeth by number of teeth plus 1	D=N•Do/N+1
Outer diameter	Diametral pitch and number of teeth	Divide the number of teeth plus 1 by the quotient of number of teeth divided by pitch diameter	Do=N+1/(N/d)
Diametral pitch	Internal diameter and number of teeth	Divide number of teeth minus 1 by the internal diameter	Pd=N-1/D
Internal diameter	Diametral pitch and number	Divide number of teeth minus 1 by	Di=N-1/Pd

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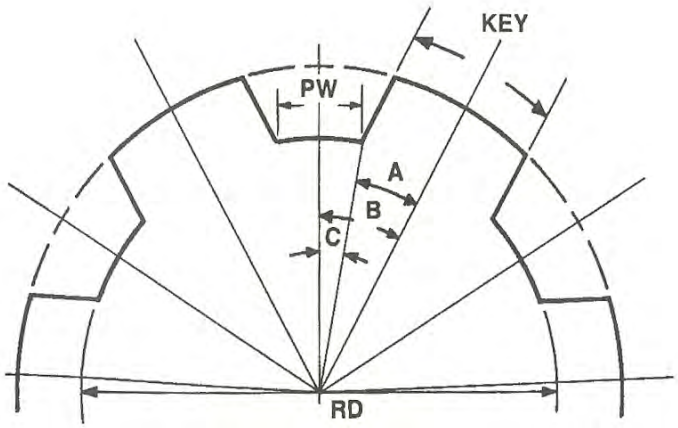
STANDARD SAE PARALLEL KEY SPLINE

No. of Keys	Space Width Internal	(A) Fit Permanent Fit		(B) Fit to Slide Not Under Load		(C) Fit to Slide Under Load		Normal Major Diameter
		WD	Minor	WD	Minor	WD	Minor	
4	0.241D	0.075D	0.850D	0.125D	0.750D			To 3"
6	0.250D	0.050D	0.900D	0.075D	0.850D	0.100D	0.800D	To 3"
10	0.156D	0.045D	0.910D	0.070D	0.860D	0.095D	0.810D	To 6"
13	0.098D	0.045D	0.910D	0.070D	0.860D	0.095D	0.810D	To 6"



N= # of Keys

B=180°/N

SIN A= KW/RD

C= B-A

PW= RD X SIN "C"

N=6

KW= .371

RD= 1.271

B= 180/6= 30°

SIN "A"= .2919

A= 16.97151°

C= 13.02849

SIN "C"= .22543

W= 1.271•.22543

PW= .2865

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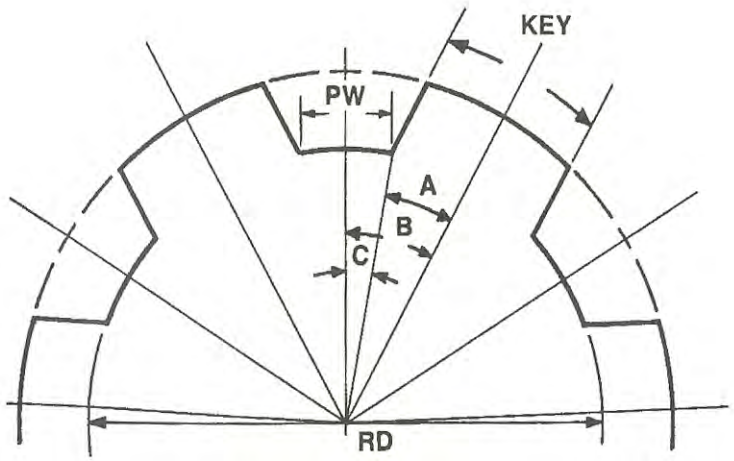
POINT WIDTH CONVERSION FORSTRAIGHT SIDED SPLINE



N= # of Keys	RD= 1.271
B=180°/N	B= 180/6= 30°
SIN A= KW/RD	SIN “A”= .2919
C= B-A	A= 16.97151°
PW= RD X SIN “C”	C= 13.02849
N=6	SIN “C”= .22543
KW= .371	W= 1.271•.22543
	PW= .2865

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GEAR TOOTH VERNIERS

The gear tooth vernier is made to measure the Chordal thickness of the gear teeth at the pitch line. Allowance may be made for any error in blank size by adjusting the height vernier.

Key

A = Addendum
C= Correction
B= Corrected Addendum
T= Chordal Thickness

Example

Height Setting = Addendum of gear + Correction(C)
= Addendum of gear + .0294/4
= Addendum of gear + .007

Thickness Setting = T/ Diametral Pitch
= 1.5694/4 = .392

Height setting for internal gear (of low pressure angle) = addendum of gear.

Height setting for internal slotting cutter =dedendum of gear.

Height setting for rotary spur cutter =dedendum of gear- correction

Height setting for end milling cutter = dedendum of gear- correction.

Height setting for hob and fly hob = dedendum of gear + correction.

Height setting for gear shaper cutter = dedendum of gear + correction.

Height setting for rack type generating cutter = dedendum of gear.

Chart for obtaining correct addendum "B", and chordal thickness "T". This chart is based on 1 D.P.; for any other D.P. divide these values by the desired D.P. (for circular pitch multiply by C.P. over π)

# of Teeth	Thickness	Correction	# of Teeth	Thickness	Correction
6	1.533	0.1022	28	1.57	0.0220
7	1.5568	0.0873	29	1.57	0.0213
8	1.5607	0.0769	30	1.5701	0.0208
9	1.5628	0.0684	32	1.5702	0.0193
10	1.5643	0.0616	34	1.5702	0.0181
11	1.5654	0.0559	36	1.5703	0.0171
12	1.5663	0.0514	38	1.5704	0.0162
13	1.567	0.0474	40	1.5704	0.0154
14	1.5675	0.0440	43	1.5702	0.0143
15	1.5679	0.0411	46	1.5705	0.0134
16	1.5683	0.0385	50	1.5706	0.0123
17	1.5686	0.0362	55	1.5706	0.0112
18	1.5688	0.0342	60	1.5707	0.0102
19	1.569	0.0324	68	1.5707	0.0091
20	1.5692	0.0308	75	1.5707	0.0083
21	1.5694	0.0294	86	1.5707	0.0072
22	1.5695	0.0281	100	1.5707	0.0061
23	1.5696	0.0268	125	1.5707	0.0049
24	1.5697	0.0257	150	1.5708	0.0045
25	1.5698	0.0247	200	1.5708	0.0035
26	1.5698	0.0237	250	1.5708	0.0025
27	1.5699	0.0228	RACK	1.5708	0.0000

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CHORDAL THICKNESS AND CHORDAL ADDENDUM OF GEAR TEETH

This table is for spur gears of one diametral pitch. For any other diametral pitch, divide the given value by the desired pitch. The table lists the chordal thickness at the pitch circle when the addendum is standard for full-depth teeth or equal to 1 divided by the diametral pitch.

# of Teeth	Chordal Thickness	Chordal Addendum	# of Teeth	Chordal Thickness	Chordal Addendum	# of Teeth	Chordal Thickness	Chordal Addendum
10	1.56434	1.06156	59	1.57051	1.01046	108	1.57074	1.00570
11	1.56546	1.05598	60	1.57062	1.01029	109	1.57075	1.00565
12	1.56631	1.05133	61	1.57062	1.01011	110	1.57075	1.00560
13	1.56698	1.04739	62	1.57063	1.00994	111	1.57075	1.00556
14	1.56750	1.0441	63	1.57063	1.00978	112	1.57075	1.00551
15	1.56794	1.04109	64	1.57064	1.00963	113	1.57075	1.00546
16	1.56827	1.03852	65	1.57064	1.00947	114	1.57075	1.00541
17	1.56856	1.03625	66	1.57065	1.00933	115	1.57075	1.00537
18	1.56880	1.03425	67	1.57065	1.00920	116	1.57075	1.00533
19	1.56901	1.03244	68	1.57066	1.00907	117	1.57075	1.00529
20	1.56918	1.03083	69	1.57066	1.00893	118	1.57075	1.00524
21	1.56933	1.02936	70	1.57067	1.00880	119	1.57075	1.00519
22	1.56946	1.02803	71	1.57067	1.00867	120	1.57075	1.00515
23	1.56958	1.02681	72	1.57067	1.00855	121	1.57075	1.00511
24	1.56967	1.02569	73	1.57068	1.00843	122	1.57075	1.00507
25	1.56977	1.02466	74	1.57068	1.00832	123	1.57076	1.00503
26	1.5684	1.02371	75	1.57068	1.00821	124	1.57076	1.00499
27	1.56991	1.02284	76	1.57069	1.00810	125	1.57076	1.00495
28	1.56998	1.02202	77	1.57069	1.00799	126	1.57076	1.00491
29	1.57003	1.02127	78	1.57069	1.00789	127	1.57076	1.00487
30	1.57008	1.02055	79	1.57069	1.00780	128	1.57076	1.00483
31	1.57012	1.01990	80	1.57070	1.00772	129	1.57076	1.00479
32	1.57016	1.01926	81	1.57070	1.00762	130	1.57076	1.00475
33	1.57019	1.01869	82	1.57070	1.00752	131	1.57076	1.00472
34	1.57024	1.01813	83	1.57070	1.00743	132	1.57076	1.00469
35	1.57027	1.01762	84	1.57071	1.00734	133	1.57076	1.00466
36	1.57030	1.01714	85	1.57071	1.00725	134	1.57076	1.00462
37	1.57032	1.01667	86	1.57071	1.00716	135	1.57076	1.00457
38	1.57035	1.01623	87	1.57071	1.00708	136	1.57076	1.00454
39	1.57037	1.01582	88	1.57071	1.00700	137	1.57076	1.00451
40	1.57039	1.01542	89	1.57072	1.00693	138	1.57076	1.00447
41	1.57041	1.01504	90	1.57072	1.00689	139	1.57076	1.00444
42	1.57043	1.01469	91	1.57072	1.00679	140	1.57076	1.00441
43	1.57045	1.01434	92	1.57072	1.00672	141	1.57076	1.00439
44	1.57047	1.01402	93	1.57072	1.00665	142	1.57076	1.00435
45	1.57048	1.01370	94	1.57072	1.00658	143	1.57076	1.00432
46	1.57050	1.01341	95	1.57073	1.00651	144	1.57076	1.00429
47	1.57051	1.01311	96	1.57073	1.00644	145	1.57077	1.00425
48	1.57052	1.01285	97	1.57073	1.00637	146	1.57077	1.00422
49	1.57053	1.01258	98	1.57073	1.00630	147	1.57077	1.00419
50	1.57054	1.01233	99	1.57073	1.00623	148	1.57077	1.00416
51	1.57055	1.01209	100	1.57073	1.00617	149	1.57077	1.00413
52	1.57056	1.01187	101	1.57074	1.00611	150	1.57077	1.00411
53	1.57057	1.01165	102	1.57074	1.00505	151	1.57077	1.00409
54	1.57058	1.01143	103	1.57074	1.00599	152	1.57077	1.00407
55	1.57058	1.01121	104	1.57074	1.00593	153	1.57077	1.00405
56	1.57059	1.01102	105	1.57074	1.00587	154	1.57077	1.00402
57	1.57060	1.01083	106	1.57074	1.00581	155	1.57077	1.00400
58	1.57061	1.01064	107	1.57074	1.00575	156	1.57077	1.00397

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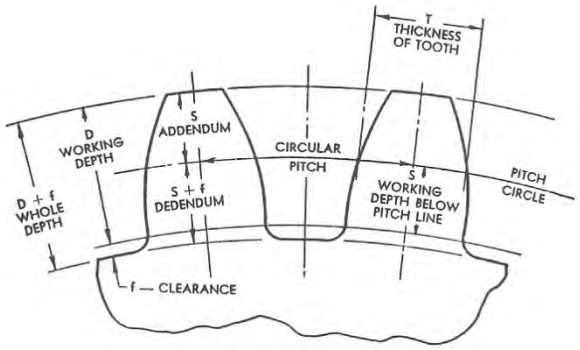
METHOD OF PRODUCING STUB DEPTH GEAR AND SPLINES

To produce a stub tooth gear, standard or nonstandard, certain information is required: Diametral pitch, pressure angle, major diameter, minor diameter, number of teeth, and circular tooth thickness, (space width of internals).

FOR EXAMPLE:
10 D.P., 20° P.A., 30 Teeth, 3.1" O.D., 2.768" R.D., 0.15708" Tooth thickness, 0.1657" D&F.
At first glance the gear tooth appears stubby, but a standard cutter can produce this part. The O.D. of this gear has been reduced, (standard O.D. is 32"). The difference between the standard O.D. and our O.D. is 10" or .05 on one side. That difference plus the D&F of the gear, (.1657") is .2157". Therefore a standard finishing cutter would work. In cases when the tooth thickness is nonstandard, a standard cutter can be modified by top=grinding to produce the correct stub tooth.



FOR EXAMPLE:
Same part as above, except the tooth thickness is .1520". The most accurate way to determine the amount to remove from the tool is to first cut a sample to measurement over pins. This will give us the tooth thickness we need. Remove the difference of root diameter produced and root diameter desired from the O.D. of the tool. This can also be determined with nearly the same accuracy without cutting a sample by dividing the difference of desired tooth thickness and standard tooth thickness by the tangent of the pressure angle. Reduce the O.D. of the tool by this amount.

FOR EXAMPLE:
.15708"- .1520"= .0051/ TAN P.A. = .0140"..0140"= Amount of Reduction

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THE INVERSE OF THE INVOLUTE FUNCTION

Given the involute of an angle, there is no simple formula for finding that angle. If you have involute tables, the inverse of the involute can be found by interpolating between known values, if needed. Without the benefit of tables, the pursuit of the angle can be achieved with a calculator, the most practical solution is to guess based on this brief table.

Remember you have involute (Inv θ) you want θ.

Θ is the Greek letter Theta often used for a given angle

Θ IN DEGREES	INV. Θ
0	0
5	0.00022
10	0.00179
14.5	0.00554
17.5	0.00987
20	0.01490
22.5	0.02151
25	0.02998
30	0.05375
35	0.08934
40	0.14097
45	0.21460
50	0.31909
55	0.46821
60	0.68585

1. **Inv (θ) = Tangent θ- (θ•π/180)**
2. **The function makes sense only from a range of 0° up to 89°. You should arrive at θ=140° for example.**
3. **The involute is a steadily increasing function; that is, the higher the angle, the higher the involute and vice versa.**

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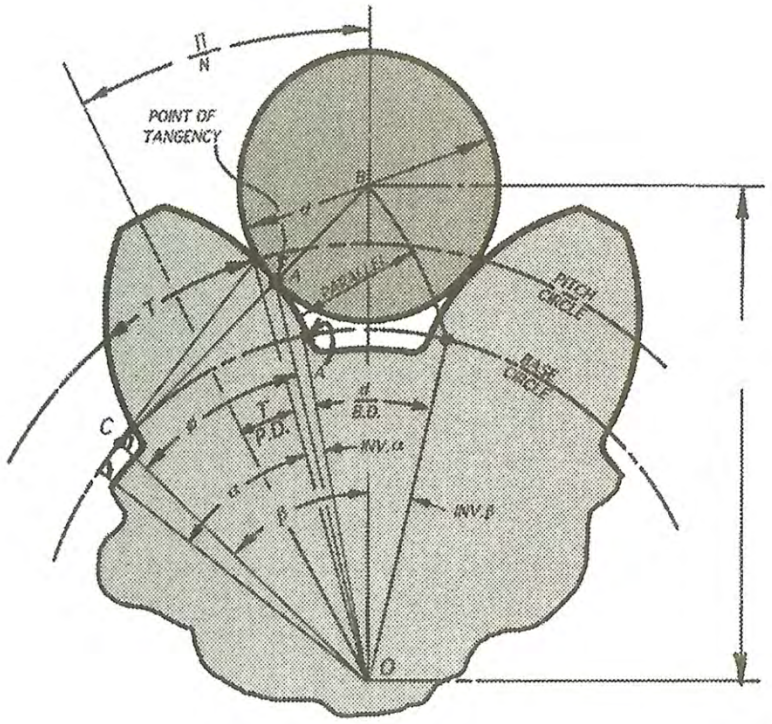
EXTERNAL SPUR GEARS –Determining Dimensions Over Pins

TO GET	HAVING	RULE	FORMULA
N	Number of teeth	Given	35
DP	Diametral pitch	Given	10
A	Pressure angle	Given	20
T	Arc tooth thickness	Given	0.15500
d	Pin diameter	Given	0.17280
PD	Pitch diameter N/Dp	Given	3.50000
BD	Base diameter	PD•COS(α)	3.28892
A		t/PD	0.04429
D		d/BD	0.05254
E		π/N	0.08976
INV α	Involute function of α	TAN(α)- [α(π/180)]	0.01490
INVβ	Involute function of β	A+D+INV α-E	0.02197
β	Pressure angle to pin center	see tables (pages G14)	22.65108
CC	Twice the center distance of pin and gear	BD/COS(α)	3.56381
DE	Dimension over pins even # of teeth	CC+d	**********
DO	Dimension over pins odd # of teeth	COS(90/N)•CC+d	3.73302
Φ	Pressure angle to point of tangency	TAN(Φ)=TAN(α)-D	0.04026
RT	Radius to point tangency	R BD/[2•COS(Φ)]	1.75045



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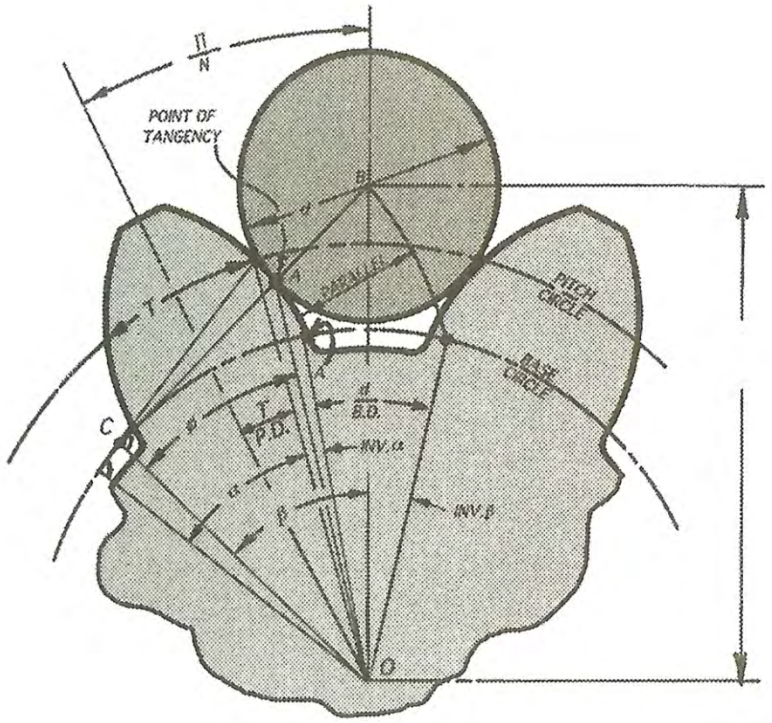
EXTERNAL SPUR GEARS –Determining Arc Tooth Thickness Given Dimensions Over Pins

TO GET	HAVING	RULE	FORMULA
N	Number of teeth	Given	50
DP	Diametral pitch	Given	8
α	Pressure angle	Given	20
d	Pin diameter	Given	0.21144
DE	Dimension over pins even # of teeth	Given	6.53345
DO	Dimension over pins odd # of teeth	Given	**********
PD	Pitch diameter	N/DP	6.25000
BD	Base diameter	PD•COS(α)	5.87308
CE	Twice the center distance of pin and gear even # of teeth	DE-d	6.32201
CO	Twice the center distance of pin and gear odd # of teeth	(DO-d)/COS(90/N)	**********
β	Pressure angle to pin center	COS(β)=BD/CE or CO	21.72221
INVβ	Involute function of β	TAN(β)-[β(π/180)]	0.01927
E		π/N	0.06283
D		d/BD	0.03600
INVα	Involute function of α	TAN(α)-[α(π/180)]	0.01490
t	Arc tooth thickness	PD(E+INVβ-INVα-D)	0.19500



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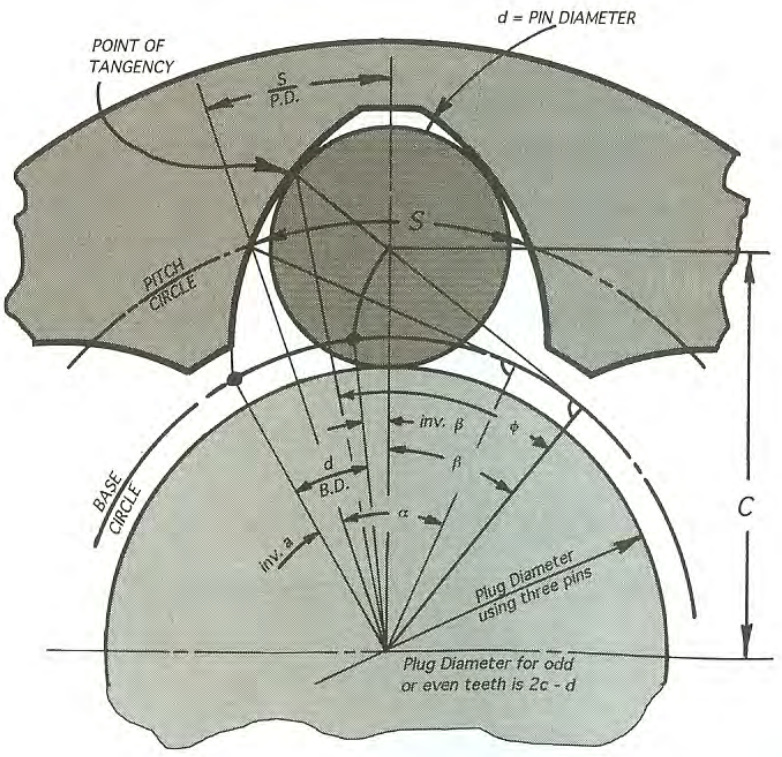
INTERNAL SPUR GEARS - DeterminingDimensions Under Pins

TO GET	HAVING	RULE	FORMULA
N	Number of teeth	Given	12
DP	Diametral pitch	Given	24
α	Pressure angle	Given	14.5
s	Arc space width	Given	0.06800
d	Pin diameter	Given	0.06701
PD	Pitch diameter	N/DP	0.50000
BD	Base diameter	PD•COS(α)	0.48407
A		s/PD	0.13600
D		d/BD	0.13843
INV α	Involute function of α	TAN(α)-[α(π/180)]	0.00554
INVβ	Involute function of β	A+INV α-D	0.00312
β	Pressure angle to pin center	see tables page (G14)	11.00809
CC	Twice the center distance of pin and gear	BD/COS(β)	0.49488
DE	Dimension under pins even # of teeth	CC-d	0.42787
DO	Dimension under pins odd # of teeth	CC•COS(90/N)-d	********** *
Φ	Pressure angle to point of tangency	TAN(Φ)=TAN(β)+D	19.33857
RT	Radius to point of tangency	BD/[2•COS(Φ)]	0.25651



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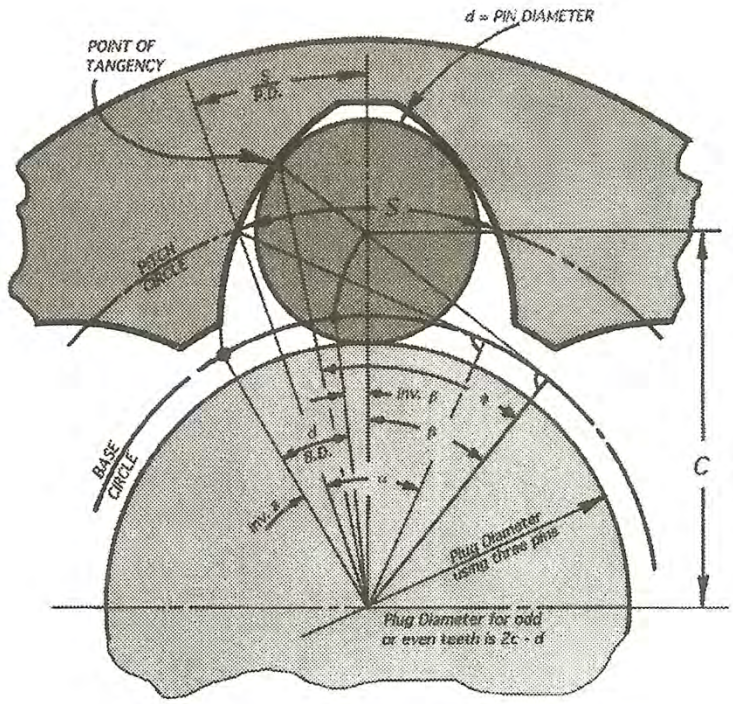
INTERNAL SPUR GEARS - Determining Arc Space Width Given Dimensions Under Pins

TO GET	HAVING	RULE	FORMULA
N	Number of teeth	Given	44
DP	Diametral pitch	Given	24
α	Pressure angle	Given	14.5
d	Pin diameter	Given	0.06701
DE	Dimension under pins even # of teeth	Given	1.76152
DO	Dimension under pins odd # of teeth	Given	**********
PD	Pitch diameter	N/DP	1.83333
BD	Base diameter	PD•COS(α)	1.77494
CE	Twice the center distance of pin and gear even # of teeth	DE+d	1.82853
CO	Twice the center distance of pin and gear odd # of teeth	(DO+d)/COS(90/N)	**********
β	Pressure angle to pin center	COS(β)=BD/CE or CO	13.90611
INVβ	Involute function of β	TAN(β)-[β(π/180)]	0.00488
D		d/BD	0.03775
INV α	Involute function of α	TAN(α)-[α(π/180)]	0.00554
s	Arc space width	PD(INV β+D-INV α)	0.06800



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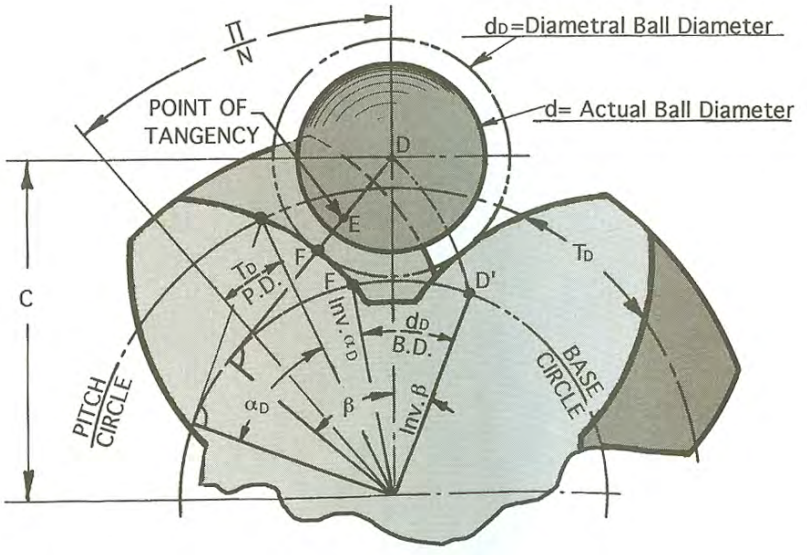
EXTERNAL HELICAL GEARS- DeterminingDimensions Over Pins or Balls

TO GET	HAVING	RULE	FORMULA
N	Number of teeth	Given	50
DP	Diametral pitch	Given	10
h	Pitch helix angle	Given	31.5
αn	Normal pressure angle	Given	30
tn	Normal arc tooth thickness	Given	0.15440
DP	Pin diameter	Given	0.17280
αd	Transverse pressure angle	TAN(αn)=TAN(αn)/COS(h)	34.10320
td	Transverse arc tooth thickness	tn/COS(h)	0.18108
H	Base helix angle	TAN(H)=TAN(h)•COScd	26.90400
dD	Transverse pin diameter	d/COS(H)	0.19377
PD	Pitch diameter	N/[DP•COS(h)]	5.86414
BD	Base diameter	PD•COS(αd)	4.85568
INVαd	Involute function of αD	TAN(αD)-[αD(π/180)]	0.08192
A		td/PD	0.03088
D		dD/BD	0.03991
E		π/N	0.06283
INVβ	Involute function of β	A+D+INV αd-E	0.08987
Φ	Pressure angle to pin center	See tables (page G14)	35.06197
CC	Twice the center distance	BD/COS(β)	5.93218
DE	Dimension over pins even # of teeth	CC+d	6.10498



TO GET	HAVING	RULE	FORMULA
DO	Dimension over pins odd # of teeth	COS(90/N)•CC+d	**********
Φ	Pressure angle to point of tangency	TAN(Φ)=TAN(β)-[d•COS(H)/BD]	33.82546
RT	Radius to point of tangency	BD/[2•COS(Φ)]	2.92251

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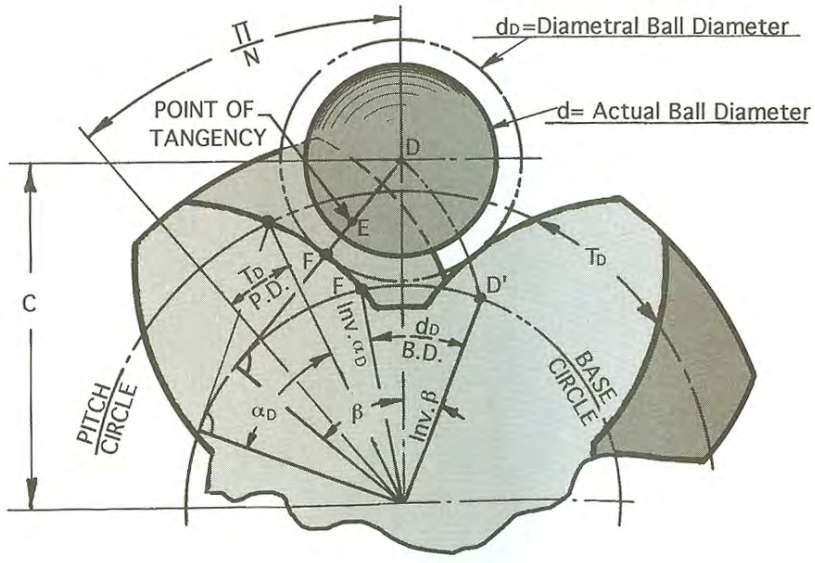
EXTERNAL HELICAL GEARS- Determining Tooth Thickness of External Helical Gear With Dimension Over Pins or Balls

TO GET	HAVING	RULE	FORMULA
N	Number of teeth	Given	31
DP	Normal diametral pitch	Given	11
	Normal pressure angle	Given	25
h	Pitch helix angle	Given	45
d	Pin diameter	Given	0.15709
DE	Dimension over pins even # of teeth	Given	
DO	Dimension over pins odd # of teeth	Given	4.07900
αd	Transverse pressure angle	TAN(αn)=TAN(αn)/COS(h)	33.40320
H	Base helix angle	TAN (H)= TAN (h) •COSαd	39.85571
dD	Transverse pin diameter	d/COS(H)	0.20463
PD	Pitch diameter	N/[DP•COS(h)]	3.98551
BD	Base diameter	PD•COS(αd)	3.32717
CE	Twice the center distance of pin and gear even # of teeth	DE-d	**********
CO	Twice the center distance of pin and gear odd # of teeth	(DO-d)/COS(90/N)	3.92695
β	Pressure angle to pin center	COS(β)=BD/CE or CO	32.08442
INVβ	Involute function of β	TAN(β)-[β(π/180)]	0.06694
INVαd	Involute function of αd	TAN(αd)-[αd(π/180)]	0.07646



TO GET	HAVING	RULE	FORMULA
E		π/N	0.10134
D		dD/BD	0.06150
td	Transverse arc tooth thickness	PD•(E+INVβ-INVαd-D)	0.12082
tn	Normal arc tooth thickness	td/COS(h)	0.08544

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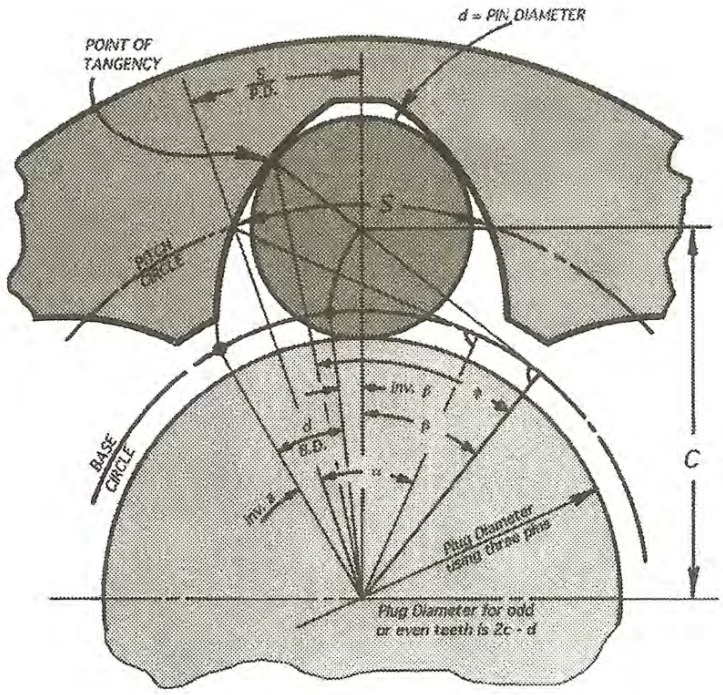
INTERNAL HELICAL GEARS - Determining Dimension Under Pins or Balls

TO GET	HAVING	RULE	FORMULA
N	Number of teeth	Given	16
DP	Normal diametral pitch	Given	6
h	Pitch helix angle	Given	12.16370
αn	Normal pressure angle	Given	25
sn	Normal arc space width	Given	0.26220
d	Ball diameter	Given	0.24000
αd	Transverse pressure angle	TAN(αd)=TAN(αn)/COS(h)	25.50193
sd	Transverse arc space width	sn/COS(h)	0.26822
H	Base helix angle	TAN(H)=TAN(h)●COSαd	11.00905
dD	Transverse ball diameter	d/COS(H)	0.24450
PD	Pitch diameter	N/[DP●COS(h)]	2.72791
Bd	Base Diameter	PD●COS(αD)	2.46213
INVαd	Involute function of aD	TAN(αD)-[αD(π/180)]	0.03192
A		sd/PD	0.09833
D		dD/BD	0.09930
INVβ	Involute function of β	A+INVαd-D	0.03095
β	Pressure angle to ball center	See tables	25.25264
CC	Twice the center distance of ball and gear	DB/COS(β)	2.72229
DE	Dimension under balls even # of teeth	CC-d	2.18229
DO	Dimension under balls odd # of teeth	CC●COS(90/N)-d	********
Φ	Pressure angle to point of tangency	TAN(Φ)=TAN(β)+[d●COS(H)/BD]	29.56926
RT	Radius to point of tangency	BD/[2●COS(Φ)]	1.41541



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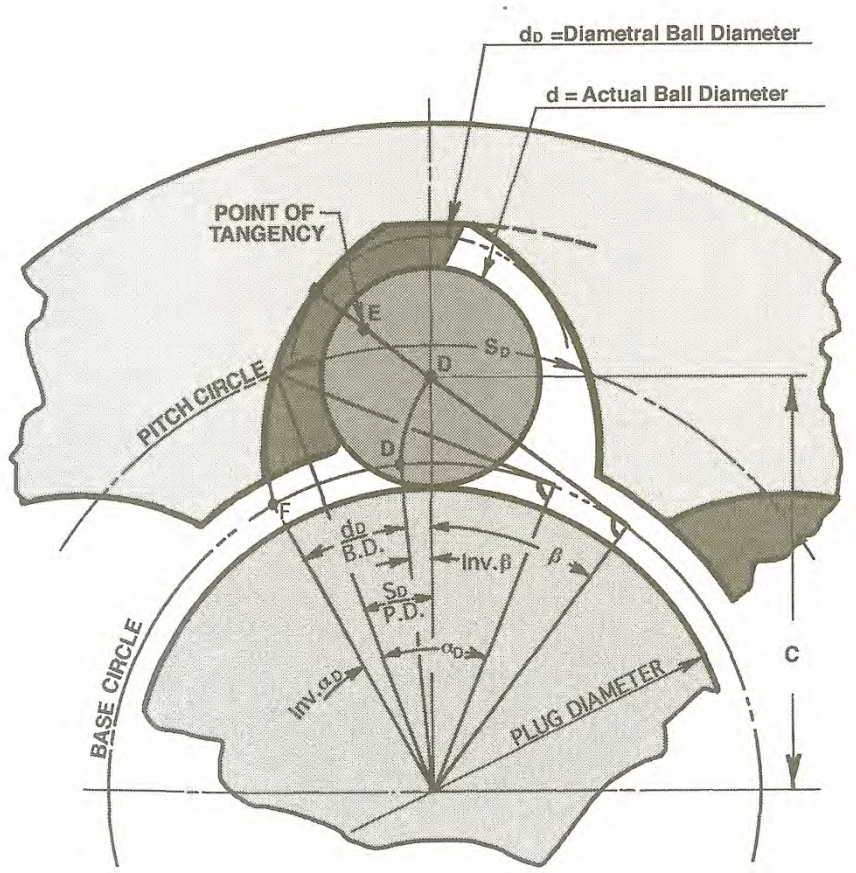
INTERNAL HELICAL GEARS - Determining Space Thickness Given Dimensions Under Pins or Balls

TO GET	HAVING	RULE	FORMULA
N	Number of teeth	Given	60
DP	Normal diametral pitch	Given	24
αn	Normal pressure angle	Given	22.5
h	Pitch helix angle	Given	7.50000
d	Ball diameter	Given	0.07377
DE	Dimension under balls even # of teeth	Given	2.41200
DO	Dimension under balls odd # of teeth	Given	*******
αd	Transverse pressure angle	TAN(αn)=TAN(αn)/COS (h)	22.67458
H	Base helix angle	TAN(H)=TAN(h)•COSαd	6.92618
dD	Transverse ball diameter	d/COS(H)	0.07431
PD	Pitch diameter	N/[DP•COS(h)]	2.52157
BD	Base diameter	PD•COS(αd)	2.32668
CE	Twice the center distance of ball and gear even # of teeth	DE+d	2.48577
CO	Twice the center distance of ball and gear odd # of teeth	(DO+d)/COS(90/N)	*******
β	Pressure angle to ball center	COS(β)=BD/CE or CO	20.60986
INVβ	Involute function of β	TAN(β)-[β(p/180)]	0.01636
INVαd	Involute function of αd	TAN(αd)-[αd(p/180)]	0.02204
D		dD/BD	0.03194
sd	Transverse arc space width	PD•(INVβ+DINVαd)	0.06621
sn	Normal arc space width	sd•COS(h)	0.06565



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SPAN MEASURMENTS 14-1/2º PA

Divide "W" measurement by actual D.P. for measuring standard tooth thickness. If tooth thickness is above or below standard, multiply the difference from standard tooth width by cosine of the pressure angle to obtain in change in "W" dimension.

N	T	W	N	T	W	N	T	W	N	T	W
10	2	4.6160	42	4	10.8708	74	7	20.1672	106	10	29.4635
11	2	4.6213	43	4	10.8762	75	7	20.1725	107	10	29.4689
12	2		44	4	10.8815	76	7	20.1779	108	10	29.4743
13	2	4.6321	45	5	13.9284	77	7	20.1833	109	10	29.4796
14	2	4.6374	46	5	13.9338	78	7	20.1886	110	10	29.4850
15	2	4.6428	47	5	13.9392	79	7	20.1940	111	10	29.4904
16	2	4.6482	48	5	13.9445	80	7	20.1994	112	10	29.4957
17	2	4.6536	49	5	13.9499	81	8	23.2463	113	10	29.5011
18	2	4.6589	50	5	13.9553	82	8	23.2516	114	10	29.5065
19	2	4.6643	51	5	13.9606	83	8	23.2570	115	10	29.5118
20	2	4.6697	52	5	13.9660	84	8	23.2624	116	10	29.5172
21	3	7.7166	53	5	13.9714	85	8	23.2677	117	10	29.5226
22	3	7.7219	54	5	13.9768	86	8	23.2731	118	11	32.5695
23	3	7.7273	55	5	13.9821	87	8	23.2785	119	11	32.5748
24	3	7.7327	56	5	13.9875	88	8	23.2839	120	11	32.5802
25	3	7.7380	57	6	17.0344	89	8	23.2892			
26	3	7.7334	58	6	17.0398	90	8	23.2946			
27	3	7.7488	59	6	17.0451	91	8	23.3000			
28	3	7.7541	60	6	17.0505	92	8	23.3053			
29	3	7.7595	61	6	17.0559	93	8	23.3107			
30	3	7.7649	62	6	17.0612	94	9	26.3576			
31	3	7.7702	63	6	17.0666	95	9	26.3630			
32	3	7.7756	64	6	17.0720	96	9	26.3683			
33	4	10.82250	65	6	17.0773	97	9	26.3737			
34	4	10.8279	66	6	17.0827	98	9	26.3791			
35	4	10.8332	67	6	17.0881	99	9	26.3844			
36	4	10.8386	68	6	17.0934	100	9	26.3898			
37	4	10.8440	69	4	20.1403	101	9	26.3952			
38	4	10.8493	70	7	20.1457	102	9	26.4005			
39	4	10.8547	71	7	20.1511	103	9	26.4059			
40	4	10.8601	72	7	20.1564	104	9	26.4113			
41	4	10.8654	73	7	20.1618	105	9	26.4166			

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SPAN MEASUREMENTS 20º PA

N	T	W	N	T	W	N	T	W	N	T	W
8	2	4.5402	40	5	13.8448	72	9	26.1015	104	13	38.3580
9	2	4.5543	41	6	16.8110	73	9	26.1155	105	13	38.3720
10	2	4.5683	42	6	16.8250	74	9	26.1295	106	13	38.3860
11	2	4.5823	43	6	16.8390	75	9	26.1435	107	13	38.4002
12	2	4.5963	44	6	16.8530	76	9	26.1575	108	13	38.4142
13	2	4.6103	45	6	16.8670	77	10	29.1237	109	13	38.4283
14	2	4.6243	46	6	16.8810	78	10	29.1377	110	13	38.4423
15	2	4.6383	47	6	16.8950	79	10	29.1517	111	13	38.4563
16	3	7.6044	48	6	16.9090	80	10	29.1657	112	13	38.4703
17	3	7.6184	49	6	16.9230	81	10	29.1790	113	14	41.4364
18	3	7.6324	50	7	19.8891	82	10	29.1900	114	14	41.4504
19	3	7.6464	51	7	19.9031	83	10	29.2000	115	14	41.4544
20	3	7.6604	52	7	19.9171	84	10	29.2200	116	14	41.4784
21	3	7.6744	53	7	19.9312	85	10	29.2300	117	14	41.4924
22	3	7.6885	54	7	19.9452	86	11	32.2010	118	14	41.5064
23	3	7.7025	55	7	19.9592	87	11	32.2150	119	14	41.5204
24	4	10.6686	56	7	19.9732	88	11	32.2290	120	14	41.5344
25	4	10.6826	57	7	19.9872	89	11	32.2430			
26	4	10.6968	58	7	20.0012	90	11	32.2570			
27	4	10.7106	59	8	22.9673	91	11	32.2710			
28	4	10.7246	60	8	22.9813	92	11	32.2850			
29	4	10.7386	61	8	22.9953	93	11	32.2990			
30	4	10.7526	62	8	23.0093	94	11	32.3130			
31	4	10.7666	63	8	23.0233	95	12	35.2800			
32	4	10.7806	64	8	23.0373	96	12	35.2940			
33	5	13.7468	65	8	23.0514	97	12	35.3080			
34	5	13.7608	66	8	23.0654	98	12	35.3220			
35	5	13.7748	67	8	23.0794	99	12	35.3360			
36	5	13.7888	68	9	26.0455	100	12	35.3500			
37	5	13.8028	69	9	26.0595	101	12	35.3640			
38	5	13.8188	70	9	26.0735	102	12	35.3780			
39	5	13.8308	71	9	26.0875	103	12	35.3920			

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SPAN MEASUREMENTS 25º PA

N	T	W	N	T	W	N	T	W
10	2	4.5425	42	7	16.8009	74	11	31.9065
11	2	4.5697	43	7	16.8281	75	11	31.9336
12	2	4.5969	44	7	19.7025	76	11	31.9608
13	2	4.6240	45	7	19.7296	77	11	31.9880
14	2	4.6512	46	7	19.7568	78	11	32.0151
15	2	7.5256	47	7	19.7840	79	11	32.0423
16	2	7.5528	48	7	19.8111	80	12	32.9167
17	2	7.5800	49	7	19.8383	81	12	34.9439
18	3	7.6071	50	7	19.8655	82	12	34.9711
19	3	7.6343	51	8	22.7399	83	12	34.9982
20	3	7.6615	52	8	22.7671	84	12	35.0254
21	3	7.6886	53	8	22.7942	85	12	35.0526
22	4	10.5630	54	9	22.8214	86	12	35.0797
23	4	10.5902	55	9	22.8486	87	13	37.9541
24	4	10.6174	56	9	22.8757	88	13	37.9813
25	4	10.6445	57	9	22.9029	89	13	38.0085
26	4	10.6717	58	9	25.7773	90	13	38.0356
27	4	10.6989	59	9	25.8045	91	13	38.0228
28	4	10.7260	60	9	25.8316	92	13	38.0900
29	5	13.6005	61	10	25.8588	93	13	38.1171
30	13	13.6276	62	10	25.8860	94	14	40.9916
31	13	13.6548	63	10	25.9131	95	14	41.0187
32	13	13.6820	64	9	25.9403	96	14	14.0459
33	13	13.7091	65	10	28.8147	97	14	14.0731
34	6	13.7363	66	10	28.8419	98	14	41.1002
35	6	13.7635	67	10	28.8691	99	14	41.1274
36	6	16.6379	68	10	28.8962			
37	6	16.6620	69	10	28.9234			
38	6	16.6922	70	10	28.9506			
39	6	16.7194	71	10	28.9777			
40	6	16.7465	72	11	31.8521			
41	7	16.7737	73	11	31.8793			

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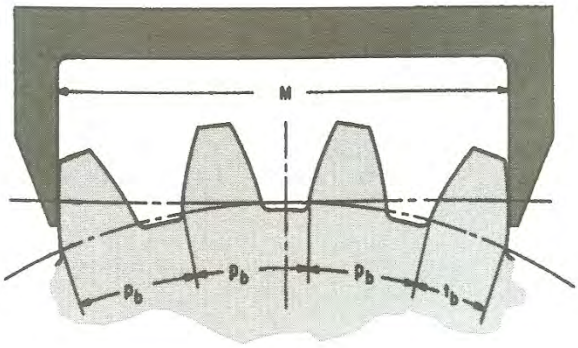
SPAN MEASUREMENTS 30º PA

Inspection of Tooth Thickness by Means of a Span Measurement.



The limitations of span measurement are:

1) Span measurement cannot be applied when a combination of helix angle and narrow face width prevent the caliper from spanning a sufficient number of teeth.

2) Readings are influenced by errors in base pitch, tooth profile, and lead. Readings would be erroneous if attempted on a portion of profile, which had been modified from true involute shape.

N	T	W	N	T	W
6	2	4.3604	29	6	16.3138
7	2	4.4069	30	6	16.3604
8	2	4.4534	31	6	16.4069
9	2	4.5000	32	6	16.4534
10	2	4.5465	33	6	16.5000
11	3	7.3138	34	6	16.5465
12	3	7.3604	35	7	19.3138
13	3	7.4069	36	7	19.3604
14	3	7.4534	37	7	19.4069
15	3	7.5000	38	7	19.4534
16	3	7.5465	39	7	19.5000
17	4	10.3138	40	7	19.5465
18	4	10.3604	41	8	22.3138
19	4	10.4069	42	8	22.3604
20	4	10.4534	43	8	22.4069
21	4	10.5000	44	8	22.4534
22	4	10.5464	45	8	22.5000
23	5	13.3168	46	9	25.2671
24	5	13.3604	47	9	25.3138
25	5	13.4069	48	9	25.3604
26	5	13.4534	49	9	25.4069
27	5	13.5000	50	9	25.4534
28	5	13.5464			

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STANDARD TOOTH DIMENSIONS
Tooth Chart – 2.157/DP System DP

Diam. Pitch	CP	Tooth Thickness	Addendum	Dedendum	Whole Depth
1	3.1416	1.5708	1.0000	1.1571	2.1571
1 1/4	2.5133	1.2567	0.8000	0.9257	1.7257
1 1/2	2.0944	1.0472	0.6667	0.7714	1.4381
1 3/4	1.7952	0.8976	0.5714	0.6612	1.2326
2	1.5708	0.7854	0.5000	0.5786	1.0786
2 1/4	1.3963	0.6985	0.4444	0.5143	0.9587
2 1/2	1.2566	0.6283	0.4000	0.4628	0.8628
2 3/4	1.1424	0.5712	0.3636	0.4208	0.7844
3	1.0472	0.5236	0.3333	0.3857	0.7190
3 1/2	0.8976	0.4488	0.2857	0.3306	0.6163
4	0.7854	0.3927	0.2500	0.2893	0.5393
5	0.6283	0.3141	0.2000	0.2314	0.4314
6	0.5236	0.2618	0.1667	0.1929	0.3595
7	0.4488	0.2244	0.1429	0.1653	0.3082
8	0.3927	0.1963	0.1250	0.1446	0.2696
9	0.3491	0.1745	0.1111	0.1286	0.2397
10	0.3142	0.1570	0.1000	0.1157	0.2157
11	0.2856	0.1428	0.0909	0.1052	0.1961
12	0.2618	0.1309	0.0833	0.0964	0.1796
13	0.2417	0.1208	0.0769	0.0890	0.1659
14	0.2244	0.4422	0.0714	0.0827	0.1541
15	0.2094	0.1047	0.0667	0.0771	0.1438
16	0.1963	0.0982	0.0625	0.0723	0.1348
17	0.1848	0.0924	0.0588	0.0681	0.1269
18	0.1745	0.0873	0.0556	0.0643	0.1198
19	0.1653	0.0827	0.0526	0.0609	0.1135

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STANDARD TOOTH DIMENSIONS
Tooth Chart – 2.25/DP System DP

Diam. Pitch	CP	Tooth Thickness	Addendum	Dedendum	Whole Depth
1	3.1416	1.5708	1.0000	1.1571	2.2500
1 1/4	2.5133	1.2567	0.8000	0.9257	1.8000
1 1/2	2.0944	1.0472	0.6667	0.7714	1.5000
1 3/4	1.7952	0.8976	0.5714	0.6612	1.2857
2	1.5708	0.7854	0.5000	0.6250	1.1250
2 1/4	1.3963	0.6981	0.4444	0.5555	0.9999
2 1/2	1.2566	0.3283	0.4000	0.5000	0.9000
2 3/4	1.1424	0.5712	0.3636	0.4545	0.8181
3	1.0472	0.5236	0.3333	0.4166	0.7499
3 1/2	0.8976	0.4488	0.2857	0.3571	0.6428
4	0.7854	0.3927	0.2500	0.3125	0.5625
5	0.6283	0.3141	0.2000	0.2500	0.4500
6	0.5236	0.2618	0.1666	0.2083	0.3750
7	0.4488	0.2244	0.1429	0.1786	0.3215
8	0.3927	0.1963	0.1250	0.1562	0.2812
9	0.3491	0.1745	0.1111	0.1389	0.2500
10	0.3142	0.1570	0.1000	0.1250	0.2250
11	0.2856	0.1428	0.0909	0.1136	0.2045
12	0.2618	0.1309	0.0833	0.1042	0.1875
13	0.2417	0.1208	0.0769	0.0961	0.1730
14	0.2244	0.4422	0.0714	0.0839	0.1607
15	0.2094	0.1047	0.0667	0.0833	0.1500
16	0.1963	0.0982	0.0625	0.0781	0.1406
17	0.1848	0.0924	0.0588	0.0735	0.1323
18	0.1745	0.0873	0.0556	0.0697	0.1250
19	0.1653	0.0827	0.0526	0.0658	0.1184

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STANDARD TOOTH DIMENSIONS
Tooth Chart – 2.20/DP +.002 System DP

Diam. Pitch	CP	Tooth Thickness	1/DP Addendum	1.25/DP Dedendum	Whole Depth
20	0.1571	0.0785	0.05	0.062	0.112
21	0.1496	0.0748	0.0476	0.0591	0.1068
22	0.1428	0.0714	0.0455	0.0565	0.102
24	0.1309	0.0654	0.0417	0.052	0.0937
26	0.1208	0.0604	0.0385	0.0482	0.0866
28	0.1122	0.0561	0.0357	0.0449	0.0806
30	0.1047	0.0524	0.0333	0.042	0.0753
32	0.0982	0.0491	0.0312	0.0395	0.0708
34	0.0924	0.0462	0.0294	0.0373	0.0667
36	0.08727	0.0436	0.0278	0.0353	0.0631
38	0.0827	0.0413	0.0263	0.0336	0.0599
40	0.0785	0.0393	0.025	0.032	0.057
42	0.0748	0.0374	0.0238	0.0306	0.0544
44	0.0714	0.0357	0.0227	0.0293	0.052
46	0.0683	0.0341	0.0217	0.0281	0.0498
48	0.0654	0.0327	0.0208	0.027	0.0478
50	0.0628	0.0314	0.02	0.026	0.046
56	0.0569	0.028	0.0179	0.0234	0.0413
60	0.0524	0.0262	0.0167	0.022	0.0387
64	0.0491	0.0245	0.0156	0.028	0.0364
72	0.0436	0.0218	0.0139	0.0187	0.0326
80	0.0393	0.0196	0.0125	0.017	0.0295
96	0.0327	0.0164	0.0101	0.0145	0.0249
120	0.0262	0.0131	0.0083	0.012	0.0203

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STANDARD TOOTH DIMENSIONS
Tooth Chart – 2.157/DP System CP

Fraction	CP	Tooth Thickness	Addendum	Dedendum	Whole Depth
1/8	0.125	0.0625	0.0398	0.0625	0.0858
1/6	0.1667	0.08335	0.05306	0.06139	0.1144
1/5	0.2000	0.1000	0.06366	0.07366	0.1373
1/4	0.2500	0.1250	0.07958	0.09207	0.1716
5/16	0.3125	0.15625	0.09947	0.11509	0.2146
1/3	0.3333	0.16667	0.1061	0.12276	0.2288
3/8	0.3750	0.1875	0.1194	0.1381	0.2575
7/16	0.4375	0.21875	0.13926	0.16112	0.3004
1/2	0.5000	0.2500	0.15915	0.18414	0.3433
9/16	0.5625	0.28125	0.1790	0.20716	0.3862
5/8	0.6250	0.3125	0.19894	0.23018	0.4291
2/3	0.6667	0.3333	0.2122	0.2455	0.4578
11/16	0.6875	0.3437	0.2188	0.2532	0.4720
3/4	0.7500	0.3750	0.2387	0.2763	0.5149
7/8	0.8750	0.4375	0.2785	0.3222	0.6008
1	1.0000	0.5000	0.3183	0.3683	0.6866
1 1/8	1.1250	0.5625	0.3581	0.4143	0.7724
1 1/4	1.2500	0.6250	0.3979	0.4604	0.8582
1 3/8	1.3750	0.6875	0.4377	0.5064	0.9441
1 1/2	1.5000	0.7500	0.4775	0.5524	1.0299
1 5/8	1.6250	0.8125	0.5173	0.5985	1.1157
1 3/4	1.7500	0.8750	0.5570	0.6445	1.2015
1 7/8	1.8750	0.9375	0.5968	0.6905	1.2874
2	2.0000	1.0000	0.6366	0.7366	1.3732

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TOOTH CHART MODULE – 2.25/DP Depth System

Module Pitch	DP	Tooth Thickness	1/DP Addendum	1.25/DP Dedendum	Whole Depth	Module Pitch	DP	Tooth Thickness	1/DP Addendum	1.25/DP Dedendum	Whole Depth
1.25	20.32	0.0773	0.0492	0.0615	0.1107	8	3.175	0.4947	0.3150	0.3937	0.7088
1.5	16.9333	0.0928	0.0591	0.0738	0.1329	8.25	3.0787	0.5102	0.3248	0.4060	0.7308
1.75	14.5142	0.1082	0.0689	0.0861	0.1550	8.5	2.9882	0.5257	0.3346	0.4183	0.7529
2	12.7	0.1237	0.0787	0.0984	0.1771	9	2.8222	0.5566	0.35543	0.4429	0.7972
2.25	11.2888	0.1391	0.0886	0.1107	0.1993	9.25	2.745	0.5720	0.3642	0.4552	0.8194
2.5	10.16	0.1546	0.0984	0.1230	0.2214	9.5	2.6736	0.5875	0.3740	0.4672	0.9415
2.75	9.2363	0.1700	0.1083	0.1353	0.2436	10	2.54	0.6184	0.3937	0.4921	0.8858
3	8.4666	0.1855	0.1181	0.1476	0.2657	11	2.309	0.6803	0.4330	0.5413	0.9744
3.25	7.8153	0.2010	0.1280	0.1599	0.2879	12	2.1167	0.7410	0.4724	0.5906	1.0630
3.5	7.2571	0.2164	0.1375	0.1722	0.3100	13	1.9538	0.8039	0.5118	0.6398	1.1516
3.75	6.7733	0.2319	0.1473	0.1845	0.3321	14	1.8143	0.8658	0.5512	0.6890	1.2401
4	6.35	0.2474	0.1575	0.1969	0.3544	15	1.6933	0.9277	0.5906	0.7382	1.3287
4.25	5.9764	0.2628	0.1673	0.2092	0.3765	16	1.5875	0.9895	0.6299	0.7874	1.4173
4.5	5.6444	0.2783	0.1772	0.2215	0.3987	17	1.4911	1.0513	0.6693	0.8366	1.5059
4.75	5.3473	0.2938	0.1870	0.2338	0.4208	18	1.4111	1.1132	0.7087	0.8858	1.5945
5	5.08	0.3092	0.1969	0.2461	0.4430	19	1.3368	1.1750	0.7480	0.9351	1.6831
5.25	4.838	0.3247	0.2067	0.2584	0.4651	20	1.27	1.2368	0.7874	0.9843	1.7717
5.5	4.5181	0.3401	0.2156	0.2707	0.4872	21	1.2095	1.2987	0.8268	1.0335	1.8602
6	4.2333	0.3711	0.2362	0.2953	0.5315	22	1.1545	1.3606	0.8661	1.0827	1.9488
6.25	4.064	0.3865	0.2461	0.3076	0.5537	24	1.0583	1.4843	0.9449	1.1811	2.1260
6.5	3.9076	0.4020	0.2559	0.3199	0.5758	25	1.016	1.5466	0.9843	1.2303	2.2146
7	3.6285	0.4329	0.2756	0.3445	0.6201						
7.25	3.5034	0.4484	0.2854	0.3568	0.6422						
7.5	3.3866	0.4638	0.2953	0.3691	0.6644						

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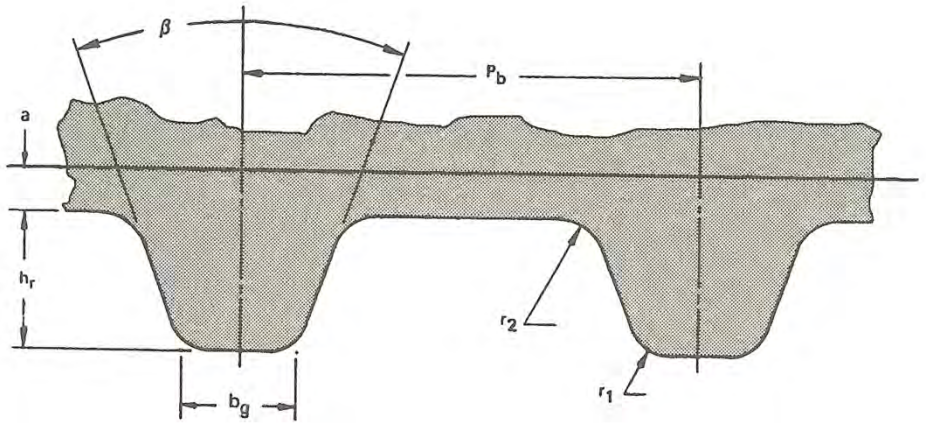
AMERICAN STANDARD TIMING BELTS

Pulley, Generating Tool Rack Form Dimensions for Involute Teeth



Belt Section	Number of Grooves	Pb +0.0001	β 10.25 (deg.)	hr +0.0002 -0.000	bs +0.0002 -0.000	r1 +0.0001	r2 +0.0001	2a
MXL	10 thru 23	0.0800	56	0.0250	0.024	0.012	0.009	0.02
	24 & over	0.0800	40	0.1250	0.0265	0.012	0.009	0.02
XL	10 & over	0.2000	50	0.0560	0.050	0.024	0.024	0.02
L	10 & over	0.3750	40	0.0840	0.122	0.034	0.021	0.03
H	14 thru 19	0.5000	40	0.1020	0.167	0.058	0.041	0.054
	over 19	0.5000	40	0.1020	0.167	0.052	0.056	0.054
XI-I	18 & over	0.8750	40	0.2710	0.299	0.079	0.076	0.11
XXH	18 & over	1.2500	40	0.4050	0.457	0.106	0.111	0.12

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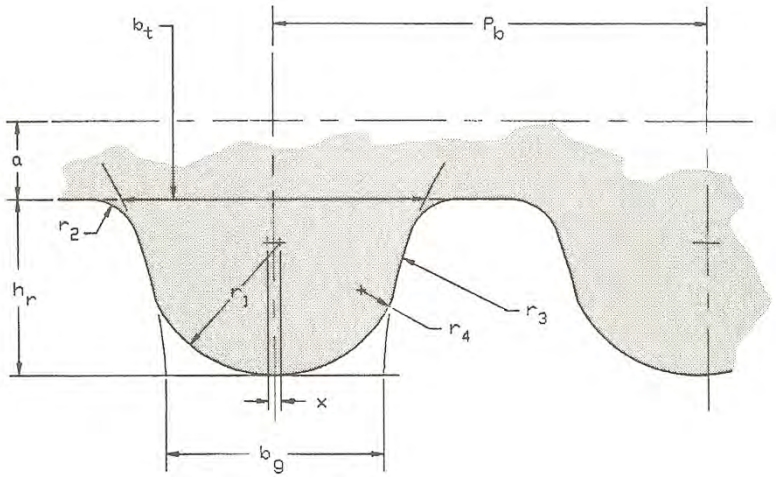
FULL RADIUS TIMING BELT

Rack Form Dimensions



Belt Section	# of Grooves	Pb	hr	bg	bt	r1	r2	r3	r4	X	2A
8 M	22-27	0.31496	0.1295	0.1370	0.2380	0.1005	0.045	*	0	0	0.054
	28-89	0.31496	0.1422	0.1640	0.2381	0.1092	0.042	0.508	0.0286	0.0098	0.054
	90-200	0.31496	0.1430	0.1671	0.2242	0.1038	0.037	*	0	0	0.054
14 M	28-36	0.55118	0.2489	0.2799	0.4385	0.1857	0.074	0.820	0.0450	0	0.110
	37-89	0.55118	0.2440	0.3043	0.4248	0.1836	0.072	0.620	0.0450	0	0.110
	90-216	0.55118	0.2500	0.3192	0.4040	0.1820	0.075	0.792	0.0100	0	0.110

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DIN7721 CHAINS & SPROKETS
Synchroflex O.D., “T” & “AT” Chart

No. of Teeth	"T" do 2.5		"T" & "AT" Version		No. of Teeth	"T" do 25		"T" & "AT" Version	
		do 5*	do 10	do 20			do 5*	do 10	do 20
10	-	15.05	-	-	61	48.05	96.25	192.30	385.45
11	-	16.65	-	-	62	48.85	97.85	195.50	391.85
12	9.00	18.25	36.35	-	63	49.60	99.45	198.65	398.20
13	9.80	19.85	39.5	-	64	50.40	101.05	201.85	404.55
14	10.60	21.45	42.7	-	65	51.20	102.65	205.05	410.95
15	11.40	23.05	45.9	92.65	66	52.00	104.20	208.20	417.30
16	12.20	24.60	49.05	99.00	67	52.80	105.80	211.40	423.65
17	18.00	26.20	52.25	105.40	68	53.60	107.40	214.60	430.05
18	18.80	27.80	55.45	111.70	69	54.40	109.00	217.75	436.40
19	14.60	29.40	58.6	118.10	70	55.20	110.60	220.95	442.80
20	15.40	31.00	61.8	124.50	71	56.00	112.20	224.15	449.15
21	16.20	32.70	65	130.75	72		113.75	227.15	455.50
22	17.00	34.25	68.15	137.20	73		115.75	230.50	461.85
23	17.80	35.85	71.35	143.55	74		116.95	233.70	468.25
24	18.55	37.40	74.55	149.95	75		118.55	236.90	474.60
25	19.35	39.00	77.7	156.30	76		120.15	240.05	480.95
26	20.15	40.60	80.9	162.65	77		121.75	243.25	487.35
27	20.95	42.20	84.1	169.05	78		123.30	246.40	493.70
28	21.76	43.75	87.25	175.40	79		124.90	249.60	500.05
29	22.55	45.35	90.45	181.75	80		126.50	252.80	506.45
30	23.35	46.95	93.65	188.15	81		128.10	255.95	512.80
31	24.15	48.55	96.8	194.50	82		129.70	259.15	519.15
32	24.95	50.10	100	200.85	83		131.30	262.30	525.55
33	25.75	51.70	103.2	207.20	84		132.85	265.50	531.90

CONTINUED ON NEXT PAGE

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DIN7721 CHAINS & SPROKETS
Synchroflex O.D., “T” & “AT” Chart

No. of Teeth	"T" do 2.5		"T" & "AT" Version		No. of Teeth	"T" do 25		"T" & "AT" Version	
34	26.55	53.25	106.4	213.60	85		134.45	268.70	538.25
35	27.85	54.85	109.55	219.95	86		136.05	271.90	544.60
36	28.10	56.45	112.75	226.35	87		137.65	275.05	551.00
37	28.90	58.05	115.90	232.70	88		139.25	278.25	557.35
38	29.70	59.65	119.10	239.05	89		140.85	281.45	563.70
39	30.50	61.25	122.30	245.45	90		142.45	284.60	570.10
40	31.30	62.85	125.45	251.80	91		144.00	287.80	576.45
41	32.10	64.40	128.65	258.15	92		145.60	291.00	582.85
42	32.90	660	131.85	264.50	93		147.20	294.15	589.20
43	33.70	67.70	135.00	270.90	94		148.80	297.35	595.55
44	34.50	69.20	138.20	277.25	95		150.40	300.55	601.90
45	35.30	70.80	141.40	283.60	96		152.00	303.70	608.30
46	36.10	72.4	144.55	290.00	97		153.55	306.90	614.65
47	36.90	73.95	147.75	296.35	98		155.15	310.10	621.00
48	37.70	75.55	150.95	302.70	99		156.75	313.25	627.40
49	38.45	77.15	154.10	309.10	100		158.35	316.45	633.75
50	39.25	78.75	157.30	315.45	101		159.95	319.65	640.10
51	40.05	80.35	160.50	321.80	102		161.55	322.80	646.50
52	40.85	81.95	163.85	328.55	103		163.10	326.20	652.85
53	41.65	83.50	166.85	334.55	104		164.70	329.20	659.20
54	42.45	85.10	170.05	340.90	105		166.30	332.35	665.60
55	43.25	86.70	173.20	347.30	106		167.90	335.55	671.95
56	44.05	88.30	176.40	353.65	107		169.50	338.75	678.30
57	44.85	89.90	179.60	360.00	108		171.10	341.91	684.70
58	45.65	91.50	182.75	366.40	109		172.65	345.10	691.05
59	46.45	93.05	185.95	372.75	110		174.25	348.30	697.40
60	47.25	94.65	189.10	379.10					

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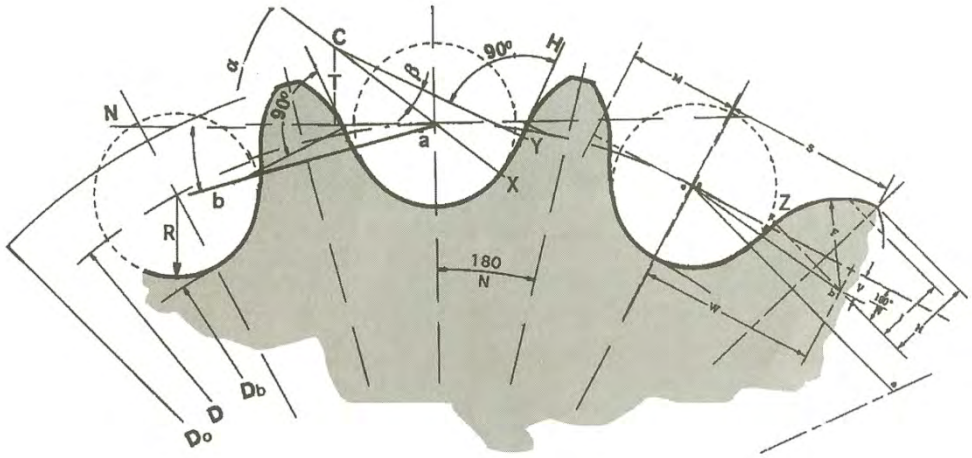
DESIGN FORMULAS FOR ASA ROLLER CHAIN SPROKETS

ASA Roller Chain – Chains &Sprokets

Symbol	Description	Formula	Result
N	# of teeth	Given	20
P	Chain pitch	Given	0.75
Dr	Roller diameter	Given	0.469
CI	Pitch line clearance minimum	07 (P-Dr)+.002	0.0217
CIM	Pitch mine clearance maximum	CI+.003 (Dr)+.005	0.0281
Rm	Seating curve radius minimum	5025(Dr)+.0025	0.2372
RM.	Seating curve radius maximum	Rm+.0015(Dr)+.0025	0.2404
D	Pitch diameter	P/(sin(180/N))	4.7943
MM	Minor diameter maximum	D-Dr	4.3253
Mm	Minor diameter minimum	MM-(.001*P*SQRT(N)+.003)	4.319
J	J dimension	.3*P	0.225
DO	Outside diameter	P(.6+cot(180/N))	5.1852



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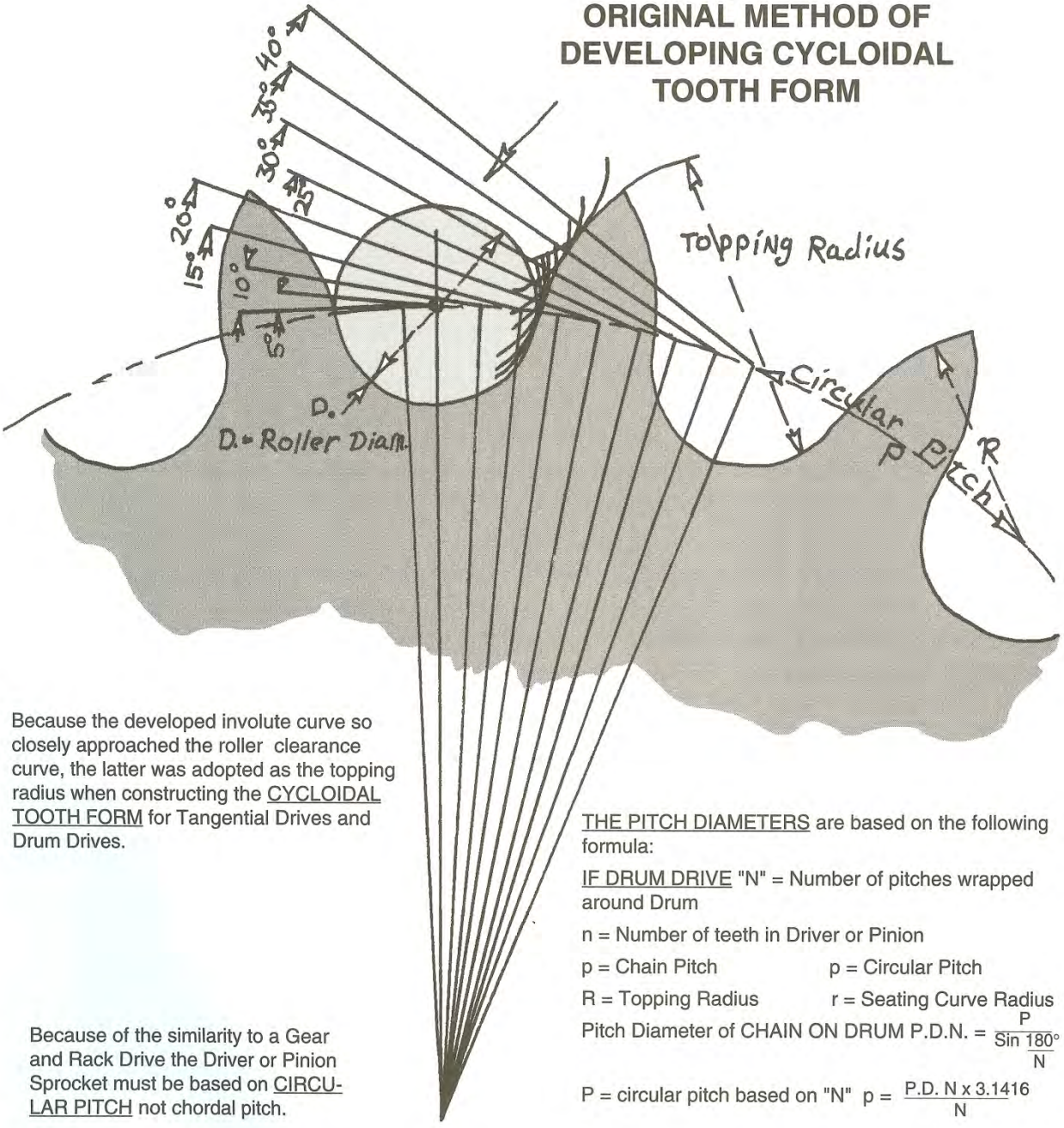
ORIGINAL METHOD OF DEVELOPING CYCLOIDAL TOOTH FORM



Because the developed involute curve so closely approached the roller clearance curve, the latter was adopted as the topping radius when constructing the CYCLOIDAL TOOTH FORM for Tangential Drives and Drum Drives.

Because of the similarity to a Gear and Rack Drive the Driver or Pinion Sprocket must be based on CIRCULAR PITCH not chordal pitch.

THE PITCH DIAMETERS are based on the following formula:

IF DRUM DRIVE "N" = Number of pitches wrapped around Drum

n = Number of teeth in Driver or Pinion

p = Chain Pitch p = Circular Pitch

R = Topping Radius r = Seating Curve Radius

Pitch Diameter of CHAIN ON DRUM P.D.N. = $\frac{P}{\text{Sin } \frac{180°}{N}}$

P = circular pitch based on "N" $p = \frac{\text{P.D. N x 3.1416}}{N}$

pitch Diameter of PINION = P. D. n. = $\frac{P \times n}{3.1416}$

ON TANGENTIAL DRIVES where chain is used as a rack, the circular pitch p = chain pitch

$r = \frac{1.005D + 0.003}{2}$ $R = (\sin \frac{180°}{n} \times \text{P.D.n}) - r$

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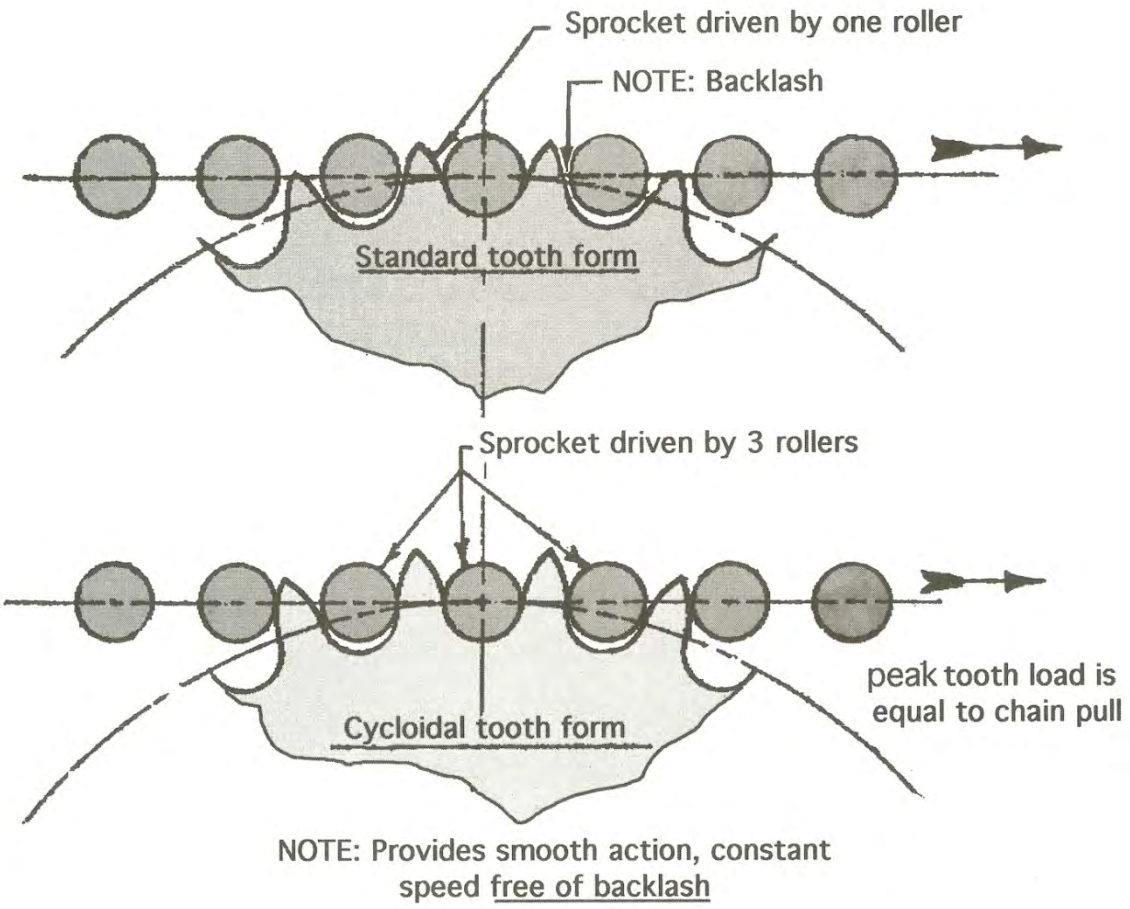
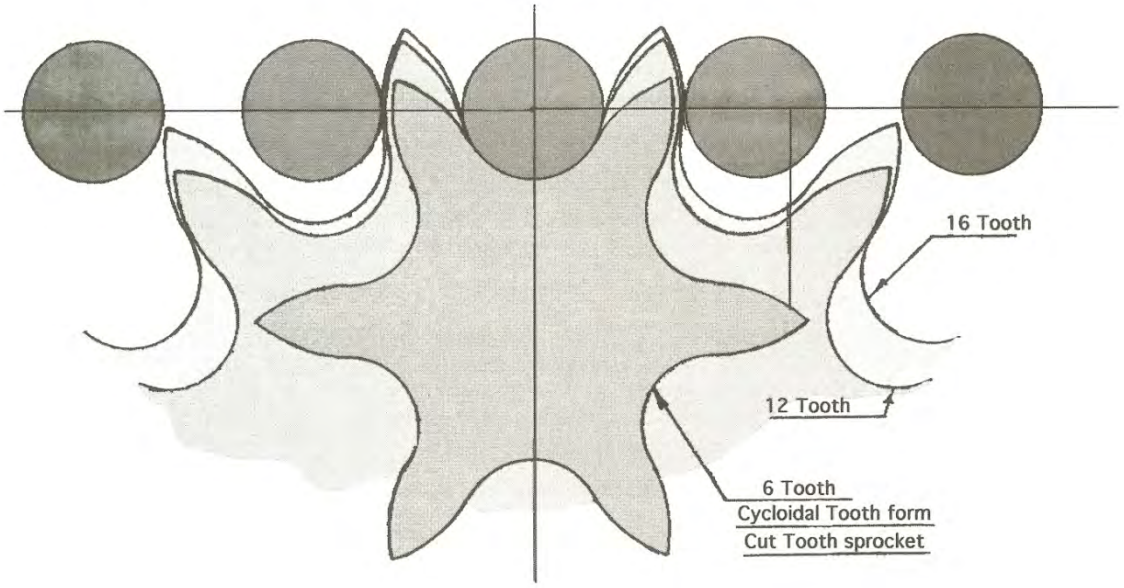


NOTE: Provides smooth action, constant speed free of backlash

12 Tooth Minimum



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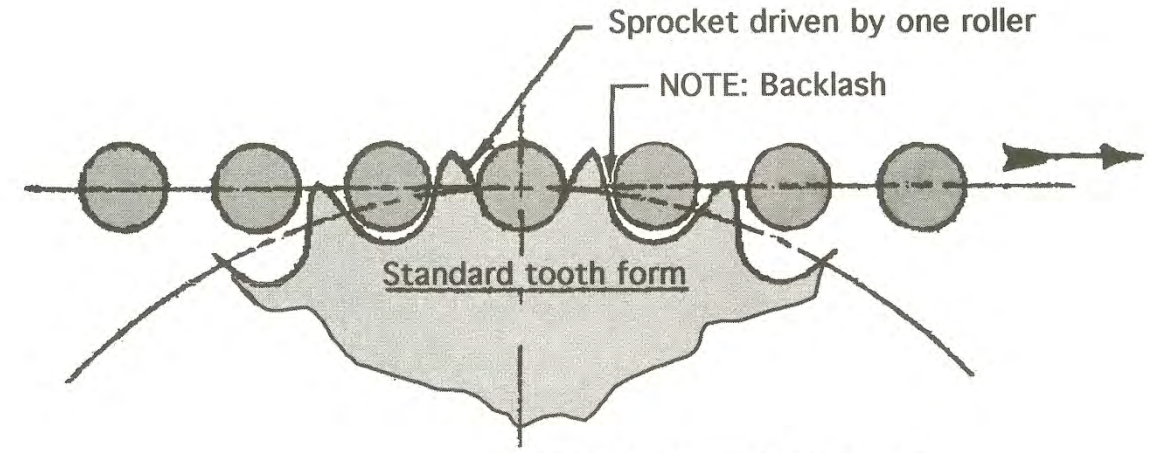
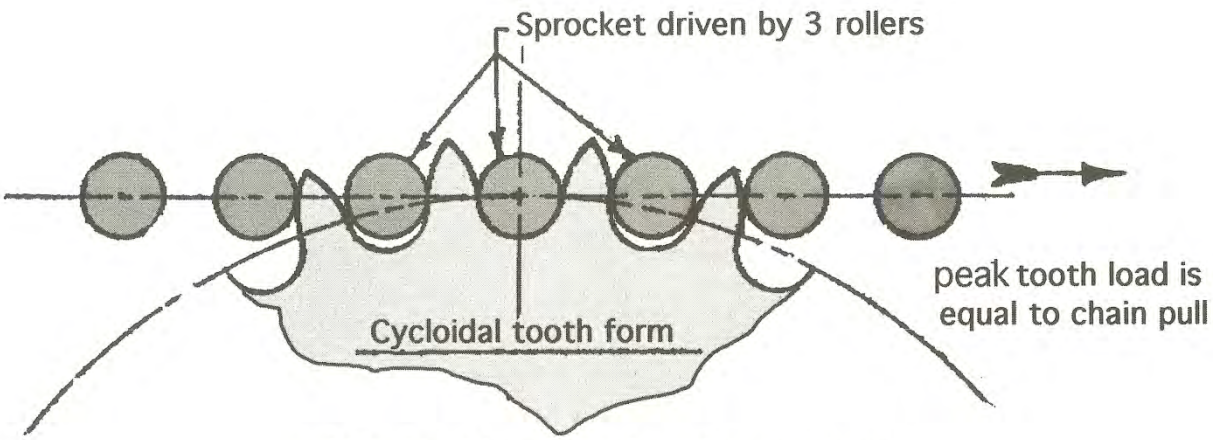
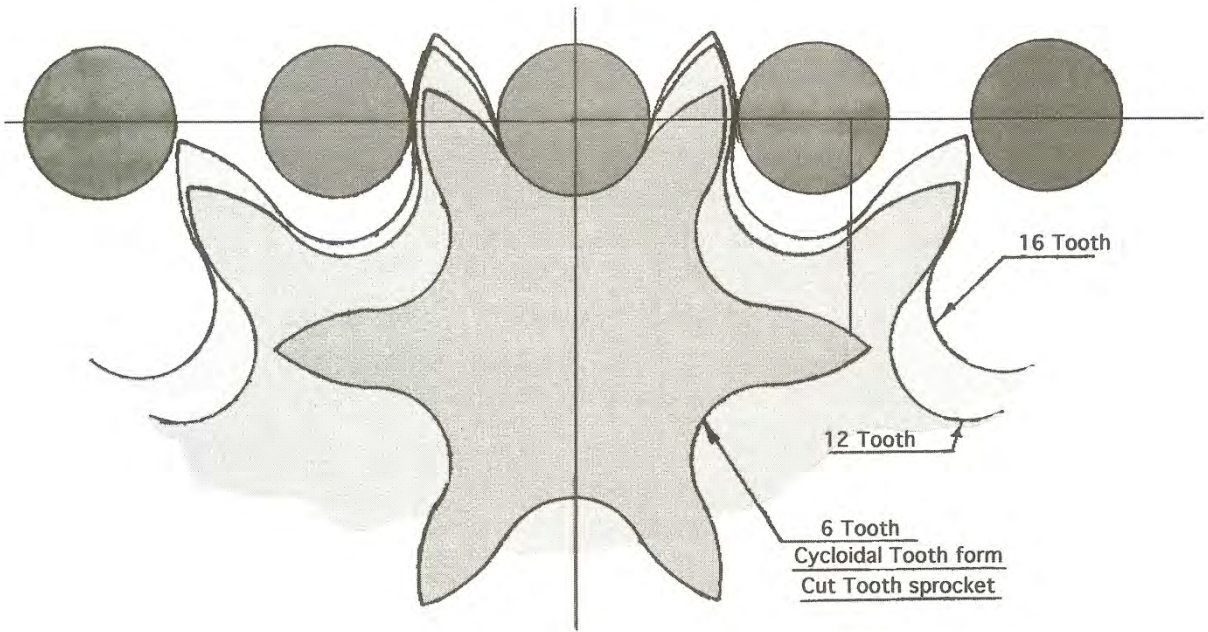




NOTE: Provides smooth action, constant speed free of backlash

12 Tooth Minimum



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CONVERYOR CHAIN

Conveyor Chain – Chains & Sprockets

Pitch Diameter, Maximum Outside and Bottom, Diameter for Normal Range of Sprocket Teeth Available with a Type A Tooth From Sprocket

Number of teeth*		Pitch Diameter		Maximum Outside Diameter		Maximum Bottom Diameter	
act.	eff.	in.	Mm	in.	mm	in.	mm
12	6	3.000	76.20	2.848	72.34	2.475	62.87
13	6 1/2	3.228	81.99	3.108	78.94	2.703	68.66
14	7	3.457	87.81	3.365	85.47	2.932	74.47
15	7 1/2	3.688	93.68	3.619	91.92	3.163	80.34
16	8	3.920	99.57	3.871	98.32	3.395	86.23
17	8 1/2	4.152	105.46	4.122	104.70	3.627	92.13
18	9	4.386	111.40	4.371	111.02	3.861	98.07
19	9 1/2	4.620	117.35	4.620	117.35	4.095	104.01
20	10	4.854	123.29	4.854	123.29	4.329	109.96
21	10 1/2	5.089	129.26	5.089	129.26	4.564	115.93
22	11	5.324	135.23	5.324	135.23	4.799	121.89
23	11 1/2	5.560	141.22	5.560	141.22	5.035	127.89
24	12	5.796	147.22	5.796	147.22	5.271	133.88
25	12 1/2	6.032	153.21	6.032	153.21	5.507	139.88
26	13	6.268	159.21	6.268	159.21	5.743	145.87
27	13 1/2	6.504	165.20	6.504	165.20	5.979	151.87
28	14	6.741	171.22	6.741	171.22	6.216	157.89
29	14 1/2	6.978	177.24	6.978	177.24	6.453	163.91
30	15	7.215	183.26	7.215	183.26	6.69	169.93
31	15 1/2	7.452	189.28	7.452	189.28	6.927	175.95
32	16	7.689	195.30	7.689	195.30	7.164	181.97
33	16 1/2	7.926	201.32	7.926	201.32	7.401	187.99
34	17	8.163	207.34	8.163	207.34	7.638	194.01
35	17 1/2	8.401	213.39	8.401	213.39	7.876	200.05
36	18	8.638	219.41	8.638	219.41	8.113	206.07
37	18 1/2	8.876	225.45	8.876	225.45	8.351	212.12
38	19	9.113	231.47	9.113	231.47	8.588	218.14
39	19 1/2	9.351	237.52	9.351	237.52	8.826	224.18
40	20	9.589	243.56	9.589	243.56	9.064	230.23
41	20 1/2	9.826	249.60	9.826	249.60	9.301	236.25

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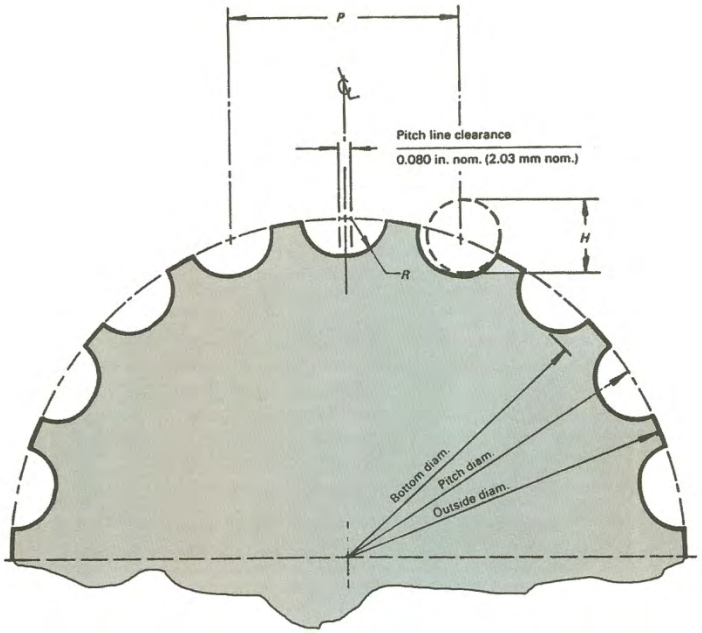
SPROCKET TPPTH FORM TYPE A
RADIUS TOOTH FORM



ANSI / ASME B 29.17m-1983
An American National Standard

Hinge type flat top conveyor chains and sprocket teeth

P= Pitch	1.5	38.1
H= Max curl diam.	0.525	13.34
R= Pocket Radius (max)	0.265	6.73

Note: All numbers of teeth may be made with one cutter if non-topping

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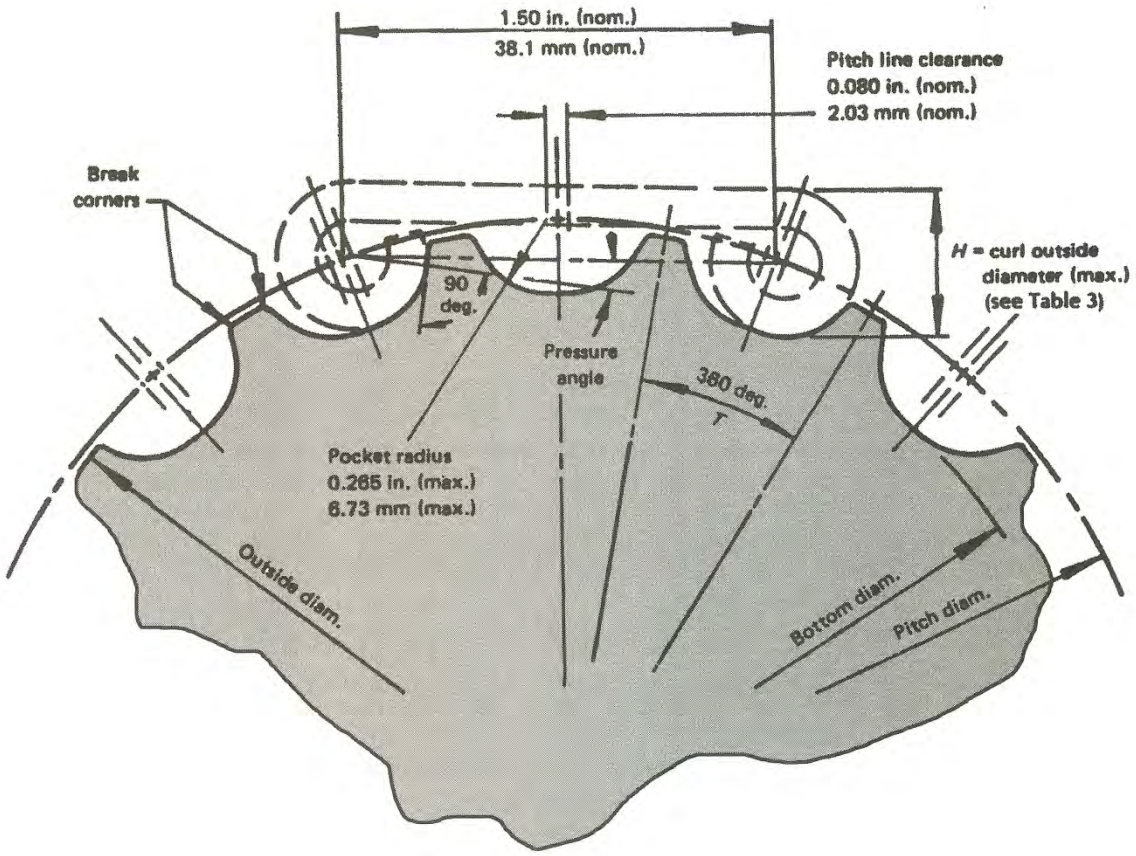
SPROCKET TOOTH FORM
TYPE B
STRAIGHT FACE TOOTH FORM

(See Table on previous page)

ANSI / ASME B 29.17m-1983
An American National Standard

Hinge type flat top conveyor chains and sprocket teeth



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SERRATED SHAFT ENDS – SAE J500

Straight Sided Serrations

Report of Parts and Fitting Division approved 1922 and last revised by Parts and Fittings Committee June 1955

This Recommended Practice is intended for service only. Use SAE Standard, Involute Splines, Serrations, and Inspection-SAE J498 for new applications.

Straight Shafts

N = Number of serrations
B = Included angle of the space in the hole, and the tooth on the shaft.

The pitch diameter (PD) and the hole are basic.

The pitch line is midway between the inner and outer sharp points.

The minimum hole with maximum shaft as measured across wires in Table1, produce basic (no clearance) fit.

The wire diameter in Table 1 is the diameter that will bear on the pitch line.

Tolerance for diameter across wires= .001 on tooth thickness of hole and shaft sizes from 1/3 to 1 ¾ in., and -.0015 on sizes from 2 to 3 in., inclusive.

Tooth thickness on the shaft may be varied from the tolerance given, to secure desired fit.

We= Constant to be added to measurement across wires for shaft, subtracted for hole, for each .001-in. increase in wire diameter used over wire size in Table1.

When serrations are hobbed, the sides of teeth are involute. This departure from flat sides is slight and is ignored.

Formulas

1. Diameter over sharp points
   (OD) = 1.0476479 PD for 36 serrations.
   = 1.0349592 PD for 48 serrations.

2. Diameter under sharp points
   (RD) = .9523521 PD for 36 serrations.
   = .9650408 PD for 48 serrations.

3. Diameter of wire that will bear on pitch line of hole
   (Wh) = .05309792 PD for 36 serrations
   = .04133332 PD for 48 serrations
   Diameter of wire that will bear on pitch line of shaft
   (Ws) = .06565005 PD for 36 serrations
   =.0485955 PD for 48 serrations

4. Measurement across wires for hole
   = .9119441 PD for 36 serrations
   = .9309375 PD for 48 serrations
   Measurement across wires for shaft
   = 1.1113285 PD for 36 serrations
   = 1.0823601 PD for 48 serrations

5. Tolerance constant for measurement across wires per .0001-in. tooth
   thickness for hole = $\frac{.001}{\sin (45-180/N)}$ $\frac{\sin 45}{}$
   for shaft = $\frac{.001}{\sin 45}$ $\frac{\sin (45-180N)}{}$

6. Wire diameter constant for use of other diameter wire than that which bears on pitch line. (We)
   thickness for hole =.001+ $\frac{.001}{\sin (45-180/N)}$ for hole
   for shaft = .001+ $\frac{.001}{\cos 45}$ for shaft

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Hole of Shaft						Hole							Shaft						
Nominal Dia.	Pitch Dia.	N	b, Deg	Theoretical Dia. Of Points		Large Dia. Min.	Small Dia.		Dia. Across Wires		Wire Size, Wh	Wc	Root Dia., Max.	Outside Dia.		Dia. Across Wires		Wire Size We	We
				OD	RD		Max.	Min.	Min.	Max.				Max.	Min.	Max.	Min.		
1/8	0.122	36	80	0.1278	0.1162	0.1250	0.1180	0.1170	0.1113	0.1124	0.0065	0.0026	0.1160	0.1240	0.1230	0.1356	0.1347	0.0080	0.0024
3/16	0.182	36	80	0.1907	0.1733	0.1870	0.1760	0.1750	0.1660	0.1671	0.0097	0.0026	0.1740	0.1860	0.1850	0.2023	0.2014	0.0120	0.0024
1/4	0.243	36	80	0.2546	0.2314	0.2500	0.2350	0.2340	0.2216	0.2227	0.0129	0.0026	0.2330	0.2490	0.2480	0.2701	0.2692	0.0160	0.0024
3/16	0.303	36	80	0.3174	0.2886	0.3120	0.2930	0.2920	0.2763	0.2774	0.0161	0.0026	0.2910	0.3110	0.3100	0.3367	0.3358	0.0200	0.0024
3/8	0.363	36	80	0.3603	0.3457	0.3750	0.3520	0.3510	0.3310	0.3321	0.0193	0.0026	0.3500	0.3740	0.3730	0.4034	0.4025	0.0239	0.0024
1/2	0.485	36	80	0.3081	0.4619	0.5000	0.4690	0.4680	0.4423	0.4434	0.0258	0.0026	0.4670	0.4990	0.4980	0.5390	0.5381	0.0319	0.0024
5/8	0.605	36	80	0.6338	0.5462	0.6250	0.5840	0.5830	0.5517	0.5528	0.0321	0.0026	0.5820	0.6240	0.6230	0.6724	0.6715	0.0398	0.0024
3/4	0.733	48	82-1/2	0.7586	0.7074	0.7500	0.7160	0.7140	0.6824	0.6835	0.0303	0.0025	0.7130	0.7490	0.7470	0.7934	0.7925	0.0356	0.0024
7/8	0.855	48	82-1/2	0.8849	0.8251	0.8750	0.8350	0.8330	0.7960	0.7971	0.0353	0.0025	0.8320	0.8740	0.8720	0.9254	0.9245	0.0415	0.0024
1	0.977	48	82-1/2	1.0112	0.9428	1.0000	0.9540	0.9520	0.9095	0.9106	0.0404	0.0025	0.9510	0.9990	0.9970	1.0575	1.0565	0.0475	0.0024
1-1/8	1.098	48	82-1/2	1.1364	1.0596	1.1250	1.0710	1.0690	1.0222	1.0233	0.0454	0.0025	1.0680	1.1240	1.1220	1.1884	1.1875	0.0534	0.0024
1-1/4	1.220	48	82-1/2	1.2626	1.1773	1.2500	1.1900	1.1880	1.1357	1.1368	0.0504	0.0025	1.1870	1.2490	1.2470	1.3205	1.3196	0.0593	0.0024
1-3/8	1.342	48	82-1/2	1.3889	1.2951	1.3750	1.3090	1.3070	1.2493	1.2504	0.0555	0.0025	1.3060	1.3740	1.3720	1.4525	1.4516	0.0652	0.0024
1-1/2	1.464	48	82-1/2	1.5152	1.4128	1.5000	1.4280	1.4260	1.3829	1.3640	0.0605	0.0025	1.4250	1.4990	1.4970	1.5846	1.5837	0.0711	0.0024
1-3/4	1.708	48	82-1/2	1.7677	1.6483	1.7500	1.6660	1.6640	1.5900	1.5911	0.0706	0.0025	1.6630	1.7490	1.7470	1.8487	1.8478	0.0830	0.0024
2	1.952	48	82-1/2	2.0202	1.8839	2.0000	1.9040	1.9020	1.8172	1.8188	0.0807	0.0025	1.9010	1.9990	1.9970	2.1128	2.1114	0.0949	0.0024
2-1/4	2.196	48	82-1/2	2.2728	2.1192	2.2500	2.1420	2.1400	2.0443	2.0459	0.0908	0.0025	2.1390	2.2490	2.2470	2.3769	2.3755	0.1067	0.0024
2-1/2	2.440	48	82-1/2	2.5252	2.3547	2.5000	2.3800	2.3780	2.2715	2.2731	0.1009	0.0025	2.3770	2.4990	2.4970	2.6410	2.6396	0.1180	0.0024
2-3/4	2.684	48	82-1/2	2.7778	2.5902	2.7500	2.6180	2.6160	2.6986	2.5002	0.1109	0.0025	2.6150	2.7490	2.7470	2.9051	2.9037	0.1304	0.0024
3	2.928	48	82-1/2	3.0304	2.8256	3.0000	2.8560	2.8540	2.7258	2.7274	0.1210	0.0025	2.8530	2.9990	2.9970	3.1692	3.1678	0.1423	0.0024

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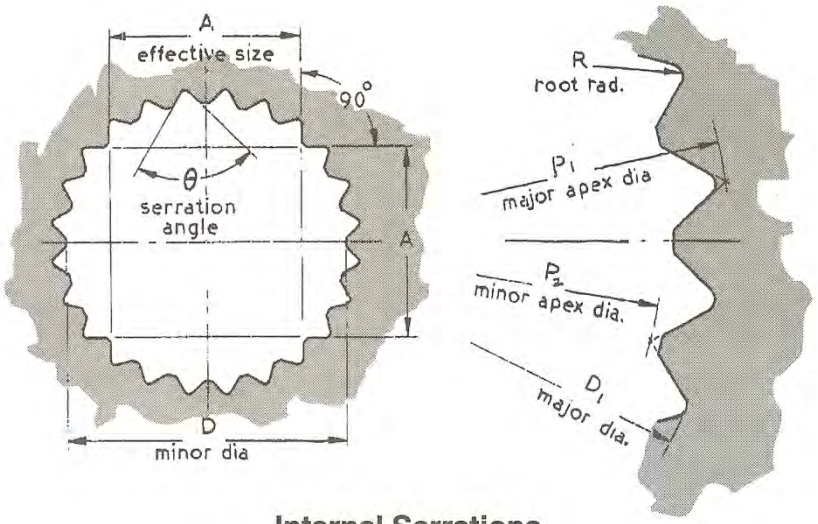
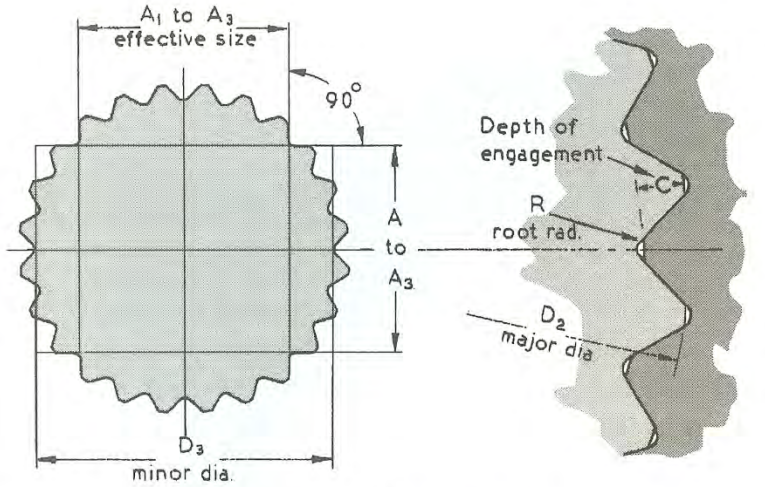
BRITISH STRAIGHT SIDED SERRATIONS STANDARD - Straight Sided Serrations



Internal Serrations



External Serrations

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BRITISH STRAIGHT SIDED SERRATIONS STANDARD - Straight Sided Serrations

									Hole			Shaft				Resultants Fits		
																Fit 1 Inter Clearance	Fit 2 Transition	Fit 3 Clearance
# of Serr.S	Norm. Size	0	P1	P2	C	C-S	R	D1	D	A	D2	D3	A1	A2	A3	A-A1	A-A2	A-A3
12	1/4	60	0.2780	0.1966	0.0172	0.2064	0.0090	0.2680	0.2114	0.1390	0.2480	0.1990	0.1405	0.1393	0.1381	-1.5	-0.3	+0.9
12	1/4	60	0.2780	0.1966	0.0172	0.2064	0.0060	0.2680	0.2126	0.1399	0.2470	0.1990	0.1399	0.1384	0.1384	0.0	+1.5	+3.0
12	5/16	60	0.3476	0.2458	0.0214	0.2568	0.0120	0.3350	0.2649	0.1738	0.3100	0.2490	0.1753	0.1741	0.1741	-1.5	-0.3	+0.9
12	5/16	60	0.3476	0.2458	0.0214	0.2568	0.0070	0.3350	0.2661	0.1747	0.3090	0.2490	0.1747	0.1732	0.1732	0.0	+1.5	+3.0
16	3/8	67-1/2	0.9374	0.3123	0.0216	0.3456	0.0060	0.3890	0.3287	0.2217	0.3720	0.3140	0.2217	0.2202	0.2187	0.0	+1.5	+3.0
16	7/16	67-1/2	0.4637	0.3643	0.0252	0.4032	0.0110	0.4560	0.3820	0.2576	0.4350	0.3660	0.2591	0.2579	0.2567	-1.5	-0.3	+0.9
16	7/16	67-1/2	0.4637	0.3643	0.0252	0.4032	0.0060	0.4560	0.3836	0.2585	0.4340	0.3660	0.2585	0.2570	0.2555	0.0	+1.5	+3.0
1/2	1/2	67-1/2	0.5299	0.4163	0.0300	0.4800	0.0120	0.5200	0.4354	0.2944	0.4980	0.4190	0.2959	0.2947	0.2935	-1.5	-0.4	+1.2
16	1/2	67-1/2	0.5299	0.4163	0.0300	0.4800	0.0070	0.5200	0.4370	0.2953	0.4970	0.4190	0.2953	0.2938	0.2923	0.0	+2.0	+4.0
20	5/8	72	0.6489	0.5394	0.0313	0.6260	0.0110	0.6430	0.5578	0.3814	0.5400	0.5230	0.3834	0.3818	0.3802	-2.0	-0.4	+1.2
20	5/8	72	0.6489	0.5394	0.0313	0.6260	0.0060	0.6430	0.5594	0.3826	0.5400	0.5220	0.3826	0.3806	0.3786	0.0	+2.0	+4.0
20	3/4	72	0.7787	0.6473	0.0378	0.7560	0.0130	0.7690	0.6685	0.4577	0.7480	0.6500	0.4597	0.4581	0.4665	-2.0	-0.4	+1.2
20	3/4	72	0.7787	0.6473	0.0378	0.7560	0.0080	0.7690	0.6705	0.4589	0.7460	0.6500	0.4589	0.4569	0.4649	0.0	+2.0	+4.0
20	7/8	72	0.9085	0.7552	0.0449	0.8980	0.0150	0.8960	0.7792	0.5340	0.8730	0.7600	0.5360	0.5344	0.5328	-2.0	-0.4	+1.2
20	7/8	72	0.9085	0.7552	0.0449	0.8980	0.0100	0.8960	0.7812	0.5352	0.8710	0.7600	0.5332	0.5332	0.5312	0.0	+2.0	+4.0
24	1	75	1.0277	0.8847	0.0437	1.0488	0.0130	1.0200	0.9066	0.6256	0.9980	0.8860	0.6281	0.6261	0.6241	-2.5	-0.5	+1.5
24	1	75	1.0277	0.8847	0.0437	1.0488	0.0080	1.0200	0.9086	0.6271	0.9960	0.8960	0.6271	0.6246	0.6221	0.0	+2.5	+5.0
24	1-1/8	75	1.1561	0.9953	0.0492	1.1808	0.0150	1.1460	1.0201	0.7038	1.1230	0.9990	0.7063	0.7043	0.7023	-2.5	-0.5	+1.5
1-1/4	1-1/8	75	1.1561	0.9953	0.0492	1.1808	0.0100	1.1460	1.0225	0.7053	1.1210	0.9990	0.7053	0.7043	0.7003	0.0	+2.5	+5.0
24	1-1/4	75	1.2846	1.1059	0.0550	1.3200	0.0170	1.2720	1.1335	0.7820	1.2480	1.1110	0.7845	0.7825	0.7805	-2.5	-0.5	+1.5

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BRITISH STRAIGHT SIDED SERRATIONS STANDARD - Straight Sided Serrations (contd)

									Hole			Shaft				Resultants Fits		
																Fit 1 Inter Clearance	Fit 2 Transition	Fit 3 Clearance
# of Serr.S	Norm. Size	0	P1	P2	C	C-S	R	D1	D	A	D2	D3	A1	A2	A3	A-A1	A-A2	A-A3
24	1-3/8	75	1.2846	1.1059	0.0550	1.3200	0.0120	1.2720	1.1359	0.7835	1.2460	1.1110	0.7835	0.7810	0.7785	0.0	+2.5	+5.0
24	1-3/8	75	1.4130	1.2165	0.0616	1.4784	0.0180	1.3990	1.2455	0.8602	1.3730	1.2220	0.8627	0.8607	0.8587	-2.5	-0.5	+1.5
24	1-1/2	75	1.4130	1.2165	0.0616	1.4784	0.0180	1.3990	1.2479	0.8617	1.3710	1.2220	0.8617	0.8592	0.8567	0.0	+2.5	+5.0
24	1-1/2	75	1.5415	1.3271	0.0674	1.6176	0.0200	1.5250	1.3589	0.9384	1.4980	1.3350	0.9409	0.9389	0.9369	-2.5	-0.5	+1.5
24	1-3/8	75	1.5415	1.3271	0.0674	1.6176	0.0150	1.5250	1.3613	1.9399	1.4960	1.3350	0.9399	0.9374	0.9349	0.0	+2.5	+5.0
36	1-5/8	80	1.6503	1.5002	0.0470	1.6920	0.0140	1.6430	1.5242	1.0608	1.5230	1.5020	1.0638	1.0614	1.0590	-3.0	-0.6	+1.8
36	1-5/8	80	1.6503	1.5002	0.0470	1.6920	0.0090	1.6430	1.5270	1.0626	1.5210	1.5020	1.0626	1.0596	1.0566	0.0	+3.0	+6.0
36	1-3/4	80	1.7773	1.6156	0.0511	1.8396	0.0150	1.7690	1.6410	1.1424	1.7480	1.6180	1.1454	1.1430	1.1406	-3.0	-0.6	+1.8
36	1-3/4	80	1.7773	1.6156	0.0511	1.8396	0.0100	1.7690	1.6438	1.1442	1.7460	1.6180	1.1442	1.1412	1.1382	0.0	+3.0	+6.0
36	1-7/8	80	1.9044	1.7311	0.0551	1.9836	0.0160	1.8950	1.7580	1.2241	1.8730	1.7430	1.2271	1.2247	1.2223	-3.0	-0.6	+1.8
36	1-7/8	80	1.9044	1.7311	0.0551	1.9836	0.0110	1.8950	1.7608	1.2259	1.8710	1.7430	1.2259	1.2229	1.2199	0.0	+3.0	+6.0
36	2	80	2.0313	1.8465	0.0592	2.1312	0.0170	2.0210	1.8748	1.3057	1.9980	1.8510	1.3087	1.3063	1.3039	-3.0	-0.6	+1.8
36	2	80	2.0313	1.8465	0.0592	2.1312	0.0120	2.0210	1.8776	1.3075	1.9960	1.8510	1.3075	1.3045	1.3015	0.0	+3.0	+6.0
36	2	80	2.2852	2.0773	0.0672	2.4192	0.0190	2.2720	2.1084	1.4689	2.2480	2.0830	1.4719	1.4695	1.4671	-3.0	-0.6	+1.8
36	2	80	2.2852	2.0773	0.0672	2.4192	0.0140	2.2720	2.1116	1.4707	2.2460	2.0830	1.4707	1.4677	1.4647	0.0	+3.0	+6.0
36	2-1/4	80	2.2852	2.3081	0.0750	2.7000	0.0210	2.5250	2.3428	1.6321	2.4980	2.3140	1.6356	1.6328	1.6300	-3.5	-0.7	+2.1
36	2-1/4	80	2.2852	2.3081	0.0750	2.7000	0.0160	2.5250	2.3460	1.6342	2.4960	2.3140	1.6342	1.6307	1.6272	0.0	+3.5	+7.0
40	2-3/4	81	2.7885	2.5611	0.0735	2.9400	0.0220	2.7730	2.5972	1.8110	2.7480	2.5680	1.8145	1.8117	1.8089	-3.5	-0.7	+2.1
40	2-3/4	81	2.7885	2.5611	0.0735	2.9400	0.0170	2.7730	2.6004	1.8131	2.7460	2.5680	1.8131	1.8096	1.8061	0.0	+3.5	+7.0
40	3	81	3.0420	2.7939	0.0798	3.1920	0.0240	3.0250	2.8328	1.9756	2.9980	2.8030	1.9791	1.9763	1.9735	-3.5	-0.7	+2.1

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BRITISH STRAIGHT SIDED SERRATIONS STANDARD - Straight Sided Serrations (contd)

									Hole			Shaft				Resultants Fits		
																Fit 1 Inter Clearance	Fit 2 Transition	Fit 3 Clearance
# of Serr.S	Norm. Size	0	P1	P2	C	C-S	R	D1	D	A	D2	D3	A1	A2	A3	A-A1	A-A2	A-A3
40	3	81	3.0420	2.7939	0.0798	3.1920	0.0190	3.0250	2.8364	1.9777	2.9960	2.9030	1.9777	1.9742	1.9707	0.0	+3.5	+7.0
48	3-1/4	82-1/2	3.2893	3.0671	0.0686	3.2928	0.0230	3.2740	3.1053	2.1688	2.2480	3.0740	2.1728	2.1696	2.1664	-3.5	-0.8	+2.4
48	3-1/4	82-1/2	3.2893	3.0671	0.0686	3.2928	0.0180	3.2740	3.1089	2.1712	2.2460	3.0740	2.1712	2.1672	2.1632	0.0	+4.0	+8.0
48	3-1/2	82-1/2	3.5424	3.3032	0.0741	3.5568	0.0250	3.5250	3.3442	2.3357	3.4980	3.3120	2.3397	2.3365	2.3333	-4.0	-0.8	+2.4
48	3-1/2	82-1/2	3.5424	3.3032	0.0741	3.5568	0.0200	3.5250	3.3478	2.3381	3.4960	3.3120	2.3381	2.3341	2.3301	0.0	+4.0	+8.0
48	3-3/4	82-1/2	3.4954	3.6391	0.0804	3.8592	0.0260	3.7770	3.5815	2.5025	3.4790	3.5480	2.5065	2.5033	2.5001	-4.0	-0.8	+2.4
48	3-3/4	82-1/2	3.7954	3.6391	0.0804	3.8592	0.0210	3.7770	3.5851	2.5049	3.4760	3.5480	2.5049	2.5009	2.4969	0.0	+4.0	+8.0
48	4	82-1/2	4.0484	3.7750	0.0859	4.1232	0.0280	4.0280	3.8202	2.6693	3.9980	3.7860	2.6733	2.6701	2.6669	-4.0	-0.8	+2.4
48	4	82-1/2	4.0484	3.7750	0.0859	4.1232	0.0230	4.0280	3.8242	2.6717	3.9960	3.7860	2.6717	2.6677	2.6637	0.0	+4.0	+8.0
48	4-1/4	82-1/2	4.3015	4.0110	0.0911	4.3728	0.0300	4.2800	4.0598	2.8362	4.2480	4.0230	2.8407	2.8371	2.8371	-4.5	-0.9	+2.7
48	4-1/4	82-1/2	4.3015	4.0110	0.0911	4.3728	0.0250	4.2800	4.0638	2.8389	4.2460	4.0230	2.8389	2.8344	2.8344	0.0	+4.5	+9.0

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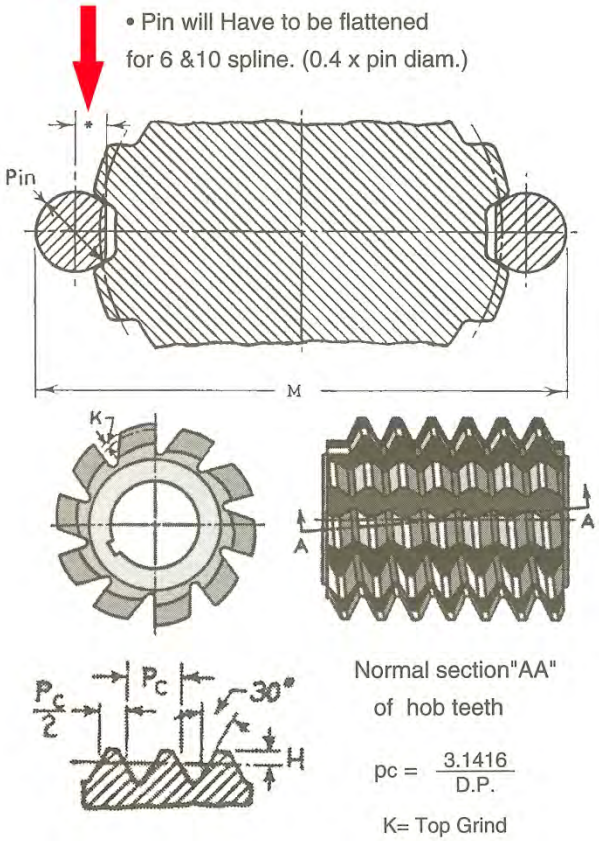
INVOLUTE SPLINES – Old American Standard

# of Splines	Pin Diameter	Measurement Over Pins		
		Deep Depth	Intermediate	Shallow
6	D x .3660253	D x 1.580365	D x 1.590770	D x 1.601561
10	D x .2012936	D x 1.303923	D x 1.315660	D x 1.327740
16	D x .1205850	D x 1.173280	D x 1.186008	D x 1.199013
24	D x .0786596	D x 1.120219	D x 1.133819	D x 1.147595
36	D x .051719	D x .0517190	D x 1.106751	D x 1.116248



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INVOLUTE SPLINES – Old American Standard

6 Spline			
Diam Pitch.	Deep H	Inter. H	Shallow H
8	0.0375	0.0319	0.0263
6.4	0.0469	0.0398	0.0328
5.3333	0.0563	0.0478	0.0394
4.5714	0.0656	0.0558	0.0459
4	0.0750	0.0638	0.0525
3.5556	0.0844	0.0717	0.0591
3.2	0.0938	0.0797	0.0656
2.9091	0.1031	0.0877	0.0722
2.6667	0.1125	0.0956	0.0788
2.4615	0.1219	0.1036	0.0853
2.2857	0.1313	0.1116	0.0919
2.1333	0.1406	0.1195	0.0984
2	0.1500	0.1275	0.105
1.8824	0.1594	0.1355	0.1116
1.7778	0.1688	0.1434	0.1181
1.6842	0.1781	0.1514	0.1247
1.6	0.1875	0.1594	0.131
1.5238	0.1969	0.1673	0.1378
1.4545	0.2063	0.1753	0.1444

16 Spline			
Diam Pitch	Deep H	Inter. H	Shallow H
21.3333	0.0375	0.0319	0.0263
17.0667	0.0469	0.0398	0.0328
14.2222	0.0563	0.0478	0.0394
12.1905	0.0656	0.0558	0.0459
10.6667	0.075	0.0638	0.0525
9.4815	0.0844	0.0717	0.0591
8.5333	0.0938	0.0797	0.0656
7.7576	0.1031	0.0877	0.0722
7.1111	0.1125	0.0956	0.0788
6.5641	0.1279	0.1036	0.0853
6.0952	0.1313	0.1116	0.0919
5.6889	0.1406	0.1195	0.984
5.3333	0.1500	0.1275	0.105
5.0196	0.1594	0.1355	0.1116
4.7407	0.1688	0.1434	0.1181
4.4912	0.1781	0.1514	0.1247
4.2667	0.1875	0.1594	0.1313
4.0635	0.1969	0.1673	0.1378
3.8788	0.2063	0.1753	0.1444

10 Spline			
Diam. Pitch	Deep H	Inter. H	Shallow H
13.3333	0.0375	0.0319	0.0263
10.0667	0.0469	0.0398	0.0328
8.2222	0.0563	0.0478	0.0394
7.1905	0.0656	0.0558	0.0459
6.6667	0.0750	0.0638	0.0525
5.4815	0.0844	0.0717	0.0591
5.5333	0.0938	0.0797	0.0656
4.7576	0.1031	0.0877	0.0722
7.1111	0.1125	0.0956	0.0788
6.5641	0.1279	0.1036	0.0853
6.0952	0.1313	0.1116	0.0919
5.6889	0.1406	0.1195	0.0984
5.3333	0.1500	0.1275	0.105
5.0196	0.1594	0.1355	0.1116
4.7407	0.1688	0.1434	0.1181
4.4912	0.1781	0.1514	0.1247
4.2667	0.1875	0.1594	0.1313
4.0635	0.1969	0.1673	0.1378
3.8788	0.2063	0.1753	0.1444

24 Spline			
Diam. Pitch	Deep H	Inter. H	Shallow H
32	0.0281	0.0225	0.0169
25.6	0.0352	0.0281	0.0211
21.3333	0.0422	0.0338	0.0253
18.2857	0.0492	0.0394	0.0295
16	0.0563	0.0450	0.0338
14.2222	0.0633	0.0506	0.038
12.8	0.0703	0.0563	0.0422
11.6364	0.0773	0.0619	0.0464
10.6667	0.0844	0.0675	0.0506
9.8462	0.0914	0.0731	0.0548
9.1429	0.0984	0.0788	0.0591
8.5333	0.1055	0.0844	0.0633
8	0.1125	0.0900	0.0675
7.5294	0.1195	0.0956	0.0717
7.1111	0.1266	0.1013	0.0759
6.7368	0.1316	0.1069	0.0802
6.4	0.1406	0.1125	0.0844
6.0952	0.1477	0.1181	0.0886
5.8182	0.1547	0.1238	0.0928

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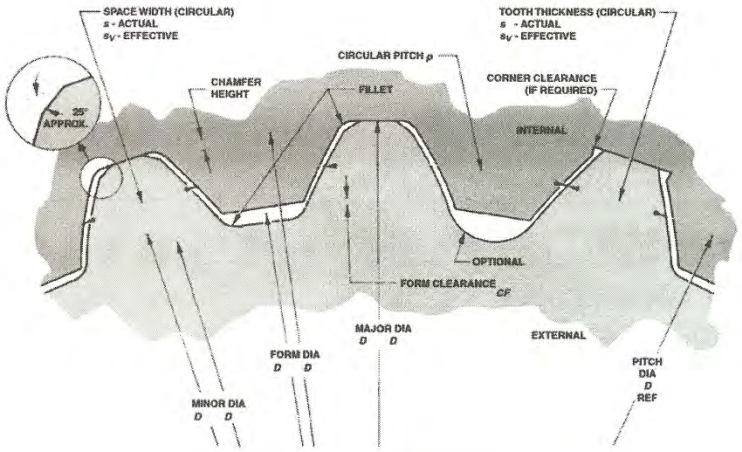
ANSI B92.1-1970

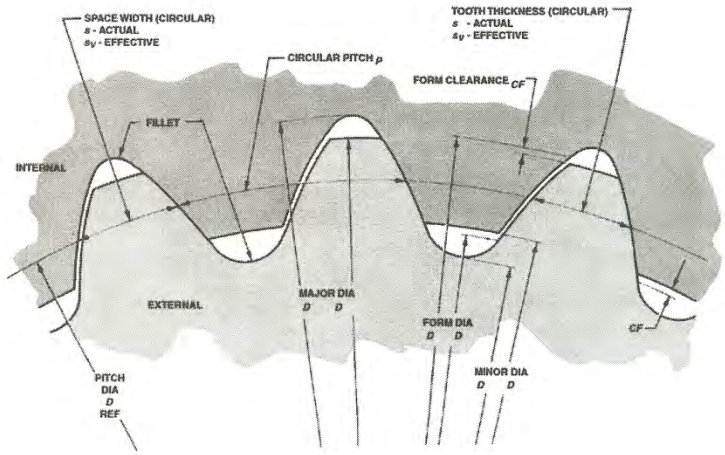
FLAT ROOT MAJOR DIAMETER FIT 30˚ PA

For DP 3/6 thru 16/32



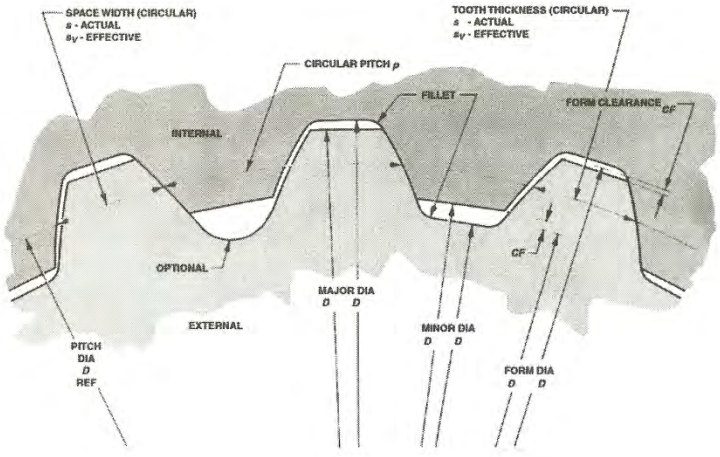
FILLET ROOT SIDE FIT 30˚ PA

For DP 2.5/5 thru 48/96



FLAT ROOT SIDE FIT 30˚ PA

For DP 2.5/5 thru 32/64



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ANSI **B92.1-1970 FORMULAS FOR THE BASIC DIMENSIONS 30°, 37.5°& 45° PA**

Terms & Symbols	30° Spline			37.5° Spline	45° Spline
	Flat Root Side Fit 2.5/5 thru 32/64 Pitch	Flat Root Major Dia. Fit 3/6 thru 16/32 Pitch	Fillet Root Side Fit 2.5/5 thru 48/96 Pitch	Fillet Root Side Fit 2.5/5 thru 48/96 Pitch	Fillet Root Side Fit 10/20 thru 128/256 Pitch
Stub Pitch (Ps)	2P	2P	2P	2P	2P
Pitch Diameter (D)	$\frac{N}{P}$	$\frac{N}{P}$	$\frac{N}{P}$	$\frac{N}{P}$	$\frac{N}{P}$
Base Diameter (Db)	$D \cos j_\Phi$	$D \cos j_\Phi$	$D \cos j_\Phi$	$D \cos j_\Phi$	$D \cos j_\Phi$
Circular Pitch (P)	$\frac{\pi}{P}$	$\frac{\pi}{P}$	$\frac{\pi}{P}$	$\frac{\pi}{P}$	$\frac{\pi}{P}$
Min. Effective Space Width (Sv)	$\frac{\pi}{2P}$	$\frac{\pi}{2P}$	$\frac{\pi}{2P}$	$\frac{5\pi + 0.1}{P}$	$\frac{5\pi + 0.2}{P}$
Major Diameter Internal (Dri)	$\frac{N + 1.35}{P}$	$\frac{N + 1}{P}$	$\frac{N + 1.8}{P}$	$\frac{N + 1.6}{P}$	$\frac{N + 1.4}{P}$
Major Diameter External (Do)	$\frac{N + 1}{P}$	$\frac{N + 1}{P}$	$\frac{N + 1}{P}$	$\frac{N + 1}{P}$	$\frac{N + 1}{P}$
Minor Diameter Internal (Di)	$\frac{N - 1}{P}$	$\frac{N - 1}{P}$	$\frac{N - 1}{P}$	$\frac{N - 0.8}{P}$	$\frac{N - 0.6}{P}$
Minor Diameter External (Dre) — 2.5/5 thru 12/24 Pitch	$\frac{N + 1.35}{P}$		$\frac{N - 1.8}{P}$	$\frac{N - 1.3}{P}$	
Minor Diameter External (Dre) — 16/32 Pitch & Finer			$\frac{N - 2}{P}$		
Minor Diameter External (Dre) — 10/20 Pitch & Finer					$\frac{N - 1}{P}$
Form Diameter Internal (Dfi)	$\frac{N + 1}{P} + 2cf$	$\frac{N + 0.8}{P} + 2cf$	$\frac{N + 1}{P} + 2cf$	$\frac{N + 1}{P} + 2cf$	$\frac{N + 1}{P} + 2cf$
Form Diameter External (Dfe)	$\frac{N - 1}{P} + 2cf$	$\frac{N - 1}{P} + 2cf$	$\frac{N - 1}{P} + 2cf$	$\frac{N - 1}{P} + 2cf$	$\frac{N - 1}{P} + 2cf$
Form Clearance (Radial) (cf)	0.001 D with Max of 0.010, Min of 0.002				

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ANSI B92.1-1970
MAXIMUM TOLERANCEFOR SPACE WIDTH ANDTOOTH THICKNESS OF TOLERANCE CLASS 5 SPLINES

For other tolerances classes:
values in ten thousands
(20 = .002)

lass 4 = 0.71 x Tabulated value

Class 5 = 0.00 x Tabulated value

Class 6 = 1.40 x Tabulated value

Class 7 = 2.00 x Tabulated value

P/Ps	2.5/5 and 3/6	4/8and 5/10	6/12 and 8/16	10/20 and 12/24	16/32 and 20/40	24/48 and 48/96	64/128 and 48/96	128/256
N	**Machining Tolerances, m**							
10	15.8	14.5	12.5	12	11.7	11.7	9.6	9.5
20	17.6	16	14	13	12.4	12.4	10.2	10
30	18.4	17.5	15.5	14	13.1	13.1	10.8	10.5
40	21.8	19	17	15	13.8	13.8	11.4	-
50	23	20.5	18.5	16	14.5	14.5	-	-
60	24.8	22	20	17	15.2	15.2	-	-
70	-	-	-	18	15.9	15.9	-	-
80	-	-	-	19	16.6	16.6	-	-
90	-	-	-	20	17.3	17.3	-	-
100	-	-	-	21	18	18	-	-
N	**Variation Allowance, Y**							
10	23.5	20.3	17	15.7	14.2	12.2	11	9.8
20	27	22.6	19	17.4	15.4	13.4	12	10.6
30	30.5	24.9	21	19.1	16.6	14.6	13	11.4
40	34	27.2	23	21.6	17.8	15.8	14	-
50	37.5	29.5	25	22.5	19	17	-	-
60	41	31.8	27	24.2	20.2	18.2	-	-
70	-	-	-	25.9	21.4	19.4	-	-
80	-	-	-	27.6	22.6	20.6	-	-
90	-	-	-	29.3	23.8	21.8	-	-
100	-	-	-	31	25	23	-	-
N	**Total Index Variation**							
10	20	17	15	15	14	12	11	10
20	24	20	18	17	15	13	12	11
30	28	22	20	19	16	15	14	13
40	32	25	22	20	18	16	15	-
50	36	27	25	22	19	17	-	-
60	40	30	27	24	20	18	-	-
70	-	-	-	26	21	20	-	-
80	-	-	-	28	22	21	-	-
90	-	-	-	29	24	23	-	-
100	-	-	-	31	25	24	-	-
N	**Profile Variation**							
ALL	7 -10	6 -8	5 -7	4 -6	3 -5	2 -4	2 -4	2 -4

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ANSI B92.1 – 1970INTERCHANGABILITY

Splines made to ANSI B92-1-1970 will generally be interchange with spline made to older standards. However the exceptions are listed below:

External Splines & Internal Splines
These will mate with older internal splines as follows:

Exceptions:

A. **The external major diameter, unless chamfered or reduced, may interfere with the internal form diameter on flat root side fit splines. Internal splines made to the 1957 and 1960 standards had the same dimensions as shown for the major diameter fit splines in this standard.**
B. **For 15 teeth or less, the minor diameter of the internal spline, unless chamfered, will interfere with the form diameter of the external spline.**
C. **For 9 teeth or less, the minor diameter of the internal spline, unless chamfered, will interfere with the external form diameter.**
D. **The internal minor diameter, unless chamfered, will interfere with the external form diameter.**
E. **The internal minor diameter, unless chamfered, will interfere with the external form diameter.**
F. **For 10 teeth or less, the minimum chamfer on the major diameter of the external splines may not clear the internal for diameter.**

Depending upon the pitch of the spline, the minimum character on the major diameter may not clear the internal form diameter.

Spline	m	y
2.5/5 & 3/6	.18N + 14	.35N + 20
4/8 & 5/10	.15N+13	.23N + 18
6/12 & 8/16	.15N + 11	.20N + 15
10/20 & 12/24	.10N + 11	.17N + 14
16/31 & 20/40	.07N + 11	.12N + 13
24/48 & thru 48/96	.07N + 11	.12N + 11
64/128 & 80/160	.06N + 9	.10N + 10
128/256	.05N + 9	.08N + 9

Formulas for machining and variation allowances for space width and tooth thickness - class 5

Year	Major Dia. Fit	Flat Root Fit	Fillet Root Side Fit
External Splines			
1946	Yes	No (A)	No (A)
1950a	Yes (B)	Yes (B)	Yes (C)
1950b	Yes(B)	No (A)	Yes (C)
1957SAE	Yes	No (A)	Yes (C)
1960	Yes	No (A)	Yes (C)
Internal Splines			
1946	No (D)a	No (E)	No (D)
1950	Yes (F)	Yes	Yes (C)
1957SAE	Yes (G)	Yes	Yes
1960	Yes (G)	Yes	Yes

For other tolerances classes:
Class 4 = 0.71 x Tabulated value Class 5 = 0.00 x Tabulated value
Class 6 = 1.40 x Tabulated value Class 7 = 2.00 x Tabulated value

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INTERNAL MAJOR DIAMETERS 8/16 DP & 10/20 DP, 30° PA

8/16 DP

# of Splines	Minor Diam.	Major Diameter			# of Splines	Minor Diam.	Major Diameter		
		Flat Root Major diam. Fit	Flat Root Side Fit	Fillet Root Side Fit			Flat Root Major diam. Fit	Flat Root Side Fit	Fillet Root Side Fit
6	664	0.875	0.923	0.997	26	3.125	3.75	3.423	3.5
7	.777/.772	1	1.048	1.122	27	3.25	3.5	3.548	3.625
8	.896/.886	1.125	1.173	1.247	28	3.375	3.625	3.673	3.75
9	1.016/1.005	1.25	1.298	1.373	29	3.5	3.75	3.798	3.875
10	1.138/1.125	1.375	1.423	1.498	30	3.625	3.875	3.923	4
11	1.260/1.250	1.5	1.548	1.623	31	3.75	4	4.048	4.125
12	1.383/1.375	1.625	1.673	1.748	32	3.875	4.125	4.173	4.25
13	1.506/1.500	1.75	1.798	1.873	33	4	4.25	4.298	4.376
14	1.629/1.625	1.875	1.923	1.998	34	4.125	4.375	4.423	4.501
15	1.753/1.750	2	2.048	2.123	35	4.25	4.5	4.548	4.626
16	1.877/1.875	2.125	2.173	2.248	36	4.375	4.625	4.673	4.751
17	2.001/2.000	2.25	2.298	2.374	37	4.5	4.75	4.798	4.876
18	2.125	2.375	2.423	2.499	38	4.625	4.875	4.923	5.001
19	2.25	2.5	2.548	2.624	39	4.75	5	5.048	5.126
20	2.375	2.625	2.673	2.749	40	4.875	5.125	5.173	5.251
21	2.5	2.75	2.798	2.874	41	5	5.25	5.298	5.376
22	2.625	2.875	2.923	2.999	42	5.125	5.375	5.423	5.502
23	2.75	3	3.048	3.124	43	5.25	5.5	5.548	5.627
24	2.875	3.125	3.173	3.249	44	5.375	5.625	5.673	5.752
25	3	3.25	3.298	3.375	45	5.5	5.75	5.798	5.877

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INTERNAL MAJOR DIAMETERS 8/16 DP & 10/20 DP, 30° PA

10/20 DP

# of Splines	Minor Diam.	Major Diameter			# of Splines	Minor Diam.	Major Diameter		
		Flat Root Major Diam. Fit	Flat Root Side Fit	Fillet Root Side Fit			Flat Root Major Diam. Fit	Flat Root Side Fit	Fillet Root Side Fit
6	0.534	0.7	0.739	0.779	26	2.5	2.7	2.739	2.801
7	.622/.621	0.8	0.839	0.889	27	2.6	2.8	2.839	2.901
8	.717/.710	0.9	0.939	0.999	28	2.7	2.9	2.939	3.001
9	.814/.805	1	1.039	1.1	29	2.8	3	3.039	3.101
10	.911/.901	1.1	1.139	1.2	30	2.9	3.1	3.139	3.201
11	1.008/1.000	1.2	1.239	1.3	31	3	3.2	3.239	3.302
12	1.107/1.100	1.3	1.339	1.4	32	3.1	3.3	3.339	3.402
13	1.205/1.200	1.4	1.439	1.5	33	3.2	3.4	3.439	3.502
14	1.304/1.300	1.5	1.539	1.6	34	3.3	3.5	3.539	3.602
15	1.403/1.400	1.6	1.639	1.7	35	3.4	3.6	3.639	3.702
16	1.502/1.500	1.7	1.739	1.8	36	3.5	3.7	3.739	3.802
17	1.601/1.600	1.8	1.839	1.9	37	3.601	3.8	3.839	3.902
18	1.7	1.9	1.939	2	38	3.7	3.9	3.939	4.002
19	1.8	2	2.039	2.1	39	3.8	4	4.039	4.102
20	1.9	2.1	2.139	2.201	40	3.9	4.1	4.139	4.202
21	2	2.2	2.239	2.301	41	4	4.2	4.239	4.302
22	2.1	2.3	2.339	2.401	42	4.1	4.3	4.339	4.403
23	2.2	2.4	2.439	2.501	43	4.2	4.4	4.439	4.503
24	2.3	2.5	2.539	2.601	44	4.3	4.5	4.539	4.603
25	2.4	2.6	2.639	2.701	45	4.4	4.6	4.639	4.703

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INTERNAL MAJOR DIAMETERS 12/24 DP &16/32 DP, 30° PA

12/24 DP

# of Splines	Minor diam.	Major diameters		
		Flat Root Major Diam. Fit	Flat Root Side Fit	Fillet Root Side Fit
6	0.448	0.5834	0.617	0.668
7	0.520	0.6667	0.700	0.751
8	0.598/0.592	0.7500	0.783	0.834
9	0.678/0.672	0.8334	0.867	0.918
10	0.759/0.752	0.9167	0.950	1.001
11	0.841/0.834	1.0000	1.033	1.085
12	0.922/0.917	1.0834	1.117	1.168
13	1.005/1.000	1.1667	1.200	1.252
14	1.087/1.084	1.2500	1.283	1.335
15	1.169/1.167	1.3334	1.367	1.418
16	1.252/1.250	1.4167	1.450	1.502
17	1.334	1.5000	1.533	1.585
18	1.417	1.5834	1.617	1.669
19	1.500	1.6667	1.700	1.752
20	1.584	1.7500	1.783	1.836
21	1.667	1.8334	1.867	1.919
22	1.750	1.9167	1.950	2.002
23	1.834	2.0000	2.033	2.086
24	1.917	2.0834	2.117	2.169
25	2.000	2.1667	2.200	2.253
26	2.084	2.2500	2.283	2.336
27	2.167	2.3334	2.367	2.420
28	2.250	2.4167	2.450	2.503
29	2.334	2.5000	2.533	2.586
30	2.417	2.5834	2.617	2.670
31	2.500	2.6667	2.700	2.753
32	2.584	2.7500	2.783	2.837
33	2.667	2.8334	2.867	2.920
34	2.750	2.9167	2.950	3.004
35	2.834	3.0000	3.033	3.087
36	2.917	3.0834	3.117	3.170
37	3.000	3.1667	3.200	3.254
38	3.084	3.2500	3.283	3.337
39	3.167	3.3334	3.367	3.421
40	3.250	3.4167	3.450	3.504
41	3.334	3.5000	3.533	3.587
42	3.417	3.5834	3.617	3.671
43	3.500	3.6667	3.700	3.754
44	3.584	3.7500	3.783	3.838
45	3.667	3.8334	3.867	3.921

16/32 DP

# of Splines	Minor diam.	Major diameters		
		Flat Root Major Diam. Fit	Flat Root Side Fit	Fillet Root Side Fit
6	0.339	0.4375	0.463	0.502
7	0.393	0.5000	0.526	0.565
8	0.449/0.448	0.5625	0.588	0.628
9	0.509/0.505	0.6250	0.651	0.690
10	0.570/0.565	0.6875	0.713	0.753
11	0.631/0.625	0.7500	0.776	0.815
12	0.692/0.688	0.8125	0.838	0.878
13	0.754/0.750	0.8750	0.901	0.940
14	0.815/0.813	0.9375	0.963	1.003
15	0.877/0.875	1.0000	1.026	1.066
16	0.939/0.938	1.0625	1.088	1.128
17	1.001/1.000	1.1250	1.151	1.191
18	1.063	1.1875	1.213	1.253
19	1.125	1.2500	1.276	1.316
20	1.188	1.3125	1.338	1.378
21	1.250	1.3750	1.401	1.441
22	1.313	1.4375	1.463	1.504
23	1.375	1.5000	1.526	1.566
24	1.438	1.5625	1.588	1.629
25	1.500	1.6250	1.651	1.691
26	1.563	1.6875	1.713	1.754
27	1.625	1.7500	1.776	1.816
28	1.688	1.8750	1.838	1.879
29	1.750	1.8750	1.901	1.941
30	1.813	1.9375	1.961	2.004
31	1.875	2.0000	2.026	2.067
32	1.938	2.0625	2.088	2.129
33	2.000	2.1250	2.151	2.192
34	2.063	2.1875	2.213	2.254
35	2.125	2.2500	2.276	2.317
36	2.188	2.3125	2.338	2.379
37	2.250	2.3750	2.401	2.442
38	2.313	2.4375	2.463	2.505
39	2.375	2.5000	2.526	2.567
40	2.438	2.5625	2.588	2.630
41	2.500	2.6250	2.651	2.692
42	2.563	2.6875	2.713	2.755
43	2.625	2.7500	2.776	2.817
44	2.688	2.8125	2.838	2.880
45	2.750	2.8750	2.901	2.943

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INTERNAL MAJOR DIAMETERS 37 ½°& 45° PA – Full Fillet Side Fit

37-1/2°

# of Teeth	10/20 DP		12/24 DP		16/32 DP	
	Minor diam.	Major diam.	Minor diam.	Major diam.	Minor diam.	Major diam.
6	0.525	0.777	0.438	0.649	0.330	0.488
7	0.620	0.877	0.517	0.732	0.388	0.550
8	0.720	0.977	0.600	0.815	0.451	0.613
9	0.820	1.077	0.684	0.899	0.513	0.675
10	0.920	1.177	0.767	0.982	0.575	0.738
11	1.020	1.277	0.851	1.066	0.638	0.801
12	1.120	1.377	0.934	1.149	0.700	0.863
13	1.220	1.477	1.017	1.232	0.763	0.926
14	1.320	1.578	1.100	1.316	0.825	0.988
15	1.420	1.678	1.184	1.399	0.888	1.051
16	1.520	1.778	1.267	1.483	0.950	1.113
17	1.620	1.878	1.350	1.566	1.013	1.176
18	1.720	1.978	1.434	1.649	1.075	1.238
19	1.820	2.078	1.517	1.733	1.138	1.301
20	1.920	2.178	1.600	1.816	1.200	1.363
21	2.020	2.278	1.684	1.900	1.263	1.426
22	2.120	2.378	1.767	1.983	1.325	1.489
23	2.220	2.478	1.850	2.066	1.388	1.551
24	2.320	2.578	1.934	2.150	1.450	1.614
25	2.420	2.678	2.017	2.233	1.513	1.676
26	2.520	2.778	2.100	2.317	1.575	1.739
27	2.620	2.878	2.184	2.400	1.638	1.801
28	2.720	2.978	2.267	2.483	1.700	1.864
29	2.820	3.079	2.350	2.567	1.763	1.926
30	2.920	3.179	2.434	2.650	1.825	1.989
31	3.020	3.279	2.517	2.734	1.888	2.052
32	3.120	3.379	2.601	2.817	1.950	2.114
33	3.221	3.479	2.684	2.901	2.013	2.177
34	3.321	3.579	2.767	2.984	2.075	2.239
35	3.421	3.679	2.851	3.067	2.138	2.302
36	3.521	3.779	2.934	3.151	2.200	2.364
37	3.621	3.879	3.017	3.234	2.263	2.427
38	3.721	3.979	3.100	3.318	2.325	2.489
39	3.821	4.079	3.184	3.401	2.388	2.552
40	3.921	4.179	3.267	3.484	2.450	2.614
41	4.020	4.279	3.350	3.568	2.513	2.677
42	4.120	4.379	3.434	3.651	2.575	2.740
43	4.220	4.479	3.517	3.735	2.638	2.802
44	4.320	4.579	3.601	3.818	2.700	2.865
45	4.420	4.679	3.684	3.901	2.763	2.927

45°

# of Teeth	10/20 DP		12/24 DP		16/32 DP	
	Minor diam.	Major diam.	Minor diam.	Major diam.	Minor diam.	Major diam.
6	0.540	0.755	0.450	0.630	0.338	0.474
7	0.640	0.855	0.534	0.714	0.400	0.536
8	0.740	0.955	0.617	0.797	0.463	0.599
9	0.840	1.055	0.700	0.880	0.525	0.661
10	0.940	1.156	0.784	0.964	0.588	0.724
11	1.040	1.256	0.868	1.047	0.650	0.786
12	1.140	1.356	0.950	1.131	0.713	0.849
13	1.240	1.456	1.034	1.214	0.775	0.912
14	1.340	1.556	1.117	1.297	0.838	0.974
15	1.440	1.656	1.200	1.381	0.900	1.037
16	1.540	1.756	1.284	1.464	0.963	1.099
17	1.640	1.856	1.367	1.548	1.025	1.162
18	1.740	1.956	1.450	1.631	1.088	1.224
19	1.840	2.056	1.534	1.714	1.150	1.287
20	1.940	2.156	1.617	1.798	1.213	1.349
21	2.040	2.256	1.700	1.881	1.275	1.412
22	2.140	2.356	1.784	1.965	1.338	1.474
23	2.240	2.456	1.867	2.048	1.400	1.537
24	2.340	2.556	1.950	2.131	1.463	1.599
25	2.440	2.656	2.034	2.215	1.525	1.662
26	2.540	2.756	2.117	2.298	1.588	1.725
27	2.640	2.856	2.200	2.381	1.650	1.787
28	2.740	2.957	2.284	2.465	1.713	1.850
29	2.840	3.057	2.367	2.548	1.775	1.912
30	2.940	3.157	2.450	2.632	1.838	1.975
31	3.040	3.257	2.534	2.715	1.900	2.037
32	3.140	3.357	2.617	2.798	1.963	2.100
33	3.240	3.457	2.700	2.882	2.025	2.162
34	3.340	3.557	2.784	2.965	2.088	2.225
35	3.440	3.657	2.867	3.049	2.150	2.287
36	3.540	3.757	2.950	3.132	2.213	2.350
37	3.640	3.857	3.034	3.215	2.275	2.412
38	3.740	3.957	3.117	3.299	2.338	2.475
39	3.840	4.057	3.200	3.382	2.400	2.538
40	3.940	4.157	3.284	3.465	2.463	2.600
41	4.040	4.257	3.367	3.549	2.525	2.663
42	4.140	4.357	3.450	3.632	2.588	2.725
43	4.240	4.457	3.534	3.716	2.650	2.788
44	4.340	4.557	3.617	3.799	2.713	2.850
45	4.440	4.657	3.700	3.882	2.775	2.220

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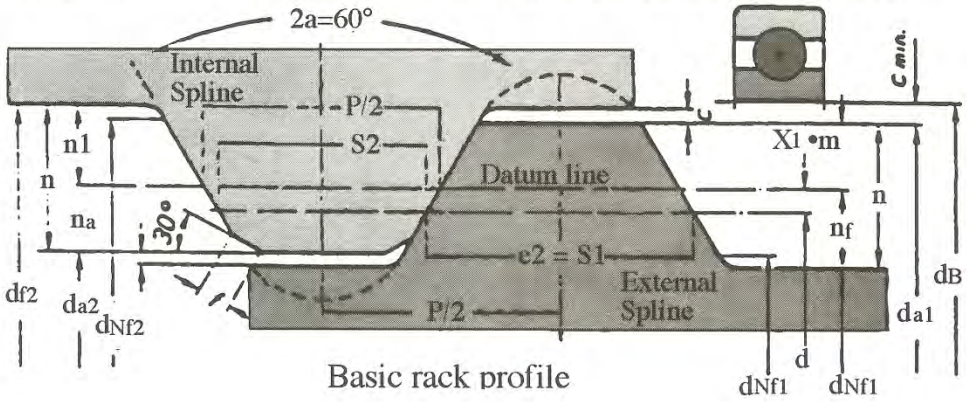
MODULE-DIN 5480 FLAT ROOT INVOLUTE SPLINES

The modules covered by this standard are:
(0/6) - 0.8 - (1) - 1.25 - (1.5) - 2 (2.5) - 3 - (4) - 5 - (6) - 8 - (10).
Modules in parentheses should be avoided wherever possible, when designing or selecting a spline connection.
Involute splines according to this Standard are used for easily detachable, sliding or tight connections between shaft and hub by a stub tooth system showing the characteristic required for the transmission of torque and for centering and also meeting the requirements for economic production.
Tooth proportions of the external and internal spline are determined by the basis rack profile, the reference diameter d_B and the number of teeth z. The latter is selected in such a way that the addendum modifications necessary to meet the reference diameter remain limited to smallest values and that the mean pressure angles will be kept close to 30°, which is expedient for self centering, accurate finish and low compressive stresses. The dedendum, h_f or the tool addendum h_{a^*} are adjusted to the production techniques so that involve lengths corresponding to the form diameter are quaranteed.



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Basic Rack Profile

Module		m	
Pitch		p	= m • π
Pressure Angle		μ	= 300
No. of teeth	External Spline	z1	
	Internal Spline	z2	= z1
Addendum Modification	External Spline	x1	= - 0.05 • m to + 0.45 • m
	Internal Spline	x2	= x1 • m = + 0.05 • m to + 0.45 • m
Tooth Depth		h	= ha + hf
Addendum		ha	= 0.45 • m
Dedendum		hf	= hao, see DIN 5480 pt. 16 = 0.05 • m. min. dimension, special tools = 0.60 • m, universal hob = 0.65 • m, universal pinion-type cutter2
Tip Clearence		c	= hf - 0.45 • m = 0.1 • m to 0.2 • m
Fillet Radius		gt	= 0.16 • m (min dimension)
Tip chamfer of broached spline		f	= 0.15 • m
Pitch Diameter		d	= m • z
Base Diameter		db	= m • z • cos μ
Reference Diameter		dB	= [df2] min dimension = = [m • z2 + 2x2 • m - 1.1 • m] = standard diameter DIN 323 & bearing bore diiam.
Internal spline Major diam.		df2	= m • z2 + 2x2 • m 2hf2
Internal spline Minor diam.		da2	= m • z2 + 2x2 • m + 0.9 • m
Internal spline Form diam.		dnf2 max	= - (da1 + fr) with Fr according to DIN 5480 pt.14 quality 11
External spline Major diam.		da1	= m • z1 + 2x1 • 2hf2
External spline Minor diam.		df2	= m • z1 + 2x1 • m + 0.9 • m
External spline Form diam.		dNf1 max	= - (da1 + fr) with Fr according to DIN 5480 pt. 14 quality 11
Internal Tooth Thickness		S2	= m • π/2 + 2x2 * m tan μ
Internal space width		e2	= s1
Internal Tooth Thickness		s1	= m • π/2 + 2x1 • m tan μ

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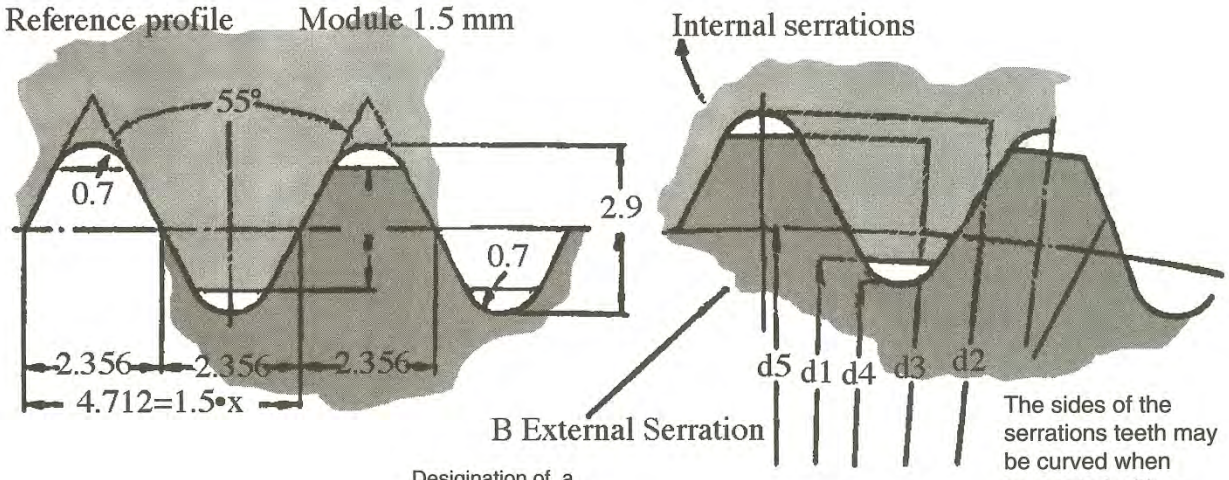
DIN 5481 SERRATION — 55° INCLUDED

Nom. Dia.	D_1			D_2	D_3			D_4	D_5	Z
	Nom. Dim.	Max.	Min.	Calc.	Nom. Dim.	Max.	Min.	Calc.		No. of Teeth
65x60	60	60.53	60.34	65.4	65	64.66	64.47	59.6	61.5[4)]	41
70x65	65	65.53	65.34	70.4	70	69.64	69.45	64.6	67.5	45
75x70	70	70.55	70.36	75.4	75	74.64	74.45	69.6	72[4)]	48
80x75	75	75.55	75.36	80.4	80	79.64	79.45	74.6	76.5[4)]	51
85x80	80	80.55	80.36	85.4	85	84.62	84.4	79.6	82.5	55
90x85	85	85.60	85.38	90.4	90	89.62	89.4	84.6	87[4)]	58
95x90	90	90.60	90.38	95.4	95	94.62	94.4	89.4	91.5[4)]	61
100x95	95	95.60	95.38	100.4	100	99.62	99.4	26.40	97.5	65
105x100	100	100.60	100.38	105.4	105	104.59	104.37	30.38	102[4)]	68
110x150	100	105.63	105.41	110.4	110	109.59	109.37	104.6	106.5[4)]	71
115x110	105	110.63	110.41	115.4	115	114.59	114.37	109.6	112.5	75
120x115	110	115.63	115.41	120.4	120	119.59	119.37	114.6	117[4)]	78
125x120	120	120.63	120.41	125.4	125	124.54	124.37	119.6	121.5[4)]	81

NOTE: all dimensions in mm

Serrations with 55° internal from angle nominal diameter 60 x 65 to 120 x 125.



Designation of a serration of nominal diameter 75x80: serration 75x80 DIN 5481.

The sides of the serrations teeth may be curved when generated with a straight-sided hob.

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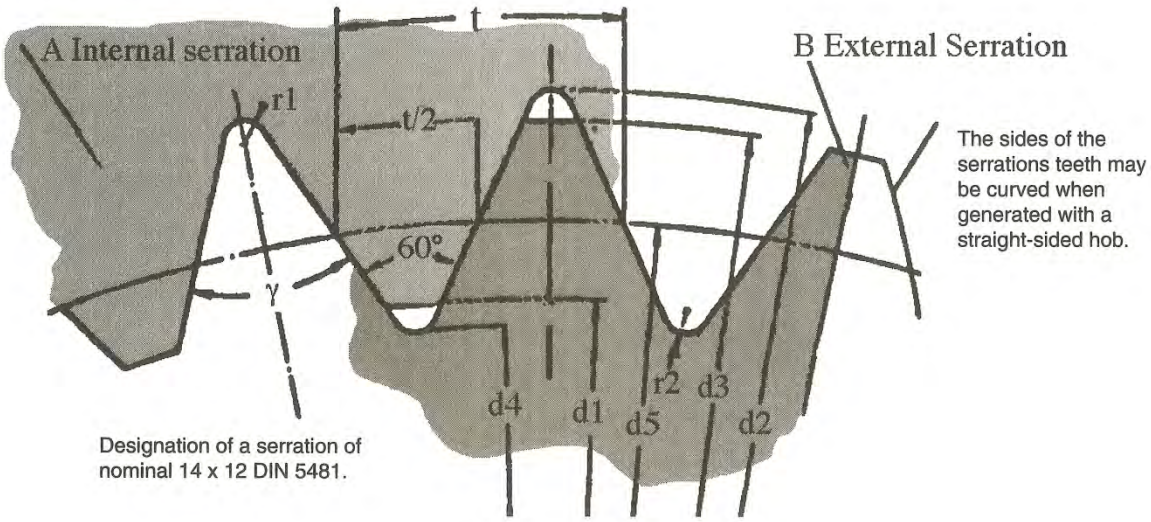
DIN 5481 SERRATION - 60° INCLUDED

Nom. Dia.	D1 Nom. Dim.	D1 Max.	D1 Min.	D2 Calc.	D3 Nom. Dim.	D3 Max.	D3 Min.	D4 Calc.	D5	R1 =	R2 =	T Calc. for D5	Inc Angle γ	Z No. of Teeth
8X7	6.9	7.27	7.18	8.21	8.1	7.82	7.73	6.91	7.5	0.08	0.08	0.842	47°8'35"	28
10X8	8.1	8.47	8.38	9.9	10.1	9.81	9.70	8.26	9	0.08	0.08	1.010	47°8'35"	28
12X10	10.1	10.5	10.39	12	12	11.71	11.60	10.2	11	0.1	0.1	1.152	48°	30
14X12	12	12.4	12.29	14.18	14.2	13.91	13.80	12.06	13	0.1	0.1	1.317	48°23'14"	31
17X15	14.9	15.3	15.19	17.28	17.2	16.91	16.80	14.91	16	0.15	0.15	1.571	48°45'	32
20X17	17.3	17.7	17.59	20	20	19.7	19.57	17.37	18.5	0.15	0.2	1.761	49°5'27"	33
24X21	20.8	21.23	21.1	23.76	23.9	23.6	23.47	20.76	22	0.15	0.25	2.033	49°24'42"	34
30X26	26.5	26.93	26.8	30.06	30	29.7	29.57	26.40	28	0.25	0.3	2.513	49°42'52"	35
34X30	30.5	30.97	30.81	34.17	34	33.69	33.53	30.38	32	0.3	0.4	2.792	50°	36
40X36	36	36.47	36.31	40.16	39.9	39.59	39.43	35.95	38	0.5	0.4	3.226	50°16'13"	37
45X40	40	40.47	40.31	44.42	44	43.68	43.52	39.72	42	0.5	0.4	3.472	50°31'35"	38
50X45	45	45.48	45.32	50.2	50	49.68	49.52	44.97	47.5	0.5	0.4	3.472	50°46'9"	39
55X50	50	50.48	50.32	55.25	54.9	54.56	54.37	49.72	52.5	0.6	0.4	4.123	51°	40
60X55	55	55.53	55.34	60.39	60	59.66	59.47	54.76	57.5	0.6	0.5	4.301	51°25'43"	42

NOTE: all dimensions in mm

Serrations with 60° internal from angle nominal diameter 7 x 8 to 55 x 60.



The sides of the serrations teeth may be curved when generated with a straight-sided hob.

Designation of a serration of nominal 14 x 12 DIN 5481.

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INVOLUTE SPLINE FOR AUTOMOBILES (JAPANESE INDUSTRIAL STANDARD)

This standard is based on straight (non-helical) involute splines and are mainly in automobile mechanisms, specifically for coupling driving shafts and mating parts. They are based on 20˚ stub tooth form and provide a smooth transmission of torque.

1. Module

Consists of the following 15 modules classified in 3 series.

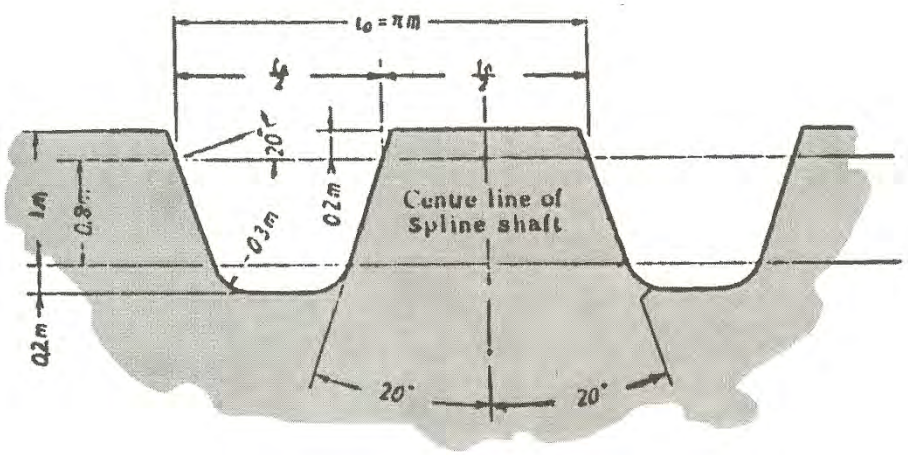
(1) 1 st series 0.5 1 1.25 1.667 2.5 5 10
(2) 2nd series 0.75 3.75 7.5
(3) 3rd series 1.5 2 3 4.5 6

Remarks: The modules is the 1st and the 2nd series are equal to the numerical valve of 10 and 7.5 divided by integers respectively, and are same as those in the ISO draft. Most of the nominal diameters of shafts for which these series are used coincide with the nominal inner diameters of radial ball and roller bearings.

The modules in the 3rd series are those providing the intermediate figures between two modules with a large step in the 1st and the 2nd series. The number of teeth is from 6 to 40.

2. Basic Form of Tooth

The tooth form of basic rack for spline shafts is shown in Fig. 1



In Fig.1 the standard pitch line is the pitch line specified so that the tooth thickness measured along the line is one half of the basic pitch.

The tip of basic rack is distant by 0.2 from standard pitch line.

The effective height of tooth of spline is equal to 1 m. When the shaft and the hole are meshed, the minimum radial clearance between two minor diameters is 0.2, and the root radius is 0.3m considering the amount of radial clearance.

Remarks
1. The elements of the spline hole is defined from those of the spline shaft.
2. The distance between the standard pitch line and the generating pitch line is the amount of profile shifting.

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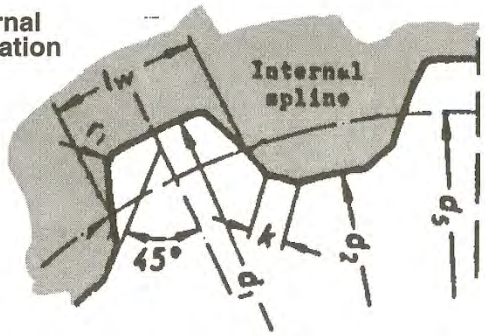
MODULE-DIN 5482 INVOLUTE SPLINE PROFILE DIMENSIONS

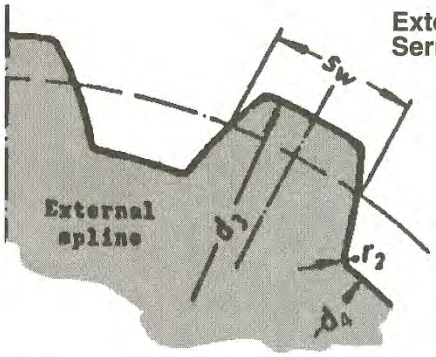
Internal Serration



Pressure Angle 30°

All Dimensions in MM

External Serration



Designation of an internal spline A of norminal dimensions 25 x 22:
Internal spline A 25 x 22 DIN 5482

Designation of an internal spline B of norminal dimensions 25 x 22:
Internal spline B 25 x 22 DIN 5482

Nom. Profile Dim.	D1 H12	D2 H11	D3 H11	D4	D5	No. of Teeth	Mod. M	Profile Displace-ment	LW=SW Nom. Dim.	R1 Max	R2 Max	K Min
15X12	15	12	14.5	11.5	12.8	8		+0.500	3.090	0.15	0.25	0.3
17X14	17	14	16.5	13.5	14.4	9		+0.700	3.321	0.15	0.25	0.3
18X15	18	15	17.5	14.5	16.0	10	1.60	+0.400	2.975	0.15	0.25	0.3
20X17	20	17	19.5	16.5	19.20	12		-0.200	2.282	0.15	0.25	0.3
22X19	22	19	21.5	18.5	20.80	13		0	2.513	0.15	0.25	0.3
25X22	25	22	24.5	21.2	22.40	14		+0.550	3.148	0.15	0.25	0.3
28X25	28	25	27.5	24.5	26.25	15		+0.302	3.098	0.15	0.25	0.3
30X27	30	27	29.5	26.3	28.00	16	1.75	+0.327	3.127	0.15	0.25	0.3
32X28	32	28	31.5	27.6	29.75	17		+0.102	2.867	0.15	0.25	0.3
35x31	35	31	34.5	30.5	31.50	18		+0.675	3.530	0.15	0.25	0.3
38x34	38	34	37.5	33.5	36.10	19		0	2.985	0.15	0.25	0.3
40x36	40	36	39.5	35.5	38.00	20	1.90	+0.049	3.042	0.15	0.25	0.3
42x38	42	38	41.5	37.5	39.90	21		+0.099	3.100	0.15	0.25	0.3
45x41	45	41	44.5	40.6	44.00	22		-0.181	2.933	0.25	0.35	0.4
48x44	48	44	47.5	43.2	46.00	23		+0.119	3.280	0.25	0.35	0.4
50x45	50	45	49.5	44.6	48.00	24		-0.181	2.933	0.25	0.35	0.4
52x47	52	47	51.5	46.5	50.00	25	2.00	-0.231	2.875	0.25	0.35	0.4
55x50	55	50	54.5	49.0	52.00	26		+0.019	3.164	0.25	0.35	0.4
58x53	58	53	57.5	52.0	54.00	27		+0.518	3.741	0.25	0.35	0.4
60x55	60	55	59.5	54.5	56.00	28		+0.768	4.030	0.25	0.35	0.4

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62x57	62	57	61.5	56.5	60.90	29		-0.434	2.797	0.25	0.45	0.5
65x60	65	60	64.3	59.5	63.00	30		+0.015	3.317	0.35	0.45	0.5
68x62	68	62	67.3	61.5	65.10	31		-0.034	3.259	0.35	0.45	0.5
70x64	70	64	69.3	63.5	67.20	32	2.10	-0.184	3.201	0.35	0.45	0.5
72x66	72	66	71.3	65.5	69.30	33		-0.134	3.144	0.35	0.45	0.5
75x69	75	69	74.3	68.5	71.40	34		+0.315	3.663	0.35	0.45	0.5
78x72	78	72	77.3	71.5	73.50	35		+0.765	4.183	0.35	0.45	0.5
80x74	80	74	79.3	73.5	75.60	36		+0.715	4.125	0.35	0.45	0.5
82x76	82	76	81.3	75.5	83.25	37		-2.425	0.734	0.35	0.45	0.5
85x79	85	79	84.3	78.5	85.50	38		-2.050	1.167	0.35	0.45	0.5
88x82	88	82	87.3	81.5	87.75	39		-1.673	1.600	0.35	0.45	0.5
90x84	90	84	89.3	83.5	90.00	40		-1.799	1.456	0.35	0.45	0.5
92x86	92	86	91.3	85.5	92.25	41	2.25	-1.923	1.311	0.35	0.45	0.5
95x89	95	89	94.3	88.5	94.50	42		-1.549	1.744	0.35	0.45	0.5
98x92	98	92	97.3	91.5	96.75	43		-1.175	2.177	0.35	0.45	0.5
100x94	100	94	99.3	93.5	99.00	44		-1.299	2.033	0.35	0.45	0.5

Note: Internal and external spline profiles according to this standard apply only to orders for replacements. for new designs, spline systems DIN 5480 shoulde be used

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INVOLUTE SPLINE FOR AUTOMOBILES (JAPANESE INDUSTRIAL STANDARD)

This standard is based on straight (non-helical) involute splines and are mainly in automobile mechanisms, specifically for coupling driving shafts and mating parts. They are based on 20˚ stub tooth form and provide a smooth transmission of torque.

1. Module

Consists of the following 15 modules classified in 3 series.

(1) 1 st series 0.5 1 1.25 1.667 2.5 5 10
(2) 2nd series 0.75 3.75 7.5
(3) 3rd series 1.5 2 3 4.5 6

Remarks: The modules is the 1st and the 2nd series are equal to the numerical valve of 10 and 7.5 divided by integers respectively, and are same as those in the ISO draft. Most of the nominal diameters of shafts for which these series are used coincide with the nominal inner diameters of radial ball and roller bearings.

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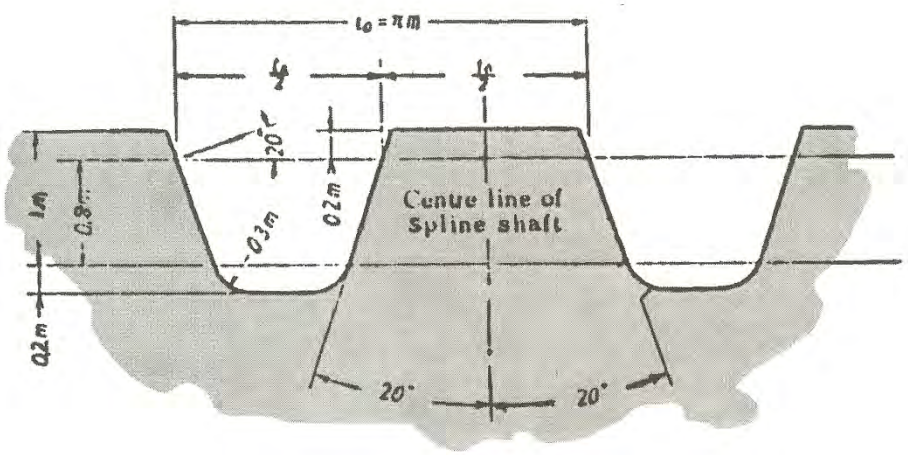
2. Basic Form of Tooth

The tooth form of basic rack for spline shafts is shown in Fig. 1



In Fig.1 the standard pitch line is the pitch line specified so that the tooth thickness measured along the line is one half of the basic pitch.

The tip of basic rack is distant by 0.2 from standard pitch line.

The effective height of tooth of spline is equal to 1 m. When the shaft and the hole are meshed, the minimum radial clearance between two minor diameters is 0.2, and the root radius is 0.3m considering the amount of radial clearance.

Remarks
1. The elements of the spline hole is defined from those of the spline shaft.
2. The distance between the standard pitch line and the generating pitch line is the amount of profile shifting.

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INVOLUTE SPLINE FOR AUTOMOBILES (JAPANESE INDUSTRIAL STANDARD) (Cont'd)

3. Class

To minimize the number of tools for cutting holes, the basic hole system is adopted, various classes of fit being obtained by varying the dimensions of the shaft. For this purpose the following grades for the measure of tooth surface and the major diameter of the shaft are prescribed without reference to their respective sizes and independently of each other.

Tooth Flank	Class A	Class B	Class C	Class D
Major diameter	—	Class 2	Class 3	—
Fit	Loose fit	Sliding fit	Fixed fit	Press Fit

3a. Fit

The standard fits for both flank fits and flank major diameter fits are four classes as follows:
(1) Loose fit: A clearance is always left.
(2) Sliding fit: Generally a slight clearance is left (2).
(3) Fixing fit: Generally a slight interference is kept (3).
(4) Press fit: An interference is always kept. This class of fit is used flank fit only.

When a hole and a shaft with the class specified in 3.A respectively are meshed each other, the method of alignment varies in relation to the clearance (interference) between the major diameters and the clearance (interference) normal to the flank surfaces of the mating members. However, any desired alignment and fit can be obtained by adlopting the following combination of the grades of dimensions for the measure of tooth surface and the major diameter of spline shafts.

Alignment	Fitting / Combination	Loose	Sliding	Fixed	Press
Tooth Flank fit	Major Diameter	----	----	-----	----
	Tooth Flank	Class A	Class B (3)	Class C (4)	Class D
Major Diameter Fit	Major Diameter	----	Class 2	Class 3 (4)	----
	Tooth Flank	---	Class A	Class A or B	----

Remarks: In the case of flank fit, since the major diameter of shaft is used as the basic dimension, grades for it are not required.

Notes (3) In the case of b class, a slight interence may rarely occur.
(4) A slight-clearance may occour sometimes.

Flat Root Side Fit	Non-Chamfering	WD 1.2m
Full Fillet Side Fit	Non-Chamfering	WD 1.346m
Flat Root Major Diameter Fit	Chamfering	WD 1.2m
Full Fillet Major Diameter Fit	Chamfering	WD 1.345m

OMNIGEAR
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AMERICAN STANDARD PARALLEL SPLINES - External

6 Spline

FIT	MAJOR	MINOR	SPLINE WIDTH	FIT	MAJOR	MINOR	SPLINE WIDTH
A		0.675	0.188	A		1.577	0.438
B	0.746	0.635	0.185	B	1.741	1.485	0.434
C		0.597	0.219	C		1.396	0.434
A		0.788	0.219	A		1.802	0.5
B	0.871	0.741	0.215	B	1.99	1.696	0.495
C		0.696	0.215	C		1.595	0.495
A		0.9	0.25	A		2.027	0.563
B	0.996	0.847	0.246	B	2.24	1.908	0.558
C		0.796	0.246	C		1.795	0.558
A		1.013	0.281	A		2.252	0.625
B	1.121	0.953	0.277	B	2.49	2.12	0.62
C		0.894	0.277	C		1.996	0.62
A		1.126	0.313	A		2.705	0.75
B	1.245	1.06	0.309	B	2.99	2.545	0.745
C		0.996	0.309	C		2.394	0.745
A		1.239	0.345	A		3.152	0.875
B	1.369	1.165	0.34	B	3.488	2.97	0.87
C		1.096	0.34	C		2.794	0.87
A		1.35	0.375	A		3.502	1.001
B	1.493	1.271	0.371	B	3.984	3.394	0.994
C		1.196	0.371	C		3.193	0.994
A		1.465	0.406				
B	1.618	1.378	0.402				
C		1.296	0.402				

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AMERICAN STANDARD PARALLEL SPLINES - External

10 Spline

FIT	MAJOR	MINOR	SPLINE WIDTH	FIT	MAJOR	MINOR	SPLINE WIDTH
A		0.6825	0.117	A		1.594	0.2735
B	0.746	0.601	0.114	B	1.741	1.408	0.2695
C		0.55	0.114	C		1.282	0.2695
A		0.7965	0.137	A		1.821	0.3125
B	0.871	0.7006	0.134	B	1.99	1.608	0.307
C		0.642	0.134	C		1.461	0.307
A		0.9105	0.156	A		2.049	0.3515
B	0.996	0.805	0.153	B	2.24	1.812	0.346
C		0.734	0.153	C		1.642	0.346
A		1.024	0.176	A		2.277	0.3905
B	1.121	0.904	0.173	B	2.49	2.008	0.385
C		0.824	0.173	C		1.83	0.385
A		1.038	0.195	A		2.732	0.4685
B	1.245	1.002	0.192	B	2.99	2.412	0.463
C		0.916	0.192	C		2.195	0.463
A		1.252	0.215	A		3.187	0.5465
B	1.369	1.107	0.212	B	3.492	2.814	0.541
C		1.008	0.212	C		2.56	0.541
A		1.366	0.2345	A		3.642	0.6245
B	1.493	1.2	0.2305	B	3.99	3.216	0.619
C		1.1	0.2305	C		3.927	0.619
A		1.48	0.255				
B	1.618	1.305	0.2505				
C		1.19	0.2505				

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AMERICAN STANDARD PARALLEL SPLINES - Internal

6 Spline

FIT	MAJOR	MINOR	SPLINE WIDTH	FIT	MAJOR	MINOR	SPLINE WIDTH	FIT	MAJOR	MINOR	SPLINE WIDTH
A		.674-.675		A		1.237-1.238		A		2.023-2.025	
B	.749-.750	.637-.638	.186-.188	B	1.374-1.375	1.168-1.169	.342-.344	B	2.248-2.250	1.911-1.913	.560-.563
C		.599-.600		C		1.099-1.100		C		1.798-1.800	
A		.787-.788		A		1.349-1.350		A		2.248-2.250	
B	.874-.875	.743-.744	.217-.219	B	1.499-1.500	1.274-1.275	.373-.375	B	2.498-2.500	2.123-2.125	.622-.625
C		.699-.700		C		1.199-1.200		C		1.998-2.000	
A		.899-.900		A		1.462-1.463		A		2.698-2.700	
B	.999-1.000	.849-.850	.248-.250	B	1.624-1.625	1.380-1.381	.404-.406	B	2.998-3.000	2.548-2.550	.747-.750
C		.799-.800		C		1.299-1.300		C		2.398-2.400	
A		1.012-1.013		A		1.574-1.575		A		3.148-3.150	
B	1.124-1.125	.955-.956	.249-.281	B	1.749-1.750	1.487-1.488	.436-.438	B	3.498-3.500	2.973-2.975	.872-.875
C		.899-.900		C		1.399-1.400		C		2.798-2.800	
A		1.124-1.125		A		1.789-1.800		A		3.498-3.500	
B	1.249-1.250	1.062-1.063	.311-.313	B	1.998-2.000	1.698-1.700	.497-.500	B	.3998-4.000	3.398-3.400	.997-1.000
C		.999-1.000		C		1.598-1.600		C		3.198-3.200	

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AMERICAN STANDARD PARALLEL SPLINES - Internal

10 Spline

FIT	MAJOR	MINOR	SPLINE WIDTH	FIT	MAJOR	MINOR	SPLINE WIDTH	FIT	MAJOR	MINOR	SPLINE WIDTH
A		.682-.683		A		1.250-1.251		A		2.046-2.048	
B	.749-.750	.644-.645	.115-.117	B	1.374-1.375	1.182-1.183	.213-.215	B	2.248-2.250	1.933-1.935	.348-.351
C		.599-.600		C		1.113-1.114		C		1.821-1.823	
A		.795-.796		A		1.364-1.365		A		2.273-2.275	
B	.874-.875	.752-.753	.135-.137	B	1.499-1.500	1.289-1.290	.232-.234	B	2.498-2.500	2.148-2.150	.387-.390
C		.708-.709		C		1.214-1.215		C		2.023-2.025	
A		.909-.910		A		1.478-1.479		A		2.728-2.730	
B	.999-1.000	.859-.860	.154-.156	B	1.624-1.625	1.397-1.398	.252-.254	B	2.998-3.000	2.578-2.580	.465-.468
C		.809-.810		C		1.315-1.316		C		2.428-2.430	
A		1.023-1.024		A		1.592-1.593		A		3.138-3.185	
B	1.124-1.125	.967-.968	.174-.176	B	1.749-1.750	1.504-1.505	.271-.273	B	3.498-3.500	3.008-3.010	.543-.546
C		.910-.911		C		1.417-1.418		C		2.833-2.835	
A		1.137-1.138		A		1.818-1.819		A		3.638-3.640	
B	1.249-1.250	1.074-1.075	.193-.195	B	1.998-2.000	1.718-1.719	.309-.312	B	3.998-4.000	3.438-3.440	.621-.624
C		1.012-1.013		C		1.618-1.620		C		3.238-3.240	

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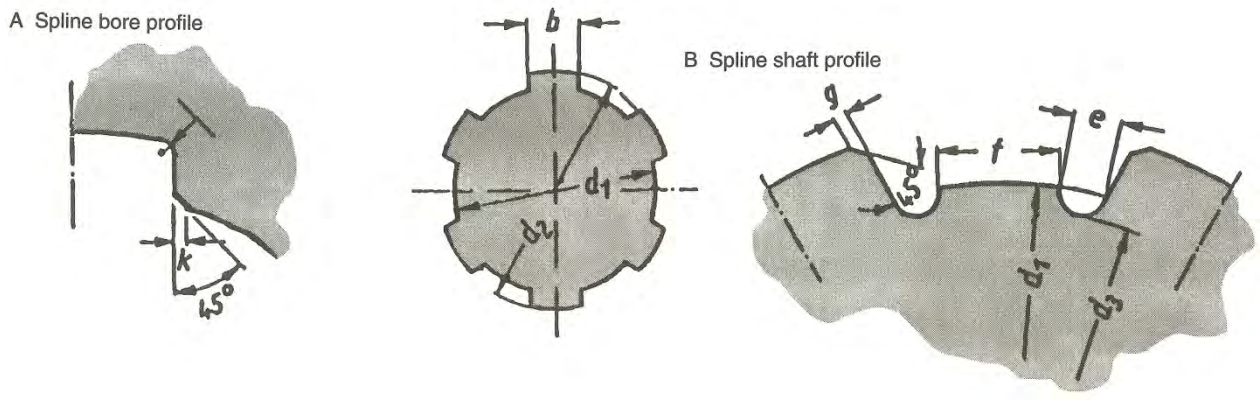
METRIC PARALLEL SPLINE SHAFT CONNECTIONS - DIN 5462 (in mm)



The flank of each key must be parallel to the inside diameter d' as far as to the point of intersection.

Details left unspecified are to be designed as appropriate

Dimensions of a spline bore profile A having the nominal dimensions 8 x 32 x 36:Spline bore profile A 8 x 32 x 38 DIN 5462

Designation of a spline shaft profile B having the nominal dimensions 8 x 46 x 54:Spline shaft profile B 8 x 46 x 54 DIN 5463

1) Internal centering is not possible for all profiles when producing spline shaft profiles by the hobbing process.
2) These values have been calculated on the basis that the spline shaft profiles are produced by the hobbing process
3) Tolerances for inside diameter d1, outside diameter d2, and key width b should be stated
4) The old symbol should no longer be used for new construction and remains in force only for the transition period.

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METRIC PARALLEL SPLINE SHAFT CONNECTIONS - DIN 5462 (in mm)

Nominal dimensions		No. of Keys	Centering	d1	d2	b	D3	e2	f	g	K	r
New symbol Number of keys inside diameter outside diam.	Old symbol inside diam. Outside diam. width of key											
6 x 23 x 26	23 x 46 x 6		interior	23	26	6	22.1	1.3	3.54	0.3	0.3	0.2
6 x 26 x 30	26 x 30 x 6	6	centering	26	30	6	24.6	1.8	3.85	0.3	0.3	0.2
6 x 28 x 32	28 x 32 x 7			28	32	7	26.7	1.8	4.03	0.3	0.3	0.2
8 x 32 x 36	32 x 36 x 6		interior	32	36	6	30.4	1.9	2.71	0.4	0.4	0.3
8 x 36 x 40	36 x 40 x 7		of flank	36	40	7	34.5	1.8	3.46	0.4	0.4	0.3
8 x 42 x 46	42 x 46 x 8		centering	42	46	8	40.4	1.7	5.03	0.4	0.4	0.3
8 x 46 x 50	46 x 50 x 9	8		46	50	9	44.6	1.6	5.75	0.4	0.4	0.3
8 x 52 x 58	52 x 58 x 10			52	58	10	49.7	2.7	4.89	0.5	0.5	0.5
8 x 56 x 62	56 x 62 x 10			56	62	10	53.6	2.8	6.38	0.5	0.5	0.5
8 x 62 x 68	62 x 68 x 12			62	68	12	59.8	2.5	7.31	0.5	0.5	0.5
10 x 72 x 78	72 x 72 x 12			72	78	12	69.6	2.5	5.45	0.5	0.5	0.5
10 x 82 x 88	82 x 88 x 12			82	88	12	79.3	2.7	8.62	0.5	0.5	0.5
10 x 92 x 98	92 x 98 x 14	10		92	98	14	89.4	2.4	10.1	0.5	0.5	0.5
10 x 102 x 108	102 x 108 x 16			102	108	16	99.9	2.3	11.5	0.5	0.5	0.5
10 x 102 x 108	102 x 108 x 18			112	120	18	109	3.2	10.7	0.5	0.5	0.5

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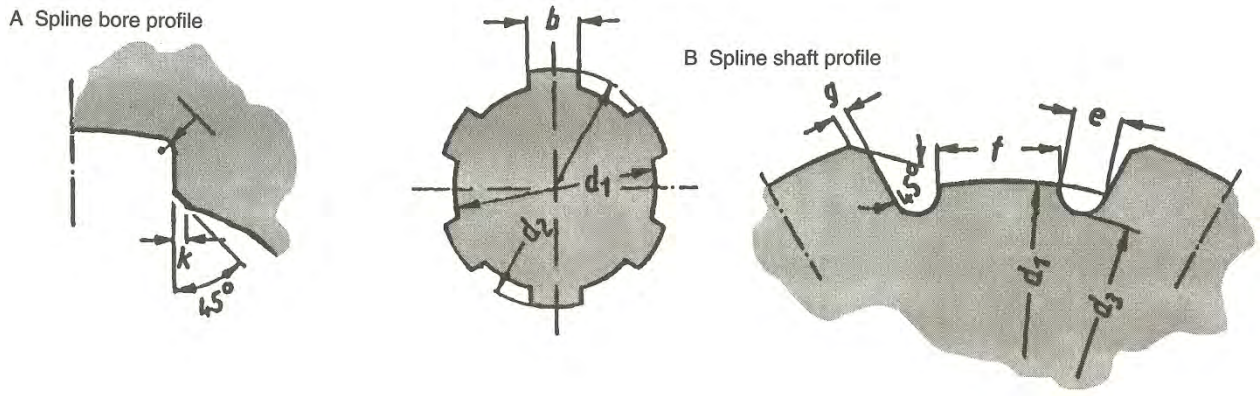

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Nominal dimensions		No. of Keys	Centering	d1	d2	b	D3	e2	f	g	K	r
New symbol Number of keys inside diameter outside diam.	Old symbol inside diam. Outside diam. width of key											
6 x 11 x 14	11 x 14 x 4	6	interior centering	11	14	3	9.9	1.55		0.3	0.3	0.2
6 x 13 x 16	13 x 16 x 3.5			13	16	4	12	1.5	0.32	0.3	0.3	0.2
6 x 16 x 20	16 x 20 x 4			16	20	4	14.5	2.1	0.16	0.3	0.3	0.2
6 x 16 x 22	18 x 22 x 5			18	22	5	16.7	1.95	0.45	0.3	0.3	0.2
6 x 21 x25	21 x 25 x 5			21	25	5	19.5	1.98	1.95	0.3	0.3	0.2
6 x 23 x 28	23 x 28 x 6			23	28	6	21.3	2.3	1.34	0.3	0.3	0.2
6 x 26 x 32	26 x 32 x 6			26	32	6	23.4	2.94	1.65	0.4	0.4	0.3
6 x 28 x 34	28 x 34 x 7			28	34	7	25.9	2.94	1.7	0.4	0.4	0.3
8 x 32 x 36	32 x 38 x 6	8	interior or flank centering	32	38	6	29.4	3.3	0.15	0.4	0.4	0.3
8 x 36 x 40	36 x 42 x 7			35	42	7	33.9	3.01	1.02	0.4	0.4	0.3
8 x 42 x 46	42 x 48 x 8			42	48	8	39.5	2.91	2.57	0.4	0.4	0.3
8 x 46 x 50	46 x 54 x 9			46	54	9	42.7	4.1	0.86	0.5	0.5	0.5
8 x 52 x 58	52 x 60 x 10			52	60	10	48.7	4.74	2.44	0.5	0.5	0.5
8 x 56 x 62	56 x 65 x 10			56	65	10	52.2	5	2.5	0.5	0.5	0.5
8 x 62 x 68	62 x 72 x 10			62	72	12	57.8	5.43	2.4	0.5	0.5	0.5
10 x 72 x 72	72 x 82 x 12	10		72	78	12	67.4	5.43		0.5	0.5	0.5
10 x 82 x 92	82 x 92 x 12			82	88	12	77.1	5.4	3	0.5	0.5	0.5
10 x 92 x 102	92 x 102 x 14			92	98	14	87.3	5.2	4.5	0.5	0.5	0.5
10 x 102 x 112	102 x 112 x 16			102	108	16	97.7	4.9	6.3	0.5	0.5	0.5
10 x 112 x 125	112 x 125 x 18			112	120	18	106	3.4	4.4	0.5	0.5	0.5

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BASE PITCH CHARTS Diametral Pitch - Base Pitch = π/D.P. •(COS.PA)

Diam. Pitch	Circular Pitch	Module	Whole Depth				
			Std. 2.157/DP	Deep 2.25/DP	Pre-Shave 2.35/DP	Full Fillet 2.335/DP	Agma Stub 1.800/DP
1	3.1416	25.4	2.1571	2.25	2.35	2.335	1.8
1 1/4	2.5133	20.32	1.7257	1.8	1.88	1.868	1.44
1 1/2	2.0944	16.9333	1.4381	1.5	1.5667	1.5567	1.2
1 3/4	1.7952	14.5143	1.2326	1.2857	1.3429	1.3343	1.0286
2	1.5708	12.7	1.0786	1.125	1.175	1.1675	0.9
2 1/4	1.3963	11.2889	0.9587	1	1.0444	1.0378	0.8
2 1/2	1.2567	10.16	0.8628	0.9	0.94	0.934	0.72
2 3/4	1.1424	9.2364	0.7844	0.8182	0.8545	0.8491	0.6545
3	1.0472	8.4667	0.719	0.75	0.7833	0.778	0.6
3 1/2	0.8976	7.2571	0.6163	0.6429	0.6714	0.6671	0.5143
4	0.7854	6.35	0.5393	0.5625	0.5875	0.5838	0.45
4 1/2	0.6981	5.644	0.4793	0.5	0.5222	0.5188	0.4
5	0.6283	5.08	0.4314	0.45	0.47	0.467	0.36
6	0.5236	4.2333	0.3595	0.375	0.3917	0.3892	0.3
7	0.4488	3.6286	0.3082	0.3214	0.3357	0.3336	0.2571
8	0.3927	3.175	0.2696	0.2813	0.2938	0.2919	0.225
9	0.3491	2.8222	0.2397	0.25	0.2611	0.2595	0.2
10	0.3142	2.54	0.2157	0.225	0.235	0.2335	0.18
11	0.2856	2.3091	0.1961	0.2045	0.2136	0.2123	0.1636
12	0.2618	2.1167	0.1798	0.1875	0.1958	0.1946	0.15
13	0.5417	1.9538	0.1659	0.1731	0.1807	0.1796	0.1385
14	0.2243	1.8143	0.1541	0.1607	0.1679	0.1668	0.1286
15	0.2094	1.6933	0.1438	0.15	0.1567	0.1557	0.12
16	0.1963	1.5875	0.1348	0.1406	0.1469	0.1459	0.1125
17	0.1848	1.4941	0.1268	0.1323	0.1382	0.1374	0.1056
18	0.1745	1.4111	0.1198	0.125	0.1306	0.1297	0.1

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BASE PITCH CHARTS Diametral Pitch - Base Pitch = π/D.P. •(COS.PA)

Diam. Pitch	Circular Pitch	Module	Whole Depth				
			Std. 2.157/DP	Deep 2.25/DP	Pre-Shave 2.35/DP	Full Fillet 2.335/DP	Agma Stub 1.800/DP
Fine Pitch 2.20/DP + .002					British System 2.40/DP		
20	0.1571	1.27	0.112		0.12	**25.4/MOD = DP**	
22	0.1428	1.1545	0.102		0.1092		
24	0.1309	1.0583	0.0937		0.1	**25.4/DP = MOD**	
26	0.1208	0.9769	0.0866		0.0923		
28	0.1122	0.9071	0.0805		0.0857	**P/DP = CP**	
30	0.1047	0.8467	0.0753		0.08		
32	0.0982	0.7938	0.0708		0.075	**P/CP = DP**	
36	0.0873	0.7056	0.0631		0.0667		
40	0.0785	0.635	0.057		0.06		
44	0.0714	0.5773	0.052		0.0545		
48	0.0654	0.5292	0.047		0.05		
56	0.0561	0.4536	0.0413		0.0429		
64	0.0491	0.3969	0.0364		0.0375		
72	0.0436	0.3528	0.0326		0.0333		
96	0.0327	0.2646	0.0249		0.025		

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CIRCULAR PITCH CONVERSION CHART

Circular Pitch	DiametralPicth	Module	Whole Depth	
			2.157/DP	2.25/DP
1/16	50.2654	0.5053	0.0429	0.0448
1/8	25.1327	1.0106	0.0858	0.0895
3/16	16.7551	1.516	0.1287	0.1343
1/4	12.5663	2.0213	0.1716	0.1791
5/16	10.053	2.5266	0.2146	0.2238
3/8	8.3775	3.0319	0.2575	0.2686
7/16	7.1807	3.5373	0.3004	0.3133
1/2	6.2831	4.0426	0.3433	0.3581
9/16	5.585	4.5479	0.3862	0.4028
5/8	5.0265	5.0532	0.4291	0.4476
1 1/16	4.5695	5.5586	0.472	0.4924
3/4	4.1887	6.0639	0.515	0.5371
13/16	3.8665	6.5692	0.5579	0.5815
7/8	3.5904	7.0744	0.6008	0.6267
15/16	3.351	7.5798	0.6437	0.6714
1	3.1416	8.0851	0.6866	0.7162
1 1/8	2.7925	9.0958	0.7724	0.8057
1 ¼	0.25133	10.1062	0.8582	0.8952
1 ½	2.0944	12.1276	1.0299	1.0743
1 ¾	1.7952	14.1488	1.2015	1.2533
2	1.5708	16.1701	1.3732	1.4329
2 ½	1.2567	20.2117	1.7164	1.7904
3	1.0472	24.2452	2.0598	2.1486

OMNIGEAR
& Machine Corp

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INVOLUTE SPLINECHART

30° Involute Spline			37 1/2° & 45° Involute	
Diam. Pitch	Whole Depth		Whole Depth	
	Full Fillet	Flat Root	37 1/2° PA	45° PA
2.5/5	0.5600	0.4700	0.5060	
	0.4667	0.3917	0.4178	
	0.3500	0.2940	0.3133	
	0.2800	0.2350	0.2540	
	0.2333	0.1960	0.2078	
	0.1750	0.1470	0.1557	0.131
	0.1400	0.1180	0.1245	0.105
	0.1250	0.0980	0.1040	0.0901
	0.0937	0.0730	0.0785	0.0656
	0.0803	0.0635		
	0.0750	0.0590	0.0600	0.0525
	0.0625	0.0490	0.0510	0.0438
	0.0469	0.0370	0.0385	0.0328
	0.0375	0.0295	0.0315	0.0263
	0.0313	0.0249	0.0265	0.0219

Note: These depths are considered standard Omni Gear and may be used as a quick reference guide for your convenience. However, this data does not necessarily reflect any single set of published standards, so always check your specific requirements.

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Module Conversion Chart

Chain No.	Circular Pitch	Roller Diameter
American Standard		
(spec.)	0.1227	0.06
(spec.)	0.1475	0.09
25	1/4	0.13
(spec.)	1/4	0.134
35	3/8	0.2
40	1/2	0.313
41	1/2	0.306
(spec.)	1/2	0.322
50	5/8	0.4
(spec.)	5/8	0.313
60	3/4	0.469
80	1	0.625
(spec.)	1	0.56253
100	1 1/4	0.75
120	1 1/2	0.875
140	1 3/4	1
160	2	1.125
180	2 1/4	1.406
200	2 1/2	1.563
240	3	1.875
(spec.)	6 mm	4 mm
(spec.)	8 mm	5 mm

Chain No.	Circular Pitch	Roller Diameter
British Standard B. S. 228: 1962		
36	3/8	0.25
42	1/2	0.355
51	5/8	0.4
61	3/4	0.475

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Module Conversion Chart

Module	Diametral Pitch	Circular Pitch	Whole Depth			Module	Diametral Pitch	Circular Pitch	Whole Depth		
			2.157/DP	2.25/DP	2.20/DP 0.0020				2.157/DP	2.25/DP	2.20/DP 0.0020
0.20	127.0000	0.0247	0.0170	0.0177	0.0193	4.25	5.9765	0.5257	0.3609	0.3765	
0.30	84.6667	0.0371	0.0255	0.0266	0.0280	4.50	5.6444	0.5566	0.3821	0.3986	
0.35	72.5714	0.0433	0.0297	0.0310	0.0323	4.75	5.3474	0.5875	0.4034	0.4208	
0.40	63.5000	0.0495	0.0340	0.0354	0.0367	5.00	5.0800	0.6184	0.4246	0.4429	
0.45	56.4444	0.0557	0.0382	0.0399	0.0410	5.25	4.8381	0.6493	0.4458	0.4651	
0.50	50.8000	0.0618	0.0425	0.0443	0.0453	5.50	4.6182	0.8030	0.4671	0.4872	
0.60	42.3333	0.0742	0.0510	0.0531	0.0539	5.75	4.4174	0.7112	0.4883	0.5094	
0.70	36.2857	0.0866	0.0594	0.0620	0.0626	6.00	4.2333	0.7421	0.5095	0.5315	
0.75	33.8667	0.0928	0.0637	0.0664	0.0670	6.50	3.0977	0.8048	0.5520	0.5758	
0.80	31.7500	0.0989	0.0679	0.0709	0.0713	7.00	3.6286	0.8658	0.5944	0.6201	
0.90	28.2222	0.1113	0.0764	0.0797	0.0800	7.50	3.3867	0.9276	0.6369	0.6644	
1.00	25.4000	0.1237	0.0849	0.0886	0.0886	8.00	3.1750	0.9895	0.6794	0.7087	

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Module Conversion Chart

Module	Diametral Pitch	Circular Pitch	Whole Depth			Module	Diametral Pitch	Circular Pitch	Whole Depth		
			2.157/DP	2.25/DP	2.20/DP 0.0020				2.157/DP	2.25/DP	2.20/DP 0.0020
1.25	20.3200	0.1546	0.1062	0.1107		9.00	2.8222	1.1132	0.7643	0.7972	
1.50	16.9333	0.1855	0.1274	0.1329		10.00	2.5400	1.2368	0.8492	0.8858	
1.75	14.5143	0.2164	0.1486	0.1550		11.00	2.3090	1.2606	0.9342	0.9744	
2.00	12.7000	0.2474	0.1698	0.1772		12.00	2.1167	1.4842	1.0191	1.0630	
2.25	11.2889	0.2783	0.1911	0.1993		14.00	1.8143	1.7316	1.1890	1.2401	
2.50	10.1600	0.3092	0.2123	0.2215		15.00	1.6933	1.8553	1.2738	1.3287	
2.75	9.2364	0.3404	0.2335	0.2436		16.00	1.5875	1.9790	1.3588	1.4173	
3.00	8.4667	0.3711	0.2548	0.2657		18.00	1.4111	2.2263	1.5286	1.5945	
3.25	7.8153	0.4020	0.2760	0.2879		20.00	1.2700	2.4737	1.6984	1.7717	
3.50	7.2571	0.4329	0.2972	0.3100		22.00	1.1545	2.7211	1.8683	1.9488	
3.75	6.7733	0.4638	0.3185	0.3322		24.00	1.0583	2.9684	2.0381	2.1260	
4.00	6.3500	0.4947	0.3397	0.3543		25.00	1.0160	3.0921	2.1230	2.2146	

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Fine Pitch Spur & Helical Master Gears - Arbor Mounted Type

Master gears are used to determine the accuracy of work gears. When work gears and master gears are rolled together on rolling fixtures with either fixed or adjustable centers, dimensional variations may be determined through the use of indicators, charts, or other suitable indicating devices. Master gears can be either spur or heliacal. While master gears can be manufactured to any specification required, the standard 4" P.D. * 1-1/4" bore size is common for 3 through 6 P.D.; 3" * 1-1/4" bore for 6 through 16 P.D. and finer.

1. Classification shall be composite tolerances in this area.
2. Not applicable 50 DP and finer. The profile tolerances shown are predicted on comparison of the master gear profile to the profile of a control master.
3. Over one pin.
4. Tolerance all plus.
5. Predicted on comparison with a control master, .0001 additional end easing is allowed is either end of the face, 80% central face shall be as shown.
6. Bore: The difference between the effective bore size and the size between any two diametrically opposite points shall not be more than the bore tolerance. Bell mouth will be allowed on 10% of the total bore length, with a length of bell mouth not to exceed .250 total.
7. Arc Tooth Thickness: After determination of arc tooth thickness, necessary adjustments to the OPD shall be calculated from the formulae shown for the calibration of master gears. NOTE: Value is based on Arc Tooth Thickness = Cp/2

Class	Classification by Composite Toleramce					
	1	2	3	4	5	6
Tooth-to-Tooth	.0002 Ref.	.00014 Ref.	.00010 Ref.	0.00007	0.00005	0.00004
Total	.0005 Ref.	.00035 Ref.	.00025 Ref.	0.00018	0.00018	0.00009

Class	Tolerance on Gear Elements					
	1	2	3	4	5	6
Pitch (tooth-to-tooth spacing)	0.00012	0.0001	0.00008	1	1	1
Profile (2)	0.00015	0.00013	0.00001	0.0001	0.0001	0.0001
Runout (tiv)3	0.003	0.00021	0.00015	1	1	1
Bore (4 6)	0.0001	0.0001	0.00005	0.00003	0.00003	0.00003
Outside Rad. (4)	0.0005	0.0005	0.0005	0.0005	0.00025	0.00025

Gear element	Tooth thickness grade	Pitch Diameter	Tolerance
Arc Tooth Thickness (7)	Grade A	Thru 2.25	-0.0002
		Over 2.25	-0.0003
	Grade B	± 1.25 % of circular pitch	
Lead- Max Total		5.0001	
Face Runout (tiv)		.00005 (.0001 Max.)	