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(INCLUDES B92.2MA — 1984)

Metric Module Involute Splines

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METRIC MODULE INVOLUTE SPLINES

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DEDICATION

This document is dedicated to the memory of Leon N. DeVos. Mr. DeVos served as Chairman of the National Involute Spline Committee for 24 years and was especially instrumental in the development of this truly international standard.

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FOREWORD

(B92.2M—1989)

This involute spline standard presented in hard metric form is the American National Standards Institute (ANSI) version of the International Standards Organization (ISO) involute spline standard ISO 4156. This is not a “soft metric” conversion of any previous inch-based spline standard. Involute splines made to this metric standard are not intended for use with components made to the B92.1 or other previous inch standards.

Parts I and II cover spline generalities and dimensions. Part III covers spline inspection and, for this printing, Parts I, II, and III have been combined into one volume. Parts I and II were originally published in 1980. This 1988 publication is the same except that the 6h columns for MRE in Appendix A, Tables A2 through A74, have been corrected. Part III was originally published in 1984 and remains the same except for editorial corrections.

The ISO 4156 standard, from which this document is derived, is the result of a cooperative effort between the ANSI B92 Committee and other members of the ISO/TC 14-2 Involute Spline Committee.

Many of the features of the previous ANSI B92.1--1970 standard have been retained, such as 30, 37.5, and 45 degree pressure angles; flat root and fillet root side fits; the four tolerance classes 4, 5, 6, and 7; tables for a single fit class; and the effective fit concept.

Among the major differences are: use of the module in place of pitch; dimensions are in millimeters rather than inches; the “basic rack”; removal of the major diameter fit; and use of the ISO symbols in place of those previously used.

In addition, provision has been made for calculating three defined clearance fits, although tables for these fits are not included.

This standard recognizes the fact that proper assembly between mating splines is dependent only on the spline being within effective specifications from the tip of the tooth to the form diameter. Therefore, the internal component major diameter is shown as a maximum dimension and the external component minor diameter is shown as a minimum dimension. The minimum internal major diameter and the maximum external minor diameter must clear the specified form diameter and thus do not need any additional control.

All dimensions listed in this standard are for the finished part. Therefore, any compensation that must be made for operations which take place during processing, such as heat treatment, must be taken into account when selecting the tolerance level for manufacturing.

The standard has the same internal minimum effective space width and external maximum effective tooth thickness for all tolerance classes. This basic concept makes it possible to have interchangeable assembly between mating splines made to this standard regardless of the tolerance class of the individual members. This allows a tolerance class “mix” of mating members which often is an advantage where one member is considerably less difficult to produce than its mate, and the “average” tolerance applied to the two units is such that it satisfies the design need. For instance, this can be the result of specification of Class 5 tolerance to one member and Class 7 to its mate, thus approximating a Class 6 assembly tolerance.

In the event the fit as provided in this standard does not satisfy a particular design need and a specific amount of effective clearance or press fit is desired, the change shall be made only to the external spline by a reduction or an increase in effective tooth thickness and a like change in actual tooth thickness. The minimum effective space width, in this standard, is always basic. This basic minimum effective space width should always be retained when special designs are derived from the concept of this standard.

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PART I GENERALITIES

1. SCOPE AND FIELD OF APPLICATION

This standard provides data and guidance for the design, manufacture, and inspection of straight, non-helical, cylindrical involute splines. It establishes a specification based on the metric module within the range 0.25–10 inclusive, relating to nominal pressure angles of 30 deg, 37.5 deg, and 45 deg. For computer programming, the term “37.5 deg” has been adopted instead of “37 deg, 30 min”.

Limiting dimensions, variations, and manufacturing tolerances and their effect on the fit between connecting co-axial spline elements, are defined and tabulated. Linear dimensions are expressed in millimeters and micrometers. Angular dimensions are expressed in degrees and decimal degrees.

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2. SPLINE TERMS AND DEFINITIONS

2.1 Spline—A machine element consisting of integral teeth or spaces equally spaced around a circle or portion thereof.

2.2 Involute Spline—A spline having teeth with involute profiles.

2.3 Internal Spline—A spline formed on the inner surface of a cylinder.

2.4 External Spline—A spline formed on the outer surface of a cylinder.

2.5 Fillet—The concave portion of the tooth profile which joins the sides to the bottom of the space.

2.6 Fillet Root Spline—A spline in which the largest practical fillets join the areas of major or minor circles to the tooth sides while still allowing the smallest practical flat at the space centerline so that good tool life is achieved (See Figs. 2B, 2C, 2D, 8, 9, and 10).

2.7 Flat Root Spline—A spline in which fillets join the arcs of major or minor circles to the tooth sides according to the basic tooth form shown in Figs. 2A and 7.

2.8 Module, m —The ratio of the circular pitch, expressed in millimeters, to the number π (or the ratio of the pitch diameter, expressed in millimeters, to the number of teeth).

2.9 Pitch Circle—The reference circle at which all circular spline dimensions are assigned and the circle on which the specified pressure angle has its nominal value.

2.10 Pitch Diameter, D —The diameter of the pitch circle.

2.11 Pitch Point—The intersection of the spline tooth profile with the pitch circle.

2.12 Circular Pitch, p —The arc length along the pitch circle between corresponding points of adjacent spline teeth.

2.13 Pressure Angle, α —The acute angle between a radial line passing through any point on a tooth flank and the tangent line to the flank at that point.

2.14 Standard Pressure Angle, α_D —The pressure angle at the pitch point.

2.15 Base Circle—The reference circle from which involute spline tooth profiles are generated.

2.16 Base Diameter, D_B —The diameter of the base circle.

2.17 Base Pitch, p_b —The arc length along the base circle between two consecutive corresponding flanks.

2.18 Major Circle—The circle formed by the outermost surface of the spline.

2.19 Major Diameter, DEE, DEI—The diameter of the major circle.

2.20 Minor Circle—The circle formed by the innermost surface of the spline.

2.21 Minor Diameter, DIE, DII—The diameter of the minor circle.

2.22 Form Circle—The circle which establishes the depth of involute form control of the tooth or space profile. It is located near and inside the major circle on the internal spline, and near and outside the minor circle on the external spline.

2.23 Form Diameter, DFE, DFI—The diameter of the form circle.

2.24 Depth of Engagement—The radial distance from the minor circle of the internal spline to the major circle of the external spline.

2.25 Basic Circular Space Width E_{bsc} or Basic Circular Tooth Thickness S_{bsc} —Half the circular pitch.

2.26 Minimum and Maximum Actual Circular Space Width, E_{min} , E_{max} —The circular width on the pitch circle of any single space considering an infinitesimal increment of axial spline length.

2.27 Effective Circular Space Width, EV—The effective circular space width of an internal spline is equal to the circular tooth thickness on the pitch circle of an imaginary perfect external spline which would fit the internal spline without looseness or interference considering engagement of the entire axial length of the splined assembly. The minimum effective circular space width of the internal spline is always basic, as shown in Table 1 (EV min always equal to E_{bsc}).

2.28 Minimum and Maximum Actual Circular Tooth Thickness, S_{min} , S_{max} —The circular thickness on the pitch circle of any single tooth considering an infinitesimal increment of axial spline length.

2.29 Effective Circular Tooth Thickness, SV—The effective circular tooth thickness of an external spline is equal to the circular space width on the pitch circle of an imaginary perfect internal spline which would fit the external spline without looseness or interference, considering engagement of the entire axial length of the splined assembly. Fit variations are obtained by adjusting this value SV.

2.30 Effective Clearance, c_v —The effective circular space width of the internal spline minus the effective circular tooth thickness of the mating external spline.

2.31 Theoretical Maximum Clearance, c_{max} —The maximum actual circular space width of an internal spline minus the minimum actual circular tooth thickness of the mating external spline. It does not define the fit between mating members, because of the effect of variations.

2.32 Form Clearance, c_f —The radial depth of involute profile beyond the deepest point of engagement with the mating part. It allows for looseness between mating splines and for eccentricities between the minor circle (internal), the major circle (external), and their respective pitch circles.

2.33 Total Index Variation, F_p —The greatest difference in any two teeth (adjacent or otherwise) between the actual and the perfect spacing of the tooth profiles (measured at the pitch circle).

2.34 Profile Variation, f_f —Any variation from the specified tooth profile normal to the flank.

2.35 Lead Variation, F_β —The variation of the direction of the spline tooth flank from its theoretical direction parallel to the datum axis (See Fig. 1A). Note: Straight, non-helical splines have an infinite lead.

2.36 Parallelism Variation—The variation of parallelism of a single spline tooth to any other single spline tooth (See Fig. 1B).

2.37 Alignment Variation—The variation of the effective spline axis with respect to the datum axis (See Fig. 1C).

2.38 Out of Roundness—The variation of the spline from a true circular configuration (See par. 8.6).

2.39 Effective Variation, λ —The accumulated effect of the spline variations on the fit with the mating part (See par. 8.1).

2.40 Machining Tolerance, T—The variation in actual circular space width or actual circular tooth thickness (See par. 8.2).

2.41 Total Tolerance, $(T + \lambda)$ —The total tolerance for an internal spline is the difference between the minimum effective circular space width and the maximum actual circular space width; for an external spline, it is the difference between the maximum effective circular tooth thickness and the minimum actual circular tooth thickness (See par. 6).

2.42 Length of Engagement, g_γ —The axial length of contact between mating splines.

2.43 Active Spline Length, g_w —The length of spline which contacts the mating spline. On sliding splines it exceeds the length of engagement.

2.44 Basic Dimension—A numerical value, expressed in appropriate units of measure, to describe the theoretically exact size, shape or location of a feature.

2.45 Reference—As used in this standard, reference is an added notation or modifier to a dimension, specification, or note when that dimension, specification, or note is:

1. Repeated for drawing clarification.
2. Needed to define a nonfeature datum or basis from which a form or feature is generated.
3. Needed to define a nonfeature dimension from which other specifications or dimensions are developed.
4. Needed to define a nonfeature dimension at which tolerated sizes of a feature are specified.
5. Needed to define a nonfeature dimension from which control tolerances or sizes are developed or added as useful information.

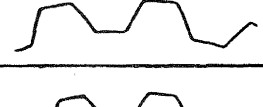
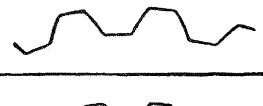
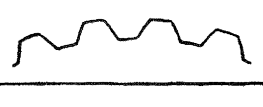
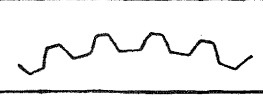
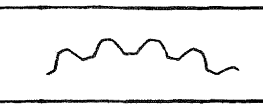
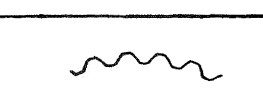
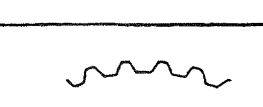
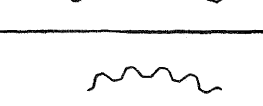
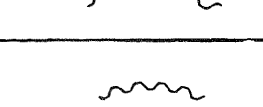
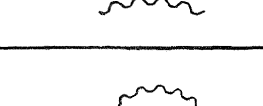
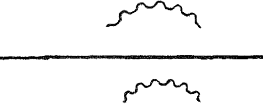
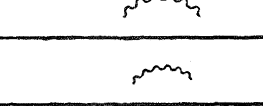
Any dimension, specification, or note that is noted "REF" shall not be used as a criterion for part acceptance or rejection.

2.46 Tooth Side (Flank)—As referred to in this standard, that surface of the tooth limited by the major diameter and the form diameter on the external spline, and the minor diameter and the form diameter on the internal spline and having an involute profile for the specified spline length.

2.47 Tooth Thickness Modification (es)—Reduction of circular tooth thickness for the required fit class (See par. 5.2).

NOTE: Tables 1 and 4 give the basic dimensions and fundamental formulae for which a graphic display is given by Table 3.

TABLE 1—Basic Dimensions for Splines

Tooth ^a	Module m	Basic Space Width or Tooth Thickness on Pitch Circle E _{bsc} or S _{bsc}			Base Pitch P _b		
		α_D 30 deg	α_D 37.5 deg	α_D 45 deg	α_D 30 deg	α_D 37.5 deg	α_D 45 deg
	10	15.708	15.708	—	27.2070	24.9239	—
	8	12.566	12.566	—	21.7656	19.9391	—
	6	9.425	9.425	—	16.3242	14.9544	—
	5	7.854	7.854	—	13.6035	12.4620	—
	4	6.283	6.283	—	10.8828	9.96957	—
	3	4.712	4.712	—	8.16210	7.47718	—
	2.5	3.927	3.927	3.927	6.80175	6.23098	5.55360
	2	3.142	3.142	3.142	5.44140	4.98479	4.44288
	1.75	2.749	2.749	2.749	4.76122	4.36169	3.88752
	1.5	2.356	2.356	2.356	4.08105	3.73859	3.33216
	1.25	1.963	1.963	1.963	3.40088	3.11549	2.77680
	1	1.571	1.571	1.571	2.72070	2.49239	2.22144
	0.75	1.178	1.178	1.178	2.04052	1.86929	1.66608
	0.5	0.785	0.785	0.785	1.36035	1.24620	1.11072
	0.25	—	—	0.393	—	—	0.555360

^aShown to illustrate: relative tooth sizes for various spline modules for $\alpha_D = 30$ deg pressure angle.

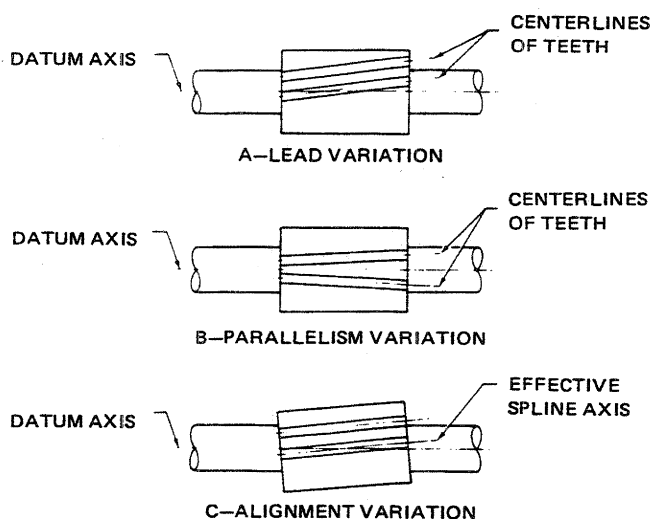


FIG. 1-LEAD VARIATIONS

3. SYMBOLS

The general symbols used to designate the various spline terms and dimensions are given below. ANSI B92.1 and Computer symbols are also given as reference.

Symbol	Term	Paragraph Reference	B92.1	Computer Form
c	theoretical clearance	2.31	—	C
c _v	effective clearance	2.30	c _v	CV
c _F	form clearance	2.32	c _F	CF
D	pitch diameter	2.10	D	D
DB	base diameter	2.16	D _b	DB
d _{ce}	pin contact diameter, external spline		D _{ce}	DCE
d _{ci}	pin contact diameter, internal spline		D _{ci}	DCI
DEE	major diameter, external spline	2.19	D _o	DEE
DEI	major diameter, internal spline	2.19	D _{ri}	DEI
DFE	form diameter, external spline	2.23	D _{Fe}	DFE
DFI	form diameter, internal spline	2.23	D _{Fi}	DFI
DIE	minor diameter, external spline	2.21	D _{re}	DIE
DII	minor diameter, internal spline	2.21	D _i	DII
DRE	diameter of measuring pin, external spline		d _e	DRE
DRI	diameter of measuring pin, internal spline		d _i	DRI
h _s	see basic rack tooth form, Figs. 2A, 2B, 2C, & 2D		—	HS
λ	effective variation	2.39	λ	LAM
INV α	involute α = tan α — arc α		—	INVA

Symbols Cont'd.

Symbol	Term	Paragraph Reference	B92.1	Computer Form
KE	change factor, external spline		K_e	KE
KI	change factor, internal spline		K_i	KI
g	spline length	8.5	L	G
g_w	active spline length	2.43	—	GW
g_γ	length of engagement	2.42	—	GL
T	machining tolerance	2.40	m	T
MRE	measurement over two pins, external spline		M_e	MRE
MRI	measurement between two pins, internal spline		M_i	MRI
W	measurement over K teeth, external spline		—	W
Z	number of teeth		N	Z
m	module	2.8	—	M
p_b	base pitch	2.17	—	PB
p	circular pitch	2.12	p	PC
π	3.141592654		π	PI
rfe	fillet radius, external spline		r_f	RFE
rfi	fillet radius, internal spline		r_f	RFI
E_{bsc}	basic circular space width	2.25	s_{vmin}	EBSC
E_{max}	maximum actual circular space width	2.26	s	EMAX
E_{min}	minimum actual circular space width	2.26	s	EMIN
EV	effective circular space width	2.27	s_v	EV
S_{bsc}	basic circular tooth thickness	2.25	t_{vmax}	SBSC
S_{max}	maximum actual circular tooth thickness	2.28	t	SMAX
S_{min}	minimum actual circular tooth thickness	2.28	t	SMIN
SV	effective circular tooth thickness	2.29	t_v	SV
α	pressure angle	2.13	ϕ	ALP
α_D	standard pressure angle	2.14	ϕ_D	ALPD
α_{ci}	pressure angle at pin contact diameter, internal spline		ϕ_{ci}	ALPCI
α_{ce}	pressure angle at pin contact diameter, external spline		ϕ_{ce}	ALPCE
α_i	pressure angle at pin center, internal spline		ϕ_i	ALPI
α_e	pressure angle at pin center, external spline		ϕ_e	ALPE
α_{Fe}	pressure angle at form diameter, external spline		ϕ_F	ALPFE
α_{Fi}	pressure angle at form diameter, internal spline		ϕ_F	ALPFI

Symbols Cont'd.

Symbol	Term	Paragraph Reference	B92.1	Computer Form
es	external spline circular tooth thickness modification for required fit class = c_v min. (par. 5.2, 8.8.1)		—	ES
h, f, e, or d	tooth thickness size modifiers (called fundamental deviation in ISO R286)		—	LH, LF, L, or LD
H	space width size modifier for internal spline (called fundamental deviation in ISO R286)		—	H
F_p	total index variation	8.3	—	FP
f_f	total profile variation	8.4	—	FF
ϕ_f	tolerance factor for profile variation	8.4	—	PF
F_β	lead variation	8.5	—	FB

3.1 Additional Symbols—The following additional symbols are used as subscripts or suffixes in conjunction with the above general symbols to designate relative conditions or locations.

Symbol	Term	B92.1	Computer Form
II	minor diameter, internal spline	i	II
EE	major diameter, external spline	o	EE
β	alignment	—	—
B, b	at base circle	b	B
c	at contact diameter	c	C
E, e	external	e	E
F	pertaining to form diameter	F	F
I, i	internal	i	I
V, v	effective	v	V
W	active	—	WA
R	pertaining to gages or pins	G	R
γ	of engagement	—	GG
D	standard	D	D
IE	minor diameter, external spline	r_e	IE
EI	major diameter, internal spline	r_i	EI
r	radius; radial	r	RI
f	pertaining to a fillet or profile	f	RF
z	any assumed condition (α_z, D_z)	z	U
p	index	—	—

Table 2—Formulae for Dimensions and Tolerances for All Fit Classes

Term	Symbol	Formula
Pitch dia	D	mZ
Base dia	DB	$mZ \cos \alpha_D$
Circular pitch	p	πm
Base pitch	p_b	$\pi m \cos \alpha_D$
Tooth thickness modification	es	according to selected fit class H/h, H/f, H/e, or H/d (See par. 8.8)
Min major dia, int		
30 deg, flat root	DEI min	$m (Z + 1.5)$
30 deg, fillet root	DEI min	$m (Z + 1.8)$
37.5 deg, fillet root	DEI min	$m (Z + 1.4)$
45 deg, fillet root	DEI min	$m (Z + 1.2)$
Max major dia, int	DEI max	$DEI \min + (T + \lambda) / \tan \alpha_D$ (See NOTE 1)
Form dia, int		
30 deg, flat root and fillet root	DFI	$m (Z + 1) + 2 c_F$
37.5 deg, fillet root	DFI	$m (Z + 0.9) + 2 c_F$
45 deg, fillet root	DFI	$m (Z + 0.8) + 2 c_F$
Min minor dia, int	DII min	$DFE + 2 c_F$ (See NOTE 2)
Max minor dia, int	DII max	$DII \min + (0.2 m^{0.667} - 0.01 m^{-0.5})$ (See Table 6)
Basic circular space width	E_{bsc}	$0.5 \pi m$
Min effective circular space width	EV min	$0.5 \pi m$
Max actual circular space width classes 4, 5, 6, and 7	E max	$EV \min + (T + \lambda)$ (See NOTE 3)
Min actual circular space width	E min	$EV \min + \lambda$ (See par. 8.2)
Max effective circular space width	EV max	$E \max - \lambda$ (See par. 8.2)
Max major dia, ext		
30 deg, flat root and fillet root	DEE max	$m (Z + 1) - es / \tan \alpha_D$ (See NOTE 4)
37.5 deg, fillet root	DEE max	$m (Z + 0.9) - es / \tan \alpha_D$ (See NOTE 4)
45 deg, fillet root	DEE max	$m (Z + 0.8) - es / \tan \alpha_D$ (See NOTE 4)
Min major dia, ext	DEE min	$DEE \max - (0.2 m^{0.667} - 0.01 m^{-0.5})$ (See Table 6)

Table 2—Formulae for Dimensions and Tolerances for All Fit Classes (Continued)

Term	Symbol	Formula
Form dia, ext	DFE	$2 \sqrt{(0.5DB)^2 + \left[h_s + \frac{(0.5 es)}{\tan \alpha_D} \right]^2}$
Max minor dia, ext		
30 deg, flat root	DIE max	$m(Z - 1.5) - es/\tan \alpha_D$
30 deg, fillet root	DIE max	$m(Z - 1.8) - es/\tan \alpha_D$
37.5 deg, fillet root	DIE max	$m(Z - 1.4) - es/\tan \alpha_D$
45 deg, fillet root	DIE max	$m(Z - 1.2) - es/\tan \alpha_D$
Min minor dia, ext	DIE min	$DIE \text{ max} - (T + \lambda)/\tan \alpha_D \text{ (See NOTE 1)}$
Basic circular tooth thickness	S_{bsc}	$0.5 \pi m$
Max effective circular tooth thickness	SV max	$S_{bsc} - es$
Min actual circular tooth thickness classes 4, 5, 6, and 7	S min	$SV \text{ max} - (T + \lambda) \text{ (See NOTE 3)}$
Max actual circular tooth thickness	S max	$SV \text{ max} - \lambda \text{ (See par. 8.2)}$
Min effective tooth thickness	SV min	$S \text{ min} + \lambda \text{ (See par. 8.2)}$
Total tolerance, circular space width or tooth thickness	$(T + \lambda)$	(See par. 6)
Machining tolerance on circular space width or tooth thickness	T	(See par. 8)
Effective variation allowed on circular space width or tooth thickness	λ	(See par. 8.1)
Form clearance	c_F	$0.1 m$
Pin diameter, int spline	DRI	See NOTE 5
Pin diameter, ext spline	DRE	See NOTE 5
Measurement between pins	MRI	See NOTE 5
Measurement over pins	MRE	See NOTE 5
Change factor, int	KI	See PART III — Inspection
Change factor, ext	KE	See PART III — Inspection
Rack dimension	h_s	As shown in Figs. 2A, 2B, 2C, 2D
30 deg		$0.6 m$
37.5 deg		$0.55 m$
45 deg		$0.5 m$

NOTE 1: $(T + \lambda)$ for class 7 — see par. 6.

NOTE 2: for all types of fit, always take the DFE value corresponding to the H/h fit.

NOTE 3: see PART I — par. 6 and PART II — Tables of Dimensions.

NOTE 4: see Table 5 for values of $es/\tan \alpha_D$.

NOTE 5: see PART II—Tables of Dimensions and PART III — Inspection, concerning choice of pins.

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4. PRESSURE ANGLE (STANDARD)

Standard pressure angles included in this standard for involute splines are 30 deg, 37.5 deg, and 45 deg.

5. TYPE OF FIT

This standard deals with only one type of fit, the side fit, for 30 deg, 37.5 deg, and 45 deg pressure angle splines. Formulae for the dimensions and tolerances for these splines are shown in Table 2.

5.1 Side Fit—In this fit the mating members contact on the sides of the teeth only; major and minor diameters are clearance dimensions. The tooth sides act as drivers and centralize mating splines.

5.2 Spline Fit Classes—This standard provides the side fit in four spline fit classes as follows:

Spline Fit Class	Minimum effective clearance, c_v (equals e_s from Table 4)
H/h	zero
H/f	f
H/e	e
H/d	d

The tooth thickness modifications h , f , e , and d are fundamental deviations selected from ISO/R 286, "ISO System of Limits and Fits," which are applied to the external spline by shifting the tooth thickness total tolerance below the basic tooth thickness by the amount of the tooth thickness modification, in order to provide a prescribed minimum effective clearance (See par. 8.8). The spline dimensions listed in PART II of this standard are based on spline fit class H/h, c_v min = zero.

6. SPACE WIDTH AND TOOTH THICKNESS, TOTAL TOLERANCE ($T + \lambda$)

6.1 Class of Tolerances—This standard includes four classes of total tolerance ($T + \lambda$) on space width and tooth thickness selected from a combination of international tolerances (IT) in ISO/R286. The following are the tolerance classes, their corresponding combination of IT tolerances, and their equivalent in terms of the international tolerance unit i .

Spline tolerance class	Total tolerance	
	Tolerance grades (IT)	Tolerance units (i)
4	(IT 6 + IT 9)	= $(10i^* + 40i^{**})$
5	(IT 7 + IT 10)	= $(16i^* + 64i^{**})$
6	(IT 8 + IT 11)	= $(25i^* + 100i^{**})$
7	(IT 9 + IT 12)	= $(40i^* + 160i^{**})$

*Tolerance unit based on pitch diameter:

$$i = 0.45 \sqrt[3]{D} + 0.001D \text{ for } D \leq 500\text{mm}$$

$$i = 0.004D + 2.1 \text{ for } D > 500\text{mm}$$

** Tolerance unit based on tooth thickness:

$$i = 0.45 \sqrt[3]{S_{bsc}} + 0.001S_{bsc}$$

where D is pitch diameter in mm, S_{bsc} is basic circular tooth thickness in mm, and the resultant $(T + \lambda)$ is in μm . For $(T + \lambda)$ in mm, multiply result by 0.001.

7. BASIC RACK PROFILES FOR SPLINE

7.1 The basic rack is an involute spline of infinitely large diameter on a plane at right angles to the tooth surfaces, the profile of which is used as the basis for defining the standard tooth dimensions of a system of involute splines.

7.2 The reference line is a straight line crossing the profile of the basic rack, from which the tooth dimensions are specified.

7.3 The profile of the basic rack for the standard pressure angle splines are represented in the following figures:

Fig. 2A — 30 deg Flat root spline, for modules 0.5 thru 10

Fig. 2B — 30 deg Fillet root spline, for modules 0.5 thru 10

Fig. 2C — 37.5 deg Fillet root spline, for modules 0.5 thru 10

Fig. 2D — 45 deg Fillet root spline, for modules 0.25 thru 2.5

Dimensions shown in the basic rack figures are for maximum material conditions and for fit class H/h.

7.4 The form clearance, c_F , shown in the basic rack profiles is equal to 0.1 mm for all pressure angle splines. The form clearance is modified for fits other than H/h (See par. 8.8.2).

7.5 External splines may be produced by generating with a pinion type shaper cutter, with a hob, or by cutting with no generating motion using a tool formed to the contour of a tooth space. External splines are also made by cold forming and in these cases are usually of the fillet root design. Internal splines are usually produced by broaching, by form cutting, or by generating with a shaper cutter. Even when full tip radius tools are used, each of these cutting methods produce a fillet contour with individual characteristics. Generated spline fillets are curves related to the prolate epicycloid for external splines and the prolate hypocycloid for internal splines. These fillets have a minimum radius of curvature at the point where the fillet is tangent to the external spline minor diameter circle or the internal spline major diameter circle and a rapidly increasing radius of curvature up to the point where the fillet comes tangent to the involute profile.

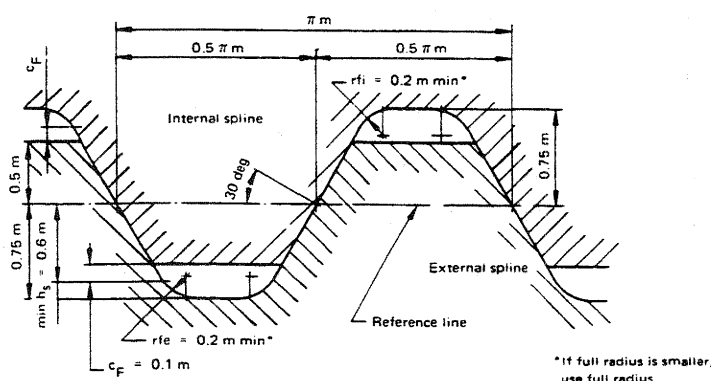


FIG. 2A—PROFILE OF THE BASIC RACK FOR 30 DEG FLAT ROOT SPLINE

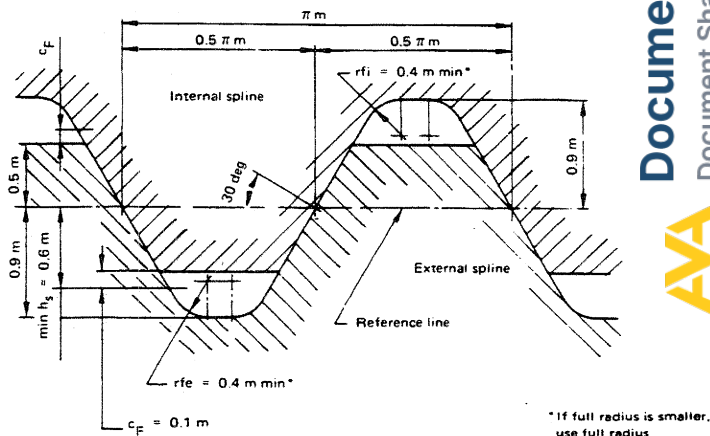


FIG. 2B—PROFILE OF THE BASIC RACK FOR 30 DEG FILLET ROOT SPLINE

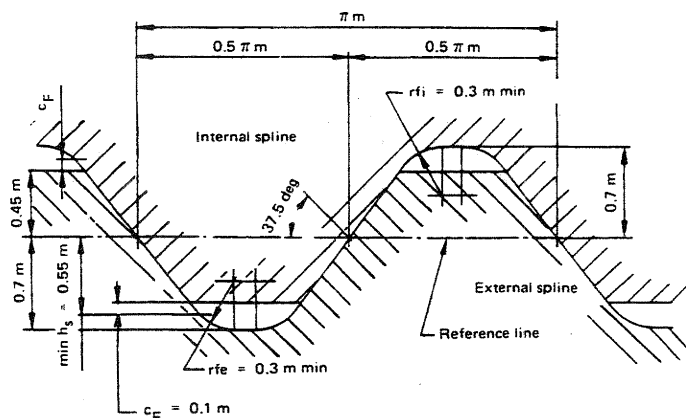


FIG. 2C—PROFILE OF THE BASIC RACK FOR 37.5 DEG FILLET ROOT SPLINE

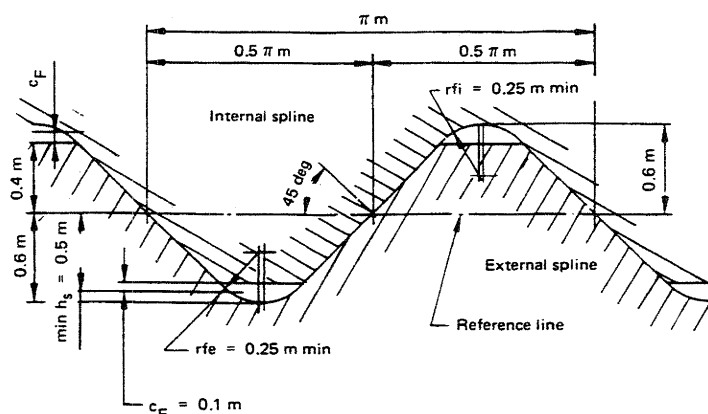


FIG. 2D—PROFILE OF THE BASIC RACK FOR 45 DEG FILLET ROOT SPLINE

The values in Table 7 may be used as minimum radii of curvature for stress calculations and they may be specified as the minimum fillet radius. These values are based on the fillet radius shown on the basic rack profiles. If the same shaper cutter is used to cut both the internal and external splines, then the shaper cutter must be made according to dimensions required on the internal spline.

8. SPLINE MACHINING TOLERANCES AND VARIATIONS

Derivation of effective variation and machining tolerance is explained in par. 8.1 and par. 8.2. Actual values for λ and T are applied only in accordance with par. 11.

8.1 Effective Variation (λ)—The effective variation is the combined effect that total index variation, positive profile variation, and tooth alignment variation has on the effective fit of mating involute splines. The effect of these individual spline

variations on fit is less than their sum of allowable variation, because areas of more than minimum clearance can have profile, tooth alignment, or index variations without changing the fit. It is also unlikely that these variations would occur in their maximum amounts simultaneously on the same spline. For this reason, total index variation, total profile variation, and tooth alignment variation are used to calculate the combined effect by the formula shown:

$$\lambda = 0.6 \sqrt{(F_p)^2 + (f_f)^2 + (F_\beta)^2}$$

The above variation is based on a length of engagement equal to one-half the pitch diameter. Adjustment on the effective variation may be required for a greater length of engagement.

8.2 Machining Tolerances (T)—A value for machining tolerance may be obtained by subtracting the effective variation (λ) from the total tolerance ($T + \lambda$). See par. 6.1 for ($T + \lambda$) and par. 8.1 for (λ).

8.2.1 The amount of machining tolerance as derived in par. 8.2 in relation to the total tolerance is recommended for general guidance. Design requirements or specific processes utilized for spline manufacture may require a different amount of machining tolerance in relation to the total tolerance.

8.3 Total Index Variation (F_p)—The total index variation (F_p) is the cumulative pitch variation between the two greatest opposite pitch variations over any sector of one half circumference. The total index variation (F_p) is a standard tolerance grade selection from ISO 1328, "Parallel Involute Gears — ISO System of Accuracy." The following formulae are used in this standard for the total index variation (F_p) expressed in micrometers:

Spline Tolerance Class	Total Index Variation (F_p) Formula
4	$2.5 \sqrt{L} + 6.3$
5	$3.55 \sqrt{L} + 9$
6	$5 \sqrt{L} + 12.5$
7	$7.1 \sqrt{L} + 18$

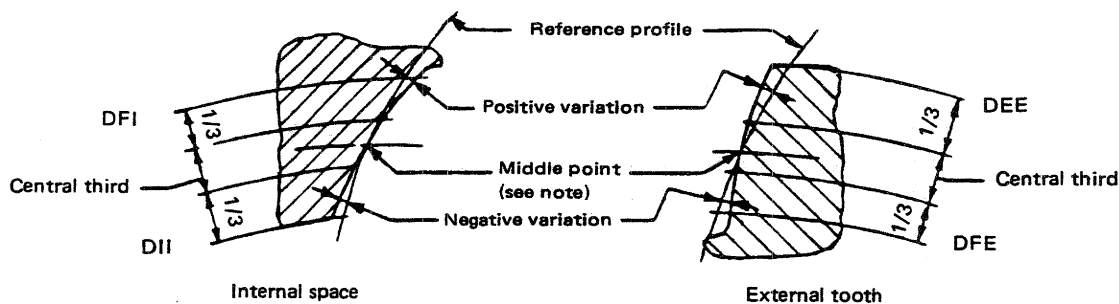
where $L = mZ \pi/2$

8.4 Total Profile Variation (f_f)—The total profile variation (f_f) is the total variation, positive plus negative, of the flank surface irregularities of the actual profile that depart from the design profile. A positive variation is in the direction of the space and a negative variation is in the direction of the tooth, as shown in Fig. 3. The total profile variation (f_f) is a standard tolerance grade selection from ISO 1328. The following formulae are used in this standard for the total profile variation (f_f) expressed in micrometers:

Spline Tolerance Class	Total Profile Variation (f_f) Formula
4	$1.6 \phi_f + 10$
5	$2.5 \phi_f + 16$
6	$4 \phi_f + 25$
7	$6.3 \phi_f + 40$

Where tolerance factor $\phi_f = m + 0.0125mZ$

The permissible positive variation on external splines and the negative variation on internal splines from the design profile within the central third of the flank depth to the form diameter shall not exceed one third of the calculated values (See Fig. 3).



NOTE: The middle point is situated on the involute halfway between the major diameter of the external spline (DEE) and the minor diameter of the internal spline (DII). This point is the reference for computing measuring pin diameters.

FIG. 3—PROFILE VARIATIONS

8.5 Lead Variation (F_β)—The lead variation (F_β) is the total tolerance on tooth misalignment from the design position, measured in a plane normal to the datum axis for the full length of spline. The lead variation (F_β) is a standard tolerance grade selection from ISO 1328. The following formulae are used in this standard for the lead variation (F_β) expressed in micrometers:

Spline Tolerance Class	Lead Variation (F_β) Formula
4	$0.8 \sqrt{g} + 4$
5	$1.0 \sqrt{g} + 5$
6	$1.25 \sqrt{g} + 6.3$
7	$2 \sqrt{g} + 10$

where g is the spline length in millimeters.

8.6 Out of Roundness—Heat treatment and deflection of thin sections may cause out of roundness, which increases index and profile variations. Tolerances for such conditions depend on many variables and are therefore not tabulated. Additional tooth thickness or space width tolerance must allow for such conditions.

8.7 Eccentricity—Eccentricity of major and minor diameters, in relation to the effective reference diameter of side fit splines, should not cause contact beyond the form diameters of the mating splines, even under conditions of maximum effective clearance. This standard does not establish specific tolerances.

8.8 Dimensions for Spline Fit Classes Other Than H/h—If working conditions require looseness, or if the alignment of mating splines is affected by eccentricity of locating surfaces relative to each other and/or the splines, it may be necessary to prescribe a minimum effective clearance by reducing the effective and actual circular tooth thickness of the external spline by an amount sufficient to allow the misaligned splines to assemble. To avoid problems with undercut teeth, only spline fit class H/h is allowed for splines having 9 or less teeth.

8.8.1 This standard provides tooth thickness modifications (es) for standard fit classes H/h, H/f, H/e, or H/d, which can be applied to the circular tooth thickness of the external spline in order to establish four standard spline fit classes. This provides standardization of composite go gages. Fig. 4 graphically illustrates the fits and tolerances for the four classes as outlined in par. 5.2.

8.8.2 Application of Spline Fit Classes—The spline tables in PART II of this standard are based on spline fit class H/h which has a minimum effective clearance of zero. Selection of a spline fit requiring a different minimum effective clearance requires adjustment of the external spline dimensions as follows:

a) For the spline fit class selected H/h, H/f, H/e, or H/d, determine the tooth thickness modification value (es) from Table 4.

b) Reduce the maximum effective tooth thickness, SV_{max} , and the minimum actual tooth thickness, S_{min} , specified in spline tables, by the amount of the tooth thickness modification (es) shown in Table 4.

c) Reduce external major and minor diameters (DEE_{max} and DIE_{min}) by the value given in Table 5 according to the selected spline fit class.

d) Calculate the required form diameter of the external spline, DFE:

$$DFE = 2 \sqrt{(0.5 DB)^2 + \left[0.5 D \sin \alpha_D - \frac{h_s + \left(\frac{0.5 es}{\tan \alpha_D} \right)}{\sin \alpha_D} \right]^2}$$

h_s (See Table 2 or Figs. 2A, 2B, 2C, or 2D)

DB = Base diameter

D = Pitch diameter

α_D = standard pressure angle

$es/\tan \alpha_D$ = See Table 5

e) Calculate minimum and maximum dimensions over two pins, external spline (MRE min and MRE max).

$$MRE_{min} = MRE_{min}^* - (es) KE$$

$$MRE_{max}^{**} = MRE_{min}^* - (es - T) KE$$

(*) MRE min values corresponding to values of fit class H/h. (See PART II, dimension tables)

(**) MRE max values corresponding to values of fit class H/h. (See Appendix A)

Values of KE factor are given in PART II, dimension tables. These formulas are approximate.

Tooth thickness modification (es) values are given in Table 4.

f) Calculate minimum and maximum base tangent length over k teeth, external spline (W_{min} and W_{max}).

Values of minimum and maximum base tangent length over k teeth are given for the fit class H/h in PART III.

8.8.3 In the manufacture of external splines with a standard tooth thickness modification, standard cutters conforming to the basic rack can be used by shifting inward the basic rack reference line from its position touching the spline pitch circle. The spline tooth profiles remain as involutes; lengths of the same involutes, lying further inward, are used.

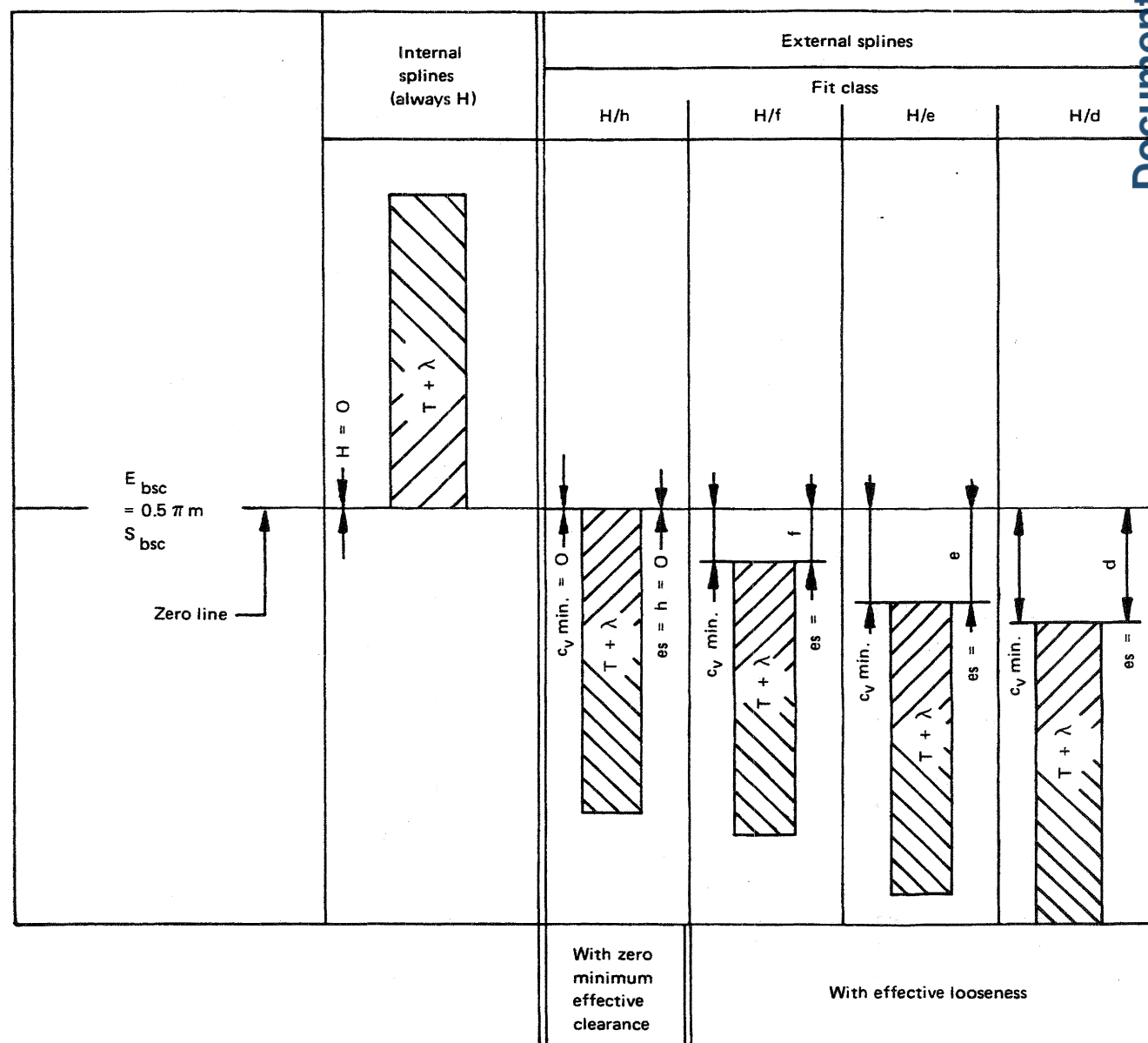


FIG. 4—GRAPHICAL ILLUSTRATION OF SPLINE FIT CLASSES

The amount of the inward radial displacement of the basic rack reference line from the position touching the spline pitch circle is equivalent to $0.5 es / \tan \alpha_D$.

8.8.4 One effect of the various magnitudes of tooth thickness modification (es) on the tooth form is to vary the circular tip thickness at the major diameter of the external spline. Various magnitudes of es may also cause undercut fillets for splines having less than 10 teeth. The following checks should be made when applying tooth thickness modification:

a) Check for tip thickness at major diameter of external spline.

b) Tip thickness less than $0.25 m$ should be avoided. Tip thickness is computed as follows:

$$c) SEE = DEE \left[(S \min / D) + \operatorname{inv} \alpha_D - \operatorname{inv} \alpha_{DEE} \right]$$

where SEE = tip thickness

α_D = pressure angle at pitch diameter

$\operatorname{arc} \alpha$ = pressure angle in radians

α_{DEE} = pressure angle at tip, $\cos \alpha_{DEE} = DB / DEE$

$\operatorname{inv} \alpha_D$ = $\tan \alpha_D - \operatorname{arc} \alpha_D$

$\operatorname{inv} \alpha_{DEE}$ = $\tan \alpha_{DEE} - \operatorname{arc} \alpha_{DEE}$

$S \min$ = minimum actual circular tooth thickness resulting from the tooth thickness modification.

Table 4—Tooth Thickness Modification (Reduction)—in Micrometers—(es) Resulting from Selected Spline Fit Classes

1 μm = 0.001 mm

D (mm) Pitch Diameter	External Splines				Internal Splines
	Tooth thickness modification (reduction) relative to basic tooth thickness at pitch diameter				Space width modification relative to basic space width at pitch diameter
	For selected fit class				
	d	e	f	h	
≤3	20	14	6	0	0
>3 to 6	30	20	10	0	0
>6 to 10	<u>40</u>	25	13	0	0
>10 to 18	50	32	16	0	0
>18 to 30	65	40	20	0	0
>30 to 50	80	50	25	0	0
>50 to 80	100	60	30	0	0
>80 to 120	120	<u>72</u>	36	0	0
>120 to 180	145	85	43	0	0
>180 to 250	170	100	50	0	0
>250 to 315	190	110	56	0	0
>315 to 400	210	<u>125</u>	<u>62</u>	0	0
>400 to 500	230	135	<u>68</u>	0	0
>500 to 630	260	145	<u>76</u>	0	0
>630 to 800	290	160	<u>80</u>	0	0
>800 to 1000	320	<u>170</u>	<u>86</u>	0	0

Formulae for determining modification amounts are as follows:

$$\begin{aligned}
 d &= 16(D)^{0.44} & f &= 5.5(D)^{0.41} \\
 e &= 11(D)^{0.41} & h &= 0
 \end{aligned}$$

where "D" is the geometrical mean of the size range.

Values in mm of basic circular tooth thickness
 S_{bsc} and basic circular space width E_{bsc} at pitch diameter

Module 0.25 = 0.393	Module 1.25 = 1.963	Module 2.5 = 3.927	Module 6 = 9.425
Module 0.5 = 0.785	Module 1.5 = 2.356	Module 3 = 4.712	Module 8 = 12.566
Module 0.75 = 1.178	Module 1.75 = 2.749	Module 4 = 6.283	Module 10 = 15.708
Module 1 = 1.571	Module 2 = 3.142	Module 5 = 7.854	

Note: The values listed in this table are taken from ISO R286, have been computed on the basis of the geometrical mean "D" of the maximum and minimum diameters of each step, and apply to all diameters of this step.

$$\text{The geometrical mean } D = \sqrt{(\text{maximum diameter})(\text{minimum diameter})}$$

Values are rounded in accordance with ISO R286 rules. Values shown in **bold type** do not comply with any documented rule for rounding, but are those used by ISO R286, and are used in this table to agree with established international practice.

Table 5—Reduction of External Spline Major and Minor Diameters Required for Application of Selected Fit Classes

$$1 \mu\text{m} = 0.001 \text{ mm}$$

D (mm)		Values in μm for $es/\tan \alpha_D$									
		d			e			f			h
		30 deg	37.5 deg	45 deg	30 deg	37.5 deg	45 deg	30 deg	37.5 deg	45 deg	α_D deg
≤ 3		35	26	20	24	18	14	10	8	6	0
>3 to 6		52	39	30	35	26	20	17	13	10	0
>6 to 10		69	52	40	43	33	25	23	17	13	0
>10 to 18		87	65	50	55	42	32	28	21	16	0
>18 to 30		113	85	65	69	52	40	35	26	20	0
>30 to 50		139	104	80	87	65	50	43	33	25	0
>50 to 80		173	130	100	104	78	60	52	39	30	0
>80 to 120		208	156	120	125	94	72	62	47	36	0
>120 to 180		251	189	145	147	111	85	74	56	43	0
>180 to 250		294	222	170	173	130	100	87	65	50	0
>250 to 315		329	248	190	191	143	110	97	73	56	0
>315 to 400		364	274	210	217	163	125	107	81	62	0
>400 to 500		398	300	230	234	176	135	118	89	68	0
>500 to 630		450	339	260	251	189	145	132	99	76	0
>630 to 800		502	378	290	277	209	160	139	104	80	0
>800 to 1000		554	417	320	294	222	170	149	112	86	0

9. EFFECT OF SPLINE VARIATIONS

9.1 Index Variations—These variations cause the clearance to vary from one set of mating tooth sides to another. Since the fit depends on the areas of minimum clearance, index variations reduce the effective clearance.

9.2 Profile Variations—These variations reduce contact area. Positive profile variations reduce the fit by reducing effective clearance. Negative profile variations do not affect the fit (See Fig. 3).

9.3 Lead Variations—These variations will cause side clearance variations and therefore reduce the fit.

10. EFFECTIVE AND ACTUAL DIMENSIONS FOR SPLINES

10.1 Effective and Actual Circular Space Width—Fig. 5A illustrates an internal spline with variations of index and profile.

Table 6—Tolerances for Internal Spline Minor Diameter and External Spline Major Diameter

Module	T _{DEE} or T _{DII}
	mm
10	0.93
8	0.80
6	0.66
5	0.58
4	0.50
3	0.41
2.5	0.36
2	0.31
1.75	0.28
1.5	0.25
1.25	0.22
1	0.19
0.75	0.15
0.5	0.11
0.25	0.06

$$T_{DEE} \text{ or } T_{DII} = 0.2(m)^{0.667} - 0.01(m) - 0.5$$

where: T_{DEE} = major diameter tolerance of external spline

T_{DII} = minor diameter tolerance of internal spline

m = module

Fig. 5B shows that a perfect external spline contour does not fit, even though each tooth has the same width as the mating space. To allow the perfect external spline to fit in any position, all spaces of the internal spline must be widened by the amount of interference.

This width as shown in Fig. 5C is the actual circular width of the internal spline. The effective circular space width is the circular tooth thickness of the perfect mating spline.

10.2 Effective and Actual Circular Tooth Thickness—The same reasoning applied to the external spline leads to the concept of effective tooth thickness which exceeds the actual circular tooth thickness by effective variation (See Fig. 6).

10.3 Effective Clearance—The effective circular space width of the internal spline minus the effective circular tooth thickness of the external spline is the effective clearance, which defines the fit of mating parts. This is strictly true only if high points of mating parts come into contact. Positive effective clearance represents looseness, negative effective clearance represents interference.

10.4 Space Width and Tooth Thickness Limits—The variation of the actual circular space width and actual circular tooth thickness within the machining tolerance causes corresponding variations of their effective dimensions. Thus, there are three limit dimensions for circular space width (minimum effective, maximum effective, and maximum actual) and three limit dimensions for circular tooth thickness (maximum effective, minimum effective, and minimum actual) only two of which are used in standard method and method B, as illustrated in Table 8. There are also two reference dimensions, the use of which is described in par. 11.2. Method A uses all three limit dimensions.

10.4.1 The minimum effective circular space width (EV min), maximum effective circular tooth thickness (SV max), and minimum effective clearance (c_v min) for the spline fit class H/h are as follows:

$$EV \text{ min} = SV \text{ max} = 0.5 \pi m (\text{basic E or S})$$

$$c_v \text{ min} = 0 (\text{Zero clearance})$$

For the standard dimensioning method, as the spline variations decrease to zero, the effective circular space width or effective circular tooth thickness become actual circular space width and actual circular tooth thickness measurements; hence, the maximum effective circular space width and minimum effective circular tooth thickness can become the same value as their corresponding actual values. This is theoretical and only possible when the spline is perfect in all respects.

10.4.2 The maximum effective circular space width (EV max), minimum effective circular tooth thickness (SV min), and maximum effective clearance (c_v max) for the spline fit class H/h dimensioning method A are as follows (See par. 8.2.1):

$$EV \text{ max} = 0.5 \pi m + T$$

$$SV \text{ min} = 0.5 \pi m - T$$

$$c_v \text{ max} = 2T$$

10.4.3 The reference minimum actual circular space width (E min), reference maximum actual circular tooth thickness (S max), and minimum theoretical clearance (c min) for spline

Table 7—Minimum Fillet Radius of Internal or External Splines (See Par. 7.5) Resulting from Fillet Radius of Basic Rack

Module	$\alpha_D = 30 \text{ deg}$ Flat Root	$\alpha_D = 30 \text{ deg}$ Fillet Root	$\alpha_D = 37.5 \text{ deg}$ Fillet Root	$\alpha_D = 45 \text{ deg}$ Fillet Root
m	0.2m	0.4m	0.3m	0.25m
	mm			
10	2.00	4.00	3.00	
8	1.60	3.20	2.40	
6	1.20	2.40	1.80	
5	1.00	2.00	1.50	
4	0.80	1.60	1.20	
3	0.60	1.20	0.90	
2.5	0.50	1.00	0.75	0.62
2	0.40	0.80	0.60	0.50
1.75	0.35	0.70	0.52	0.44
1.5	0.30	0.60	0.45	0.38
1.25	0.25	0.50	0.38	0.31
1	0.20	0.40	0.30	0.25
0.75	0.15	0.30	0.22	0.19
0.5	0.10	0.20	0.15	0.12
0.25				0.06

fit class H/h are as follows (See par. 11.2):

$$E_{\min} = 0.5 \pi m + \lambda$$

$$S_{\max} = 0.5 \pi m - \lambda$$

$$c_{\min} = 2 \lambda$$

10.4.4 The maximum actual circular space width ($E_{\max}$), minimum actual circular tooth thickness ($S_{\min}$), and maximum theoretical clearance ($c_{\max}$) for spline fit class H/h are as follows:

$$E_{\max} = 0.5 \pi m + (T + \lambda)$$

$$S_{\min} = 0.5 \pi m - (T + \lambda)$$

$$c_{\max} = 2 (T + \lambda)$$

10.4.5 Where the external spline has a tooth thickness modification other than h , the above effective and theoretical values, c_v and c , as described in par. 10.4.1 thru par. 10.4.4 must be adjusted by the amount of these tooth thickness modifications (es).

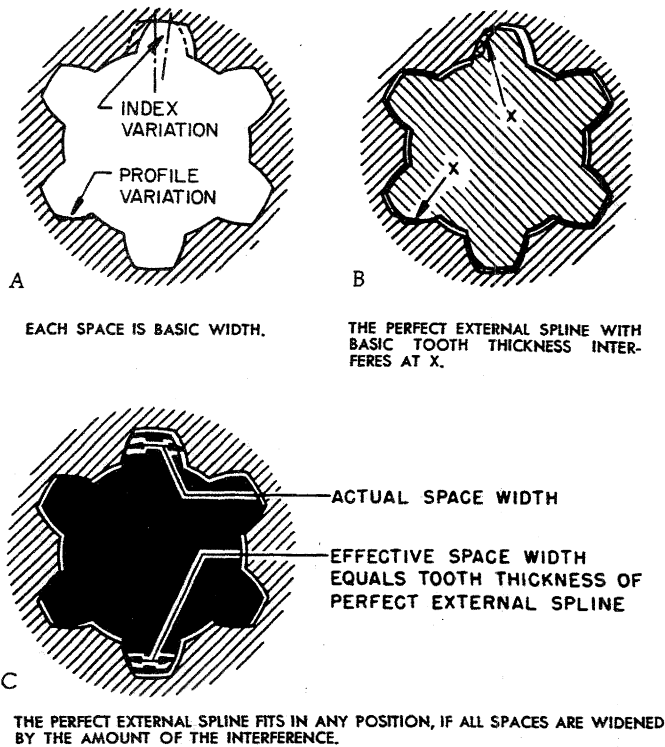


FIG. 5—EFFECT OF VARIATIONS ON INTERNAL SPLINE

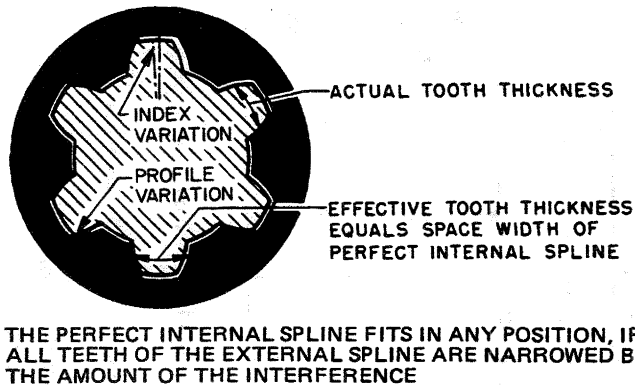


FIG. 6—EFFECT OF VARIATIONS ON EXTERNAL SPLINE

11. USE OF EFFECTIVE AND ACTUAL DIMENSIONS FOR SPACE WIDTH AND TOOTH THICKNESS

11.1 Minimum Effective Circular Space Width and Maximum Effective Circular Tooth Thickness—These dimensions define the maximum material condition which assures that the splines will assemble. These dimensions shall be specified for all splines inspected by composite spline GO gages controlling the minimum effective clearance (c_v min).

11.2 Minimum Actual Circular Space Width and Maximum Actual Circular Tooth Thickness—These dimensions may be specified as reference (REF), and are not used for acceptance or rejection of parts inspected by composite spline GO gages controlling the maximum material limit. If the measured actual

circular space width is less than the reference minimum actual circular space width and the internal spline accepts the composite plug GO gage, or if the measured actual circular tooth thickness is more than the reference maximum actual circular tooth thickness and the external spline accepts the composite ring GO gage, the cumulative effect of the individual spline effective variation is less than the effective variation. Such parts are acceptable because the maximum material condition was not exceeded.

The specification of these actual dimensions as reference dimensions is desirable for process control of space width and tooth thickness. For splines where the use of composite spline GO gages may be unavailable, impractical, or uneconomical for the control of the effective size maximum material limit, the minimum actual circular space width and maximum actual circular tooth thickness are used for acceptance or rejection of parts along with the control of the individual spline tolerances for profile, index, and tooth alignment. The minimum effective circular space width and maximum effective circular tooth thickness are not specified or referenced since their measurement requires the composite GO gage. The individual spline form and position tolerances are specified and used for inspection of parts in lieu of the GO composite gage. The following tolerances are added to the spline drawing data:

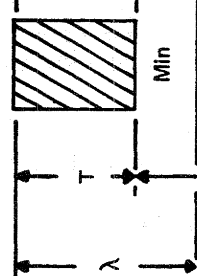
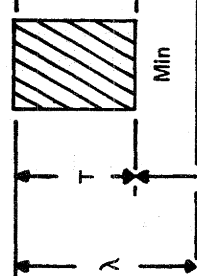
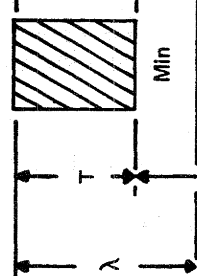
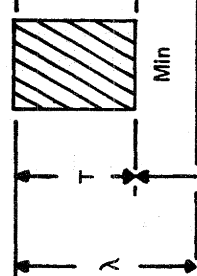
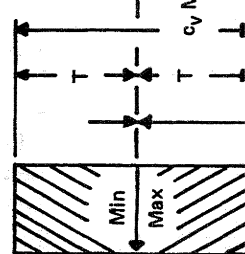
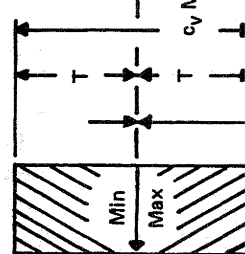
- | | |
|--|-----------|
| a) Involute profile tolerance | |
| total (zero at pitch point) | 0.0XX |
| Positive tolerance within central third of flank depth | +0.0XX |
| b) Total index tolerance over any sector of one-half circumference | 0.0XX MAX |
| c) Lead Tolerance, $g_y = XX.XXX$ | 0.0XX |

11.3 Maximum Actual Circular Space Width and Minimum Actual Circular Tooth Thickness—These dimensions define the minimum material condition and shall be specified for all splines for acceptance or rejection of parts, except for Method B, Table 8.

11.4 Maximum Effective Circular Space Width and Minimum Effective Circular Tooth Thickness—These dimensions define the maximum effective clearance for mating splines, but they do not limit the effective variation.

11.4.1 They may be used, in addition to the limits of paragraph 11.3, in order to prevent the increase of maximum effective clearance due to reduction of effective variations. See Table 8, Method A. This method requires inspection by NOT GO composite gages as well as GO composite gages which increases the gaging requirements. The notation "inspection optional" may be added where maximum effective clearance is an assembly requirement, but does not need absolute control. It will indicate, without necessarily adding inspection time and equipment, that in this case the actual circular space width of the internal spline must be held below the maximum, or the actual circular tooth thickness of the external spline above the

Table 8—Specification Guide for Space Width and Tooth Thickness

Disposition of Variations, Clearances and Tolerances on Part (See Par. 8.)			Dimensioning Methods		
Dimension	Effective	Actual	Standard	A* See Par. 11.4.1	B* See Par. 11.4.2
Space Width of Internal Spline			Required	Required	REF
(Basic)			REF	REF	REF
Tooth Thickness of External Spline			Required	Required	Required
	$c_v \text{ Min} = 0$		REF	REF	REF
	$c_v \text{ Max}^{**}$		Required	Required	Required
	$0.5 \pi m$		Required	Required	Required

NOTE: The minimum effective clearance $c_v \text{ min}$, is greater than zero for fit classes other than H/h (See par. 8.8).

* Methods A and B are to be used only when design requirements make them necessary.

** Only true for dimensioning methods A and B. For standard dimensioning method, $c_v \text{ Max}$ can vary throughout the total tolerance zone.

minimum, if machining methods result in less than allowable variations.

11.4.2 Where spline variations require no control, method B shown in Table 8 shall be used. When method B is used and it is necessary to control the spline variations by laboratory inspection, the following data shall be added to the spline specifications:

- | | |
|--|-----------|
| a) Involute profile tolerance | |
| total (zero at pitch point) | 0.0XX |
| Positive tolerance within central third of flank depth | +0.0XX |
| b) Total index tolerance over any sector of one-half circumference | 0.0XX MAX |
| c) Lead Tolerance, $g_Y = XX.XXX$ | 0.0XX |

These values result from formulas given in par. 8.3, par. 8.4, and par. 8.5.

12. DRAWING DATA

It is important that uniform specifications be used to show complete information on detail drawings of splines. Many misunderstandings will be avoided by following the suggested arrangement of dimensions and data, as shown in Figs. 7, 8, 9, and 10. The number of X's indicates the number of significant places normally used. With this charted type of spline specifications, it is usually not necessary to show a graphic illustration of the spline teeth.

12.1 Spline Data and Basic Dimensions—Spline data are used for engineering and manufacturing purposes. Module and pressure angle are not subject to individual inspection. Basic dimensions are defined in par. 2.44.

12.2 Combinations of Types

12.2.1 Flat root internal splines may be used with fillet root external splines where the larger radius is desired on the external spline for control of stress concentrations. This combination of spline roots may also be permitted as a design option by specifying for the minimum root diameter of the external, the value of the minimum root diameter of the fillet root external spline and noting this as "optional root".

12.2.2 A design option may provide either flat root internal or fillet root internal by specifying for the maximum major diameter equal to the maximum major diameter of the fillet root internal spline and noting this as "optional root".

NOTE: If needed, the major diameter of a flat root internal spline may be placed between the form diameter and the maximum major diameter of the fillet root internal spline (See par. 12.2.1 and par. 12.2.2).

12.3 Designation—The mating parts of straight cylindrical involute splines in this standard are designated as follows:

- | | |
|---|------------------------------|
| a) internal spline | = INT |
| external spline | = EXT |
| mating splines | = INT/EXT |
| b) number of teeth | = Z (preceded by the number) |
| c) module | = m (preceded by the value) |
| d) pressure angle: 30 deg flat root | = 30 P |
| pressure angle: 30 deg fillet root | = 30 R |
| pressure angle: 37.5 deg | = 37.5 |
| pressure angle: 45 deg | = 45 |
| e) tolerance classes | = 4, 5, 6, & 7 |
| f) space width modification, internal spline | = H |
| tooth thickness modification, external spline | = h, f, e and d |
| g) Example | |

For: Mating splines 24 teeth—
module 2.5 —
pressure angle 30 deg—
fillet root —
tolerance class 5—fit H/h.

Designate as follows:

- | | | |
|---|------------------|--|
| { | mating: | INT/EXT 24Z x 2.5m x 30R x 5H/5h
ANSI B92.2M — 1980 |
| | internal spline: | INT 24Z x 2.5m x 30R x 5H
ANSI B92.2M — 1980 |
| | external spline: | EXT 24Z x 2.5m x 30R x 5h
ANSI B92.2M — 1980 |

*Applies only to standard dimensioning and inspection method. If dimensioning and inspection method A or B is used, then splines must be designated as shown in Figs. 7 thru 10.

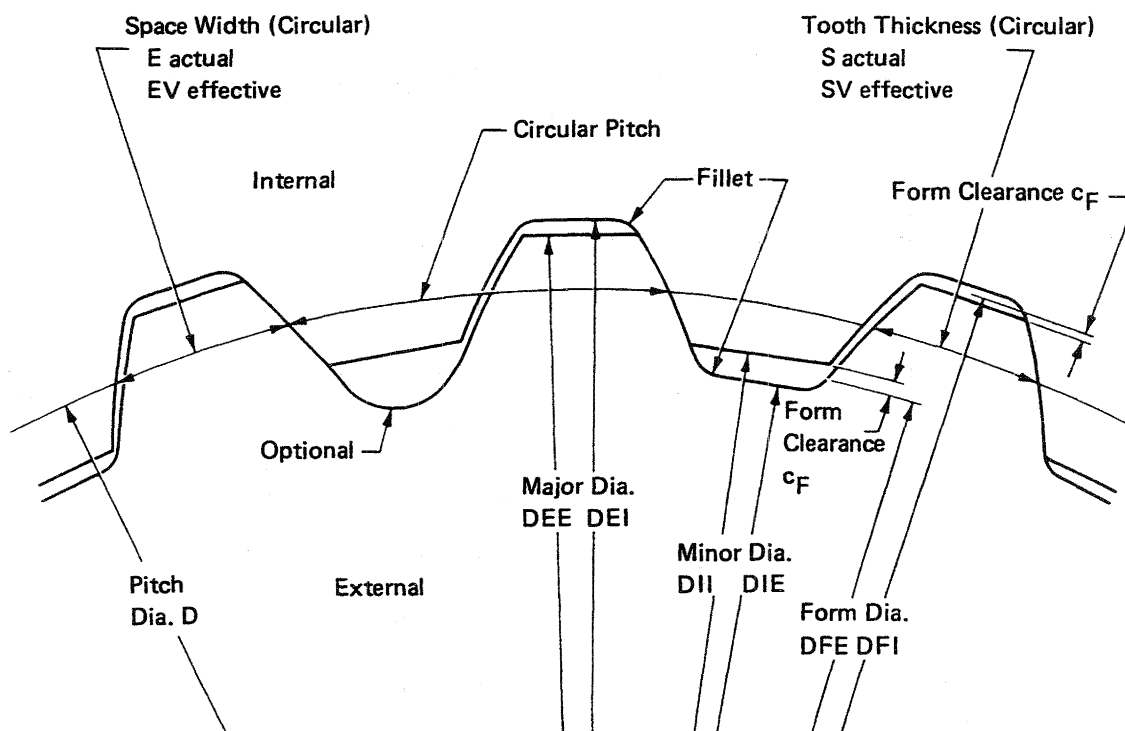


FIG. 7—SPLINE TERMS, SYMBOLS, AND DRAWING DATA—FLAT ROOT, 30 DEG PRESSURE ANGLE, MODULES 0.5 TO 10

This configuration is used in restricted areas, as with tubular parts with wall thickness too small to permit use of fillet roots, to allow hobbing closer to shoulders, for economy when hob-

bing, shaping, or for shorter broaches for the internal member (PART II – Tables 9 thru 36 and Appendix A, Tables A1 thru A28).

DRAWING DATA

Internal Involute Spline Data		External Involute Spline Data	
FLAT ROOT SIDE FIT	TOLERANCE CLASS—(*)	FLAT ROOT SIDE FIT	TOLERANCE CLASS—(*)
NUMBER OF TEETH	*	NUMBER OF TEETH	*
MODULE	*	MODULE	*
PRESSURE ANGLE	30 deg	PRESSURE ANGLE	30 deg
BASE DIAMETER	xx.xxxx REF.	BASE DIAMETER	xx.xxxx REF.
PITCH DIAMETER	xx.xxxx REF.	PITCH DIAMETER	xx.xxxx REF.
MAJOR DIAMETER	xx.xx MAX.	MAJOR DIAMETER	xx.xx/xx.xx
FORM DIAMETER	xx.xx	FORM DIAMETER	xx.xx
MINOR DIAMETER	xx.xx/xx.xx	MINOR DIAMETER	xx.xx MIN.
CIRCULAR SPACE WIDTH		CIRCULAR TOOTH THICKNESS	
MAX. ACTUAL	xx.xxx	MAX. EFFECTIVE	xx.xxx
MIN. EFFECTIVE	xx.xxx	MIN. ACTUAL	xx.xxx
MAX MEASUREMENT BETWEEN PINS	xx.xxx REF.	MIN MEASUREMENT OVER PINS	xx.xxx REF.
PIN DIAMETER	xx.xxx	PIN DIAMETER	xx.xxx
FILLET RADIUS (Optional)	See Table 7	FILLET RADIUS (Optional)	See Table 7

The above drawing data is required for the spline specifications.
The standard system is shown; for alternative systems, see par. 11.4 and par. 12.2.

*Specify.

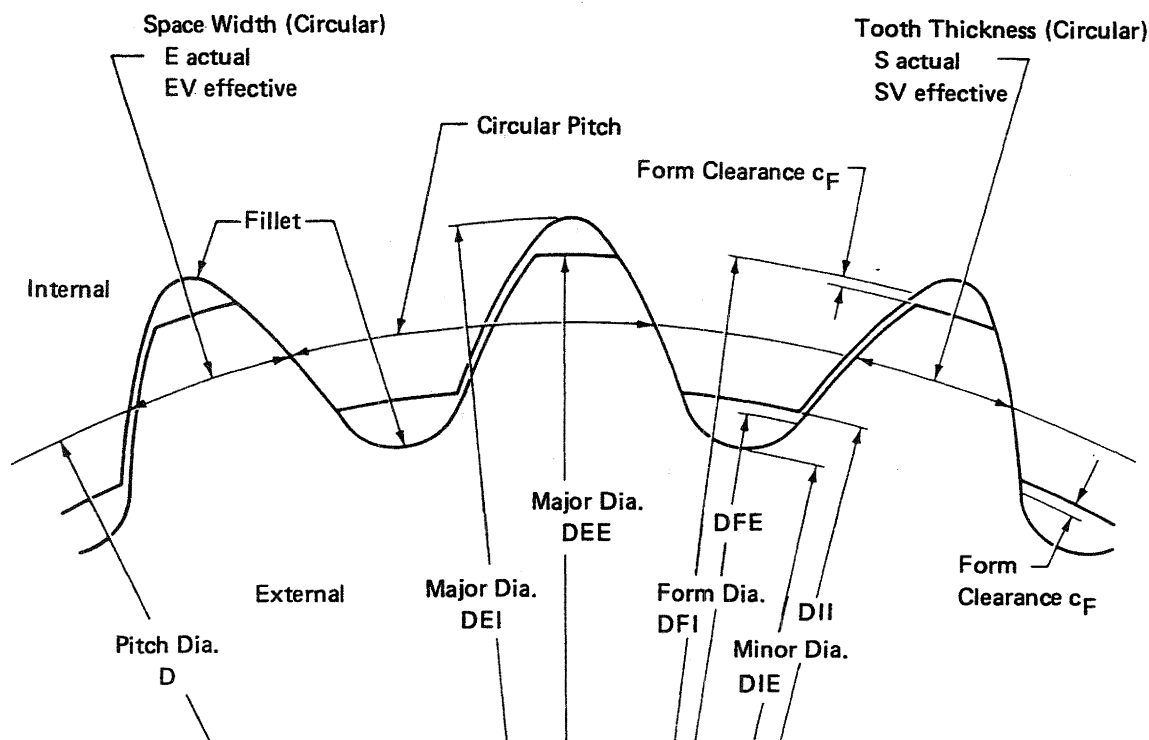


FIG. 8—SPLINE TERMS, SYMBOLS, AND DRAWING DATA—FILLET ROOT, 30 DEG PRESSURE ANGLE, MODULES 0.5 TO 10

The fillet radius permits heavier loading and effects greater fatigue resistance than flat roots through absence of stress raisers

(PART II – Tables 37 thru 64 and Appendix A, Tables A1 thru A28).

DRAWING DATA

Internal Involute Spline Data		External Involute Spline Data	
FILLET ROOT SIDE FIT	TOLERANCE CLASS—(*)	FILLET ROOT SIDE FIT	TOLERANCE CLASS—(*)
NUMBER OF TEETH	*	NUMBER OF TEETH	*
MODULE	*	MODULE	*
PRESSURE ANGLE	30 deg	PRESSURE ANGLE	30 deg
BASE DIAMETER	xx.xxxx REF.	BASE DIAMETER	xx.xxxx REF.
PITCH DIAMETER	xx.xxxx REF.	PITCH DIAMETER	xx.xxxx REF.
MAJOR DIAMETER	xx.xx MAX.	MAJOR DIAMETER	xx.xx/xx.xx
FORM DIAMETER	xx.xx	FORM DIAMETER	xx.xx
MINOR DIAMETER	xx.xx/xx.xx	MINOR DIAMETER	xx.xx MIN.
CIRCULAR SPACE WIDTH		CIRCULAR TOOTH THICKNESS	
MAX. ACTUAL	xx.xxx	MAX. EFFECTIVE	xx.xxx
MIN. EFFECTIVE	xx.xxx	MIN. ACTUAL	xx.xxx
MAX MEASUREMENT BETWEEN PINS	xx.xxx REF.	MIN MEASUREMENT OVER PINS	xx.xxx REF.
PIN DIAMETER	xx.xxx	PIN DIAMETER	xx.xxx
FILLET RADIUS (Optional)	See Table 7	FILLET RADIUS (Optional)	See Table 7

The above drawing data is required for the spline specifications.
The standard system is shown; for alternative systems, see par. 11.4 and par. 12.2.

*Specify.

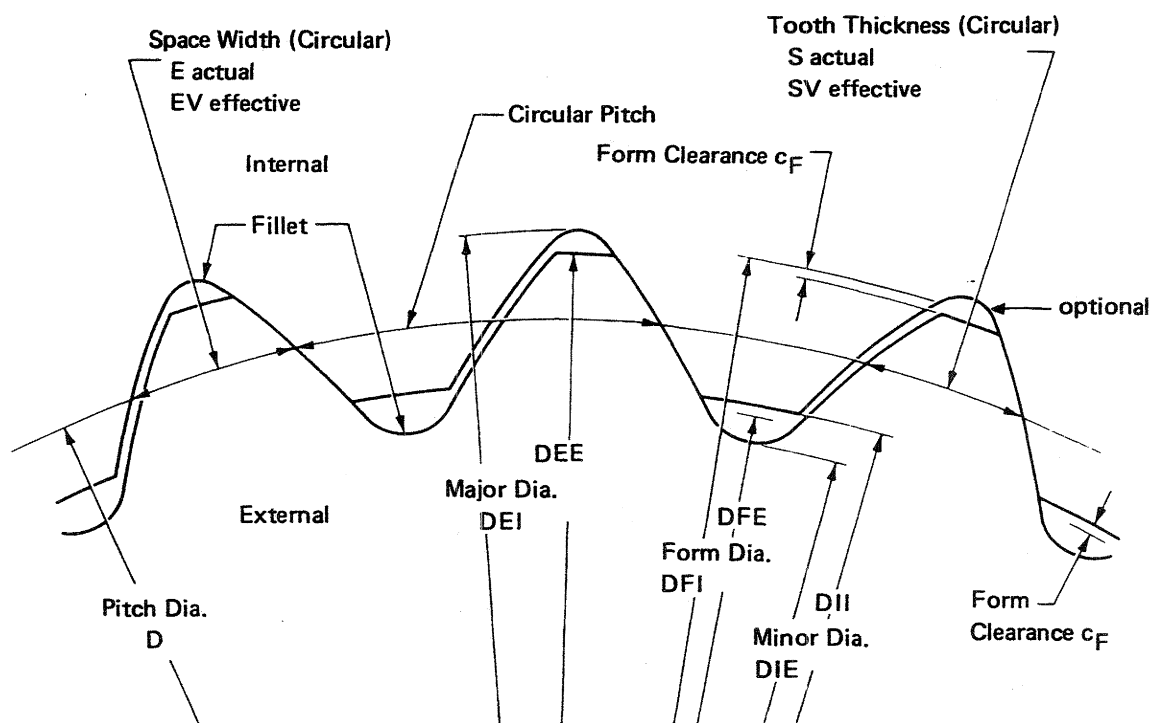


FIG. 9—SPLINE TERMS, SYMBOLS, AND DRAWING DATA—FILLET ROOT, 37.5 DEG PRESSURE ANGLE, MODULES 0.5 TO 10

The pressure angle and proportions of this spline are a direct compromise of the 30 and 45 deg pressure angle splines. It is often used on couplings where the external spline is to be cold formed; especially where a 45 deg pressure angle spline will

not satisfy functional requirements and the shaft material is above hardness limitation of 30 deg pressure angle cold forming tools (PART II – Tables 65 thru 92, and Appendix A, Tables A29 thru A56).

DRAWING DATA

Internal Involute Spline Data		External Involute Spline Data	
FILLET ROOT SIDE FIT	TOLERANCE CLASS—(*)	FILLET ROOT SIDE FIT	TOLERANCE CLASS—(*)
NUMBER OF TEETH	*	NUMBER OF TEETH	*
MODULE	*	MODULE	*
PRESSURE ANGLE	37.5 deg	PRESSURE ANGLE	37.5 deg
BASE DIAMETER	xx.xxxx REF.	BASE DIAMETER	xx.xxxx REF.
PITCH DIAMETER	xx.xxxx REF.	PITCH DIAMETER	xx.xxxx REF.
MAJOR DIAMETER	xx.xx MAX.	MAJOR DIAMETER	xx.xx/xx.xx
FORM DIAMETER	xx.xx	FORM DIAMETER	xx.xx
MINOR DIAMETER	xx.xx/xx.xx	MINOR DIAMETER	xx.xx MIN.
CIRCULAR SPACE WIDTH		CIRCULAR TOOTH THICKNESS	
MAX. ACTUAL	xx.xxx	MAX. EFFECTIVE	xx.xxx
MIN. EFFECTIVE	xx.xxx	MIN. ACTUAL	xx.xxx
MAX MEASUREMENT BETWEEN PINS	xx.xxx REF.	MIN MEASUREMENT OVER PINS	xx.xxx REF.
PIN DIAMETER	xx.xxx	PIN DIAMETER	xx.xxx
FILLET RADIUS (Optional)	See Table 7	FILLET RADIUS (Optional)	See Table 7

The above drawing data is required for the spline specifications.
The standard system is shown; for alternative systems, see par. 11.4 and par. 12.2.

*Specify.

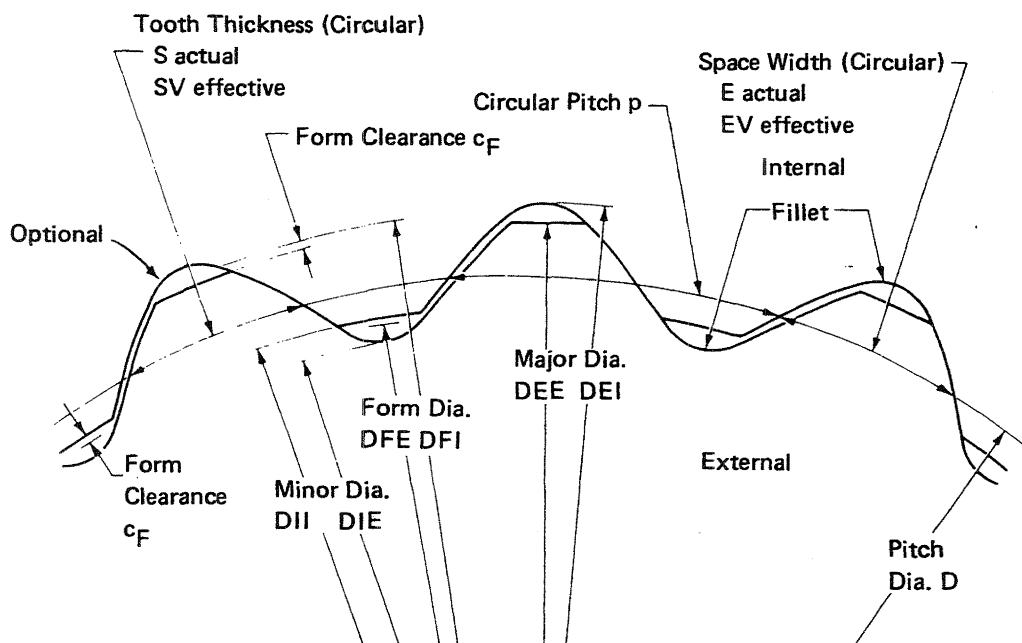


FIG. 10—SPLINE TERMS, SYMBOLS, AND DRAWING DATA—FILLET ROOT, 45 DEG PRESSURE ANGLE, MODULES 0.25 TO 2.5

Involute splines with 45 deg pressure angle are used where the toothed member delivers torque only, does not slide under load, and where wall thicknesses are great enough to resist burst-

ing tendencies. The 45 deg pressure angle spline is suitable for cold forming. (PART II — Tables 93 thru 110, and Appendix A, Tables A57 thru A74.

DRAWING DATA

Internal Involute Spline Data		External Involute Spline Data	
FILLET ROOT SIDE FIT	TOLERANCE CLASS—(*)	FILLET ROOT SIDE FIT	TOLERANCE CLASS—(*)
NUMBER OF TEETH	*	NUMBER OF TEETH	*
MODULE	*	MODULE	*
PRESSURE ANGLE	45 deg	PRESSURE ANGLE	45 deg
BASE DIAMETER	xx.xxxx REF.	BASE DIAMETER	xx.xxxx REF.
PITCH DIAMETER	xx.xxxx REF.	PITCH DIAMETER	xx.xxxx REF.
MAJOR DIAMETER	xx.xx MAX.	MAJOR DIAMETER	xx.xx/xx.xx
FORM DIAMETER	xx.xx	FORM DIAMETER	xx.xx
MINOR DIAMETER	xx.xx/xx.xx	MINOR DIAMETER	xx.xx MIN.
CIRCULAR SPACE WIDTH		CIRCULAR TOOTH THICKNESS	
MAX. ACTUAL	xx.xxx	MAX. EFFECTIVE	xx.xxx
MIN. EFFECTIVE	xx.xxx	MIN. ACTUAL	xx.xxx
MAX MEASUREMENT BETWEEN PINS	xx.xxx REF.	MIN MEASUREMENT OVER PINS	xx.xxx REF.
PIN DIAMETER	xx.xxx	PIN DIAMETER	xx.xxx
FILLET RADIUS (Optional)	See Table 7	FILLET RADIUS (Optional)	See Table 7

The above drawing data is required for the spline specifications.
The standard system is shown; for alternative systems, see par. 11.4 and par. 12.2.

*Specify.

PART II DIMENSIONS

FOREWORD

The spline tables in PART II of this standard are based on spline tolerance classes 4, 5, 6, and 7 and fit Class H/h, which has a minimum effective clearance of zero. All tables are for side fit splines only. Selection of a spline fit class having a different tooth thickness modification requires adjustment in the external spline dimensions (See PART I, par. 8.8.2).

Tables 9 thru 64 give dimensions for 30 deg pressure angle flat root and fillet root splines.

Tables 65 thru 92 give dimensions for 37.5 deg pressure angle fillet root splines.

Tables 93 thru 110 give dimensions for 45 deg pressure angle fillet root splines.

DIMENSIONS AND TOLERANCES

The dimensions and tolerances listed in Tables in PART II are derived from the formulae listed in Table 2, PART I. Circular space width and circular tooth thickness tolerances are based on formulas given in PART I, par. 6.1 and par. 8.2.

INTERNAL
10.00 MODULE

30.0 DEGRFF PRESSURE ANGLE INTERNAL INVOLUTE SPLINE
TABLE9- DIMENSIONS FOR FLAT ROOT SIDE FIT - 10.00 SPLINE MODULE

Z NO. OF TEETH	D PITCH DIA	DB BASE DIA	DEI MAJOR DIA MAX	DFI FORM DIA	DII MINOR DIA MIN	MINIMUM EFFECTIVE CIRCULAR SPACE WIDTH = 15.708												DRI PIN DIA	KI FACTOR				
						MAXIMUM ACTUAL CIRCULAR SPACE WIDTH AND MEASUREMENT BETWEEN PINS FOR TOLERANCE CLASS																	
						4H				5H				6H						7H			
						E MAX	MRI	E MAX	MRI	E MAX	MRI	E MAX	MRI	E MAX	MRI	E MAX	MRI						
6	60.0000	51.9615	75.44	72.00	54.31	15.772	38.277	15.810	38.391	15.848	38.557	15.964	38.823	16.000	39.000	1.0000	1.7161						
7	70.0000	60.6218	85.45	82.00	63.61	15.773	44.937	15.812	47.032	15.850	47.173	15.968	47.403	16.000	47.584	1.0000	1.3321						
8	80.0000	69.2820	95.46	92.00	73.11	15.774	54.563	15.813	54.698	15.851	54.839	15.970	55.070	16.000	55.251	1.0000	1.0783						
9	90.0000	77.9423	105.46	102.00	82.72	15.775	63.775	15.814	63.856	15.852	64.018	15.972	64.280	16.000	64.442	1.0000	0.8743						
10	100.0000	86.6025	115.47	112.00	92.42	15.776	75.237	15.815	75.339	15.853	75.490	15.974	75.737	16.000	75.984	1.0000	0.7161						
11	110.0000	95.2628	125.47	122.00	102.18	15.776	84.359	15.817	84.455	15.857	84.597	15.981	84.831	16.000	85.065	1.0000	0.5847						
12	120.0000	103.9230	135.48	132.00	111.98	15.777	95.521	15.819	95.614	15.861	95.754	15.984	95.984	16.000	96.214	1.0000	0.4783						
13	130.0000	112.5833	145.48	142.00	121.82	15.778	104.718	15.820	104.809	15.862	104.945	15.987	105.168	16.000	105.391	1.0000	0.3847						
14	140.0000	121.2436	155.49	152.00	131.66	15.779	112.088	15.821	112.188	15.864	112.339	15.990	112.584	16.000	112.829	1.0000	0.3047						
15	150.0000	129.9038	165.49	162.00	141.56	15.779	121.451	15.822	121.548	15.866	121.694	15.992	121.934	16.000	122.174	1.0000	0.2347						
16	160.0000	138.5641	175.50	172.00	151.45	15.780	132.325	15.823	132.421	15.867	132.564	15.995	132.801	16.000	133.038	1.0000	0.1747						
17	170.0000	147.2243	185.50	182.00	161.34	15.780	141.727	15.824	141.821	15.869	141.962	15.997	142.195	16.000	142.428	1.0000	0.1247						
18	180.0000	155.8846	195.51	192.00	171.24	15.781	152.485	15.825	152.578	15.871	152.719	16.000	152.950	16.000	153.181	1.0000	0.0847						
19	190.0000	164.5448	205.51	202.00	181.21	15.781	161.939	15.826	162.032	15.873	162.174	16.002	162.405	16.000	162.636	1.0000	0.0547						
20	200.0000	173.2051	215.51	212.00	191.15	15.782	172.601	15.826	172.693	15.873	172.834	16.004	173.065	16.000	173.296	1.0000	0.0347						
21	210.0000	181.8653	225.52	222.00	201.09	15.783	182.086	15.827	182.178	15.874	182.315	16.006	182.541	16.000	182.772	1.0000	0.0233						
22	220.0000	190.5255	235.52	232.00	211.04	15.783	192.649	15.828	192.780	15.875	192.917	16.008	193.144	16.000	193.375	1.0000	0.0193						
23	230.0000	199.1858	245.52	242.00	221.04	15.784	202.211	15.829	202.302	15.876	202.439	16.010	202.666	16.000	202.897	1.0000	0.0147						
24	240.0000	207.8461	255.53	252.00	231.04	15.785	212.759	15.830	212.850	15.877	212.986	16.012	213.212	16.000	213.443	1.0000	0.0107						
25	250.0000	216.5064	265.53	262.00	241.01	15.785	222.313	15.830	222.404	15.877	222.540	16.014	222.765	16.000	222.996	1.0000	0.0095						
26	260.0000	225.1666	275.53	272.00	250.87	15.785	232.816	15.831	232.906	15.878	233.042	16.016	233.268	16.000	233.499	1.0000	0.0081						
27	270.0000	233.8269	285.54	282.00	260.84	15.785	242.399	15.832	242.489	15.879	242.625	16.018	242.851	16.000	243.082	1.0000	0.0072						
28	280.0000	242.4871	295.54	292.00	270.80	15.786	252.663	15.833	252.753	15.880	252.889	16.020	253.115	16.000	253.346	1.0000	0.0063						
29	290.0000	251.1474	305.54	302.00	280.78	15.786	262.902	15.833	262.993	15.881	263.129	16.022	263.355	16.000	263.586	1.0000	0.0055						
30	300.0000	259.8076	315.55	312.00	290.75	15.787	272.902	15.834	272.993	15.881	273.129	16.023	273.355	16.000	273.586	1.0000	0.0047						
31	310.0000	268.4679	325.55	322.00	300.72	15.787	282.534	15.835	282.625	15.882	282.761	16.025	282.988	16.000	283.219	1.0000	0.0039						
32	320.0000	277.1281	335.55	332.00	310.70	15.788	292.936	15.835	293.027	15.883	293.164	16.027	293.391	16.000	293.622	1.0000	0.0031						
33	330.0000	285.7884	345.55	342.00	320.68	15.788	302.211	15.836	302.302	15.884	302.439	16.028	302.666	16.000	302.897	1.0000	0.0023						
34	340.0000	294.4486	355.56	352.00	330.66	15.788	312.616	15.837	312.707	15.885	312.844	16.030	313.071	16.000	313.302	1.0000	0.0019						
35	350.0000	303.1089	365.56	362.00	340.64	15.789	322.636	15.837	322.727	15.885	322.864	16.032	323.091	16.000	323.322	1.0000	0.0015						
36	360.0000	311.7691	375.56	372.00	350.62	15.789	332.991	15.838	333.083	15.886	333.220	16.033	333.447	16.000	333.678	1.0000	0.0011						
37	370.0000	320.4294	385.57	382.00	360.60	15.790	342.678	15.839	342.770	15.887	342.907	16.035	343.134	16.000	343.365	1.0000	0.0008						
38	380.0000	329.0897	395.57	392.00	370.58	15.790	352.211	15.839	352.302	15.887	352.439	16.036	352.666	16.000	352.897	1.0000	0.0006						
39	390.0000	337.7499	405.57	402.00	380.57	15.791	362.716	15.840	362.807	15.888	362.944	16.038	363.171	16.000	363.402	1.0000	0.0004						
40	400.0000	346.4102	415.57	412.00	390.54	15.791	372.035	15.840	372.127	15.888	372.264	16.039	372.491	16.000	372.722	1.0000	0.0003						
41	410.0000	355.0704	425.58	422.00	400.54	15.791	382.750	15.841	382.843	15.889	382.980	16.041	383.207	16.000	383.438	1.0000	0.0002						
42	420.0000	363.7307	435.58	432.00	410.53	15.792	392.953	15.842	393.046	15.890	393.183	16.042	393.410	16.000	393.641	1.0000	0.0001						
43	430.0000	372.3910	445.58	442.00	420.52	15.792	402.911	15.843	403.004	15.891	403.141	16.044	403.368	16.000	403.599	1.0000	0.0000						
44	440.0000	381.0512	455.59	452.00	430.50	15.793	412.656	15.843	412.749	15.891	412.886	16.045	413.113	16.000	413.344	1.0000	0.0000						
45	450.0000	389.7114	465.59	462.00	440.49	15.793	422.656	15.844	422.749	15.892	422.886	16.047	423.113	16.000	423.344	1.0000	0.0000						
46	460.0000	398.3717	475.59	472.00	450.48	15.793	432.934	15.844	433.027	15.892	433.164	16.048	433.391	16.000	433.622	1.0000	0.0000						
47	470.0000	407.0319	485.59	482.00	460.47	15.793	442.678	15.845	442.771	15.893	442.908	16.050	443.135	16.000	443.366	1.0000	0.0000						
48	480.0000	415.6922	495.59	492.00	470.46	15.794	452.211	15.845	452.304	15.893	452.441	16.051	452.668	16.000	452.899	1.0000	0.0000						
49	490.0000	424.3524	505.59	502.00	480.45	15.794	462.716	15.846	462.809	15.894	462.946	16.052	463.173	16.000	463.404	1.0000	0.0000						
50	500.0000	433.0127	515.60	512.00	490.44	15.794	472.975	15.846	473.068	15.894	473.205	16.054	473.432	16.000	473.663	1.0000	0.0000						
51	510.0000	441.6730	525.60	522.00	500.43	15.795	482.948	15.847	483.041	15.895	483.178	16.056	483.405	16.000	483.636	1.0000	0.0000						
52	520.0000	450.3332	535.61	532.00	510.42	15.795	492.943	15.848	493.036	15.895	493.173	16.058	493.400	16.000	493.631	1.0000	0.0000						
53	530.0000	458.9935	545.61	542.00	520.41	15.795	502.943	15.849	503.036	15.896	503.173	16.060	503.400	16.000	503.631	1.0000	0.0000						
54	540.0000	467.6537	555.61	552.00	530.40	15.796	512.943	15.849	513.036	15.896	513.173	16.063	513.400	16.000	513.631	1.0000	0.0000						
55	550.0000	476.3140	565.61	562.00	540.40	15.797	522.943	15.850	52														

30.0 DEGREE PRESSURE ANGLE EXTERNAL INVOLUTE SPLINE
TABLE 10- DIMENSIONS FOR FLAT ROOT SIDE FIT • 10.00 SPLINE MODULE

Z NO. OF TEETH	D PITCH DIA	DB BASE DIA	DEE MAJOR DIA MAX	DFE FORM DIA	DIE MINOR DIA MIN	SV MAXIMUM EFFECTIVE CIRCULAR TOOTH THICKNESS = 15.708								DRE PIN DIA	K FACTOR
						MINIMUM ACTUAL CIRCULAR TOOTH THICKNESS AND MEASUREMENT OVER PINS FOR TOLERANCE CLASS									
						4h		5h		6h		7h			
						S MIN	MRE	S MIN	MRE	S MIN	MRE	S MIN	MRE		
6	60.0000	51.9615	70.00	52.31	44.56	15.644	106.096	15.604	106.052	15.548	105.986	15.452	105.876	26.500	1.5156
7	70.0000	60.6218	80.00	61.61	54.55	15.644	110.747	15.604	110.701	15.548	110.633	15.448	110.519	25.000	1.5182
8	80.0000	69.2820	90.00	71.11	64.54	15.642	119.861	15.603	119.811	15.543	119.737	15.444	119.614	23.500	1.5209
9	90.0000	77.9423	100.00	80.72	74.54	15.641	125.516	15.601	125.465	15.541	125.388	15.441	125.260	22.000	1.5232
10	100.0000	86.6025	110.00	90.42	84.53	15.640	137.274	15.600	137.221	15.539	137.141	15.438	137.007	20.500	1.5252
11	110.0000	95.2628	120.00	100.18	94.53	15.640	146.149	15.599	146.094	15.537	146.013	15.434	145.877	19.000	1.5277
12	120.0000	103.9230	130.00	109.98	104.52	15.639	154.455	15.597	154.398	15.535	154.311	15.432	154.168	17.500	1.5306
13	130.0000	112.5833	140.00	119.82	114.52	15.638	163.504	15.596	163.446	15.533	163.359	15.429	163.213	16.000	1.5339
14	140.0000	121.2436	150.00	129.68	124.51	15.637	174.436	15.595	174.375	15.532	174.285	15.426	174.135	14.500	1.5377
15	150.0000	129.9038	160.00	139.54	134.51	15.637	183.815	15.594	183.755	15.530	183.664	15.423	183.512	13.000	1.5422
16	160.0000	138.5641	170.00	149.45	144.50	15.636	194.780	15.593	194.718	15.529	194.625	15.421	194.470	11.500	1.5464
17	170.0000	147.2243	180.00	159.36	154.50	15.636	204.060	15.592	203.997	15.527	203.903	15.419	203.746	10.000	1.5471
18	180.0000	155.8846	190.00	169.28	164.49	15.635	214.901	15.591	214.837	15.526	214.741	15.416	214.581	9.000	1.5463
19	190.0000	164.5448	200.00	179.21	174.49	15.634	221.011	15.590	220.945	15.524	220.846	15.414	220.681	8.000	1.5472
20	200.0000	173.2051	210.00	189.15	184.49	15.634	231.737	15.589	231.673	15.523	231.569	15.412	231.402	7.000	1.5105
21	210.0000	181.8653	220.00	199.09	194.48	15.633	241.151	15.589	241.083	15.522	240.982	15.410	240.813	6.000	1.5138
22	220.0000	190.5256	230.00	209.04	204.48	15.633	251.802	15.588	251.734	15.520	251.631	15.408	251.459	5.000	1.5252
23	230.0000	199.1858	240.00	218.99	214.48	15.632	261.268	15.587	261.199	15.519	261.095	15.406	260.922	4.000	1.5282
24	240.0000	207.8461	250.00	228.95	224.47	15.632	271.858	15.586	271.789	15.518	271.684	15.404	271.509	3.000	1.5388
25	250.0000	216.5064	260.00	238.91	234.47	15.631	281.388	15.585	281.297	15.517	281.191	15.402	281.014	2.000	1.5408
26	260.0000	225.1666	270.00	248.87	244.47	15.631	291.908	15.585	291.837	15.515	291.730	15.400	291.551	1.500	1.5493
27	270.0000	233.8269	280.00	258.84	254.46	15.630	301.454	15.584	301.382	15.514	301.274	15.398	301.093	1.000	1.5519
28	280.0000	242.4871	290.00	268.80	264.46	15.630	311.951	15.583	311.879	15.513	311.770	15.396	311.587	0.500	1.5594
29	290.0000	251.1474	300.00	278.76	274.46	15.630	321.458	15.583	321.385	15.512	321.345	15.394	321.161	0.250	1.5617
30	300.0000	259.8076	310.00	288.75	284.45	15.629	331.990	15.582	331.916	15.511	331.805	15.393	331.619	0.125	1.5684
31	310.0000	268.4679	320.00	298.72	294.45	15.629	341.594	15.581	341.519	15.510	341.407	15.391	341.221	0.0625	1.5706
32	320.0000	277.1281	330.00	308.70	304.45	15.629	352.024	15.580	351.948	15.509	351.836	15.389	351.647	0.03125	1.5765
33	330.0000	285.7884	340.00	318.68	314.45	15.628	361.652	15.580	361.576	15.508	361.463	15.388	361.272	0.015625	1.5789
34	340.0000	294.4486	350.00	328.66	324.44	15.627	371.280	15.579	371.204	15.507	371.091	15.386	370.900	0.0078125	1.5830
35	350.0000	303.1089	360.00	338.64	334.44	15.627	381.704	15.578	381.627	15.506	381.511	15.384	381.319	0.00390625	1.5857
36	360.0000	311.7691	370.00	348.62	344.44	15.627	392.081	15.578	392.004	15.505	391.888	15.383	391.694	0.001953125	1.5906
37	370.0000	320.4294	380.00	358.60	354.43	15.626	401.750	15.577	401.672	15.504	401.555	15.381	401.360	0.0009765625	1.5923
38	380.0000	329.0897	390.00	368.59	364.43	15.626	412.106	15.577	412.028	15.503	411.910	15.380	411.715	0.00048828125	1.5967
39	390.0000	337.7499	400.00	378.57	374.43	15.625	422.129	15.576	422.050	15.502	421.932	15.377	421.737	0.000244140625	1.5983
40	400.0000	346.4102	410.00	388.56	384.43	15.625	432.129	15.575	432.049	15.501	431.930	15.377	431.731	0.0001220703125	1.6023
41	410.0000	355.0704	420.00	398.54	394.42	15.625	441.830	15.575	441.750	15.500	441.630	15.375	441.429	0.00006103515625	1.6038
42	420.0000	363.7307	430.00	408.53	404.42	15.624	452.149	15.574	452.069	15.499	451.948	15.374	451.747	0.000030517578125	1.6078
43	430.0000	372.3909	440.00	418.52	414.42	15.624	461.864	15.574	461.783	15.498	461.662	15.372	461.459	0.0000152587890625	1.6088
44	440.0000	381.0512	450.00	428.50	424.42	15.624	471.168	15.573	471.087	15.497	470.966	15.370	470.765	0.00000762939453125	1.6135
45	450.0000	389.7114	460.00	438.49	434.41	15.623	481.195	15.572	481.114	15.496	481.033	15.369	480.832	0.000003814697265625	1.6155
46	460.0000	398.3717	470.00	448.48	444.41	15.623	492.185	15.572	492.103	15.495	491.980	15.368	491.779	0.0000019073486328125	1.6168
47	470.0000	407.0319	480.00	458.47	454.41	15.623	501.924	15.571	501.842	15.494	501.717	15.366	501.516	0.00000095367431640625	1.6178
48	480.0000	415.6922	490.00	468.46	464.41	15.622	512.201	15.571	512.118	15.494	511.993	15.365	511.785	0.000000476837158203125	1.6208
49	490.0000	424.3525	500.00	478.45	474.40	15.622	522.214	15.570	522.132	15.493	521.957	15.362	521.756	0.0000002384185791015625	1.6219
50	500.0000	433.0127	510.00	488.44	484.40	15.622	532.214	15.570	532.132	15.492	532.006	15.362	531.795	0.00000011920928955078125	1.6246
51	510.0000	441.6730	520.00	498.43	494.40	15.621	541.975	15.569	541.890	15.490	541.763	15.360	541.550	0.000000059604644775390625	1.6256
52	520.0000	450.3332	530.00	508.43	504.39	15.621	552.229	15.568	552.144	15.489	552.016	15.359	551.802	0.0000000298023223876953125	1.6256
53	530.0000	458.9935	540.00	518.42	514.39	15.620	561.997	15.567	561.912	15.488	561.783	15.358	561.568	0.00000001490116119384765625	1.6292
54	540.0000	467.6537	550.00	528.42	524.39	15.620	572.242	15.567	572.155	15.487	572.026	15.355	571.810	0.000000007450580596923828125	1.6315
55	550.0000	476.3140	560.00	538.40	534.39	15.619	582.018	15.566	581.931	15.486	581.801	15.353	581.584	0.0000000037252902984619140625	1.6324
56	560.0000	484.9742	570.00	548.39	544.38	15.619	592.253	15.565	592.166	15.485	592.035	15.352	591.817	0.00000000186264514923095703125	1.6347
57	570.0000	493.6345	580.00	558.39	554.38	15.618	602.145	15.565	602.058	15.484	601.924	15.350	601.706	0.000000000931322574615478515625	1.6345
58	580.0000	502.2947	590.00	568.38	564.38	15.618	612.168	15.564	612.081	15.483	611.946	15.348	611.728	0.0000000004656612873077392578125	1.6514
59	5														

INTERNAL
8.00 MODULE

30.0 DEGREE PRESSURE ANGLE INTERNAL INVOLUTE SPLINE
TABLE 11— DIMENSIONS FOR FLAT ROOT STD FIT • 8.00 SPLINE MODULE

Z NO. OF TEETH	D PITCH DIA	DB BASE DIA	DEI MAJOR DIA MAX	DFI FORM DIA	DII MINOR DIA MIN	MINIMUM EFFECTIVE CIRCULAR SPACE WIDTH = 12.566												DRI PIN DIA	DRI PIN DIA	DRI PIN DIA			
						MAXIMUM ACTUAL CIRCULAR SPACE WIDTH AND MEASUREMENT BETWEEN PINS FOR TOLERANCE CLASS																	
						4H				5H				6H							7H		
						E MAX	M RI	E MAX	M RI	E MAX	M RI	E MAX	M RI	E MAX	M RI	E MAX	M RI						
6	48.0000	41.5692	60.41	57.60	43.45	12.626	31.878	12.661	31.966	12.714	32.094	12.803	32.303	12.900	32.519	13.000	32.738	13.100	32.957	13.200			
7	56.0000	48.4974	68.42	65.60	50.49	12.626	35.909	12.661	36.021	12.714	36.182	12.803	36.439	12.900	36.696	13.000	36.953	13.100	37.210	13.200			
8	64.0000	55.4256	76.42	73.60	58.48	12.626	40.000	12.661	40.161	12.714	40.322	12.803	40.579	12.900	40.836	13.000	41.093	13.100	41.350	13.200			
9	72.0000	62.3538	84.43	81.60	66.48	12.626	44.011	12.661	44.172	12.714	44.333	12.803	44.590	12.900	44.847	13.000	45.104	13.100	45.361	13.200			
10	80.0000	69.2820	92.43	89.60	73.49	12.626	48.022	12.661	48.183	12.714	48.344	12.803	48.601	12.900	48.858	13.000	49.115	13.100	49.372	13.200			
11	88.0000	76.2102	100.44	97.60	81.50	12.630	55.977	12.668	56.077	12.724	56.219	12.819	56.455	12.914	56.691	13.009	56.926	13.104	57.161	13.209			
12	96.0000	83.1384	108.44	105.60	89.50	12.630	64.955	12.669	65.055	12.724	65.196	12.822	65.432	12.917	65.668	13.012	65.904	13.107	66.139	13.212			
13	104.0000	90.0666	116.45	113.60	97.45	12.631	74.932	12.670	75.032	12.728	75.173	12.825	75.409	12.920	75.645	13.035	75.881	13.140	76.116	13.217			
14	112.0000	96.9948	124.45	121.60	105.34	12.632	84.909	12.671	85.009	12.731	85.150	12.827	85.386	12.922	85.622	13.027	85.858	13.132	86.093	13.217			
15	120.0000	103.9230	132.46	129.60	113.35	12.632	94.886	12.671	94.986	12.731	95.127	12.827	95.363	12.922	95.599	13.027	95.835	13.132	96.070	13.217			
16	128.0000	110.8513	140.46	137.60	121.16	12.633	104.863	12.672	104.963	12.732	105.104	12.828	105.340	12.923	105.576	13.028	105.812	13.133	106.047	13.217			
17	136.0000	117.7795	148.46	145.60	129.00	12.633	114.840	12.672	114.940	12.732	115.081	12.828	115.317	12.923	115.553	13.028	115.789	13.133	116.024	13.217			
18	144.0000	124.7077	156.47	153.60	137.02	12.634	124.817	12.672	124.917	12.732	125.058	12.828	125.294	12.923	125.530	13.028	125.766	13.133	126.001	13.217			
19	152.0000	131.6359	164.47	161.60	144.97	12.634	134.794	12.672	134.894	12.732	135.035	12.828	135.271	12.923	135.507	13.028	135.743	13.133	135.978	13.217			
20	160.0000	138.5641	172.47	169.60	152.92	12.635	144.771	12.672	144.871	12.732	145.012	12.828	145.248	12.923	145.484	13.028	145.720	13.133	145.955	13.217			
21	168.0000	145.4923	180.48	177.60	160.87	12.635	154.748	12.672	154.848	12.732	154.989	12.828	155.225	12.923	155.461	13.028	155.697	13.133	155.932	13.217			
22	176.0000	152.4205	188.48	185.60	168.83	12.636	164.725	12.672	164.825	12.732	164.966	12.828	165.202	12.923	165.438	13.028	165.674	13.133	165.909	13.217			
23	184.0000	159.3487	196.48	193.60	176.79	12.636	174.702	12.672	174.802	12.732	174.943	12.828	175.179	12.923	175.415	13.028	175.651	13.133	175.886	13.217			
24	192.0000	166.2769	204.49	201.60	184.76	12.637	184.679	12.672	184.779	12.732	184.920	12.828	185.156	12.923	185.392	13.028	185.628	13.133	185.863	13.217			
25	200.0000	173.2051	212.49	209.60	192.72	12.637	194.656	12.672	194.756	12.732	194.897	12.828	195.133	12.923	195.369	13.028	195.605	13.133	195.840	13.217			
26	208.0000	180.1333	220.49	217.60	200.70	12.637	204.633	12.672	204.733	12.732	204.874	12.828	205.110	12.923	205.346	13.028	205.582	13.133	205.817	13.217			
27	216.0000	187.0615	228.50	225.60	208.67	12.638	214.610	12.672	214.710	12.732	214.851	12.828	215.087	12.923	215.323	13.028	215.559	13.133	215.794	13.217			
28	224.0000	193.9897	236.50	233.60	216.64	12.638	224.587	12.672	224.687	12.732	224.828	12.828	225.064	12.923	225.300	13.028	225.536	13.133	225.771	13.217			
29	232.0000	200.9179	244.50	241.60	224.62	12.639	234.564	12.672	234.664	12.732	234.805	12.828	235.041	12.923	235.277	13.028	235.513	13.133	235.748	13.217			
30	240.0000	207.8461	252.50	249.60	232.40	12.639	244.541	12.672	244.641	12.732	244.782	12.828	245.018	12.923	245.254	13.028	245.490	13.133	245.725	13.217			
31	248.0000	214.7743	260.51	257.60	240.58	12.639	254.518	12.672	254.618	12.732	254.759	12.828	255.005	12.923	255.241	13.028	255.477	13.133	255.712	13.217			
32	256.0000	221.7025	268.51	265.60	248.56	12.640	264.495	12.672	264.595	12.732	264.736	12.828	264.982	12.923	265.218	13.028	265.454	13.133	265.689	13.217			
33	264.0000	228.6307	276.51	273.60	256.54	12.640	274.472	12.672	274.572	12.732	274.713	12.828	274.959	12.923	275.195	13.028	275.431	13.133	275.666	13.217			
34	272.0000	235.5589	284.52	281.60	264.53	12.641	284.449	12.672	284.549	12.732	284.690	12.828	284.936	12.923	285.172	13.028	285.408	13.133	285.643	13.217			
35	280.0000	242.4871	292.52	289.60	272.51	12.641	294.426	12.672	294.526	12.732	294.667	12.828	294.913	12.923	295.149	13.028	295.385	13.133	295.620	13.217			
36	288.0000	249.4153	300.52	297.60	280.50	12.641	304.403	12.672	304.503	12.732	304.644	12.828	304.890	12.923	305.126	13.028	305.362	13.133	305.597	13.217			
37	296.0000	256.3435	308.52	305.60	288.48	12.642	314.380	12.672	314.480	12.732	314.621	12.828	314.867	12.923	315.103	13.028	315.339	13.133	315.574	13.217			
38	304.0000	263.2717	316.52	313.60	296.47	12.642	324.357	12.672	324.457	12.732	324.598	12.828	324.844	12.923	325.080	13.028	325.316	13.133	325.551	13.217			
39	312.0000	270.1999	324.53	321.60	304.44	12.642	334.334	12.672	334.434	12.732	334.575	12.828	334.821	12.923	335.057	13.028	335.293	13.133	335.528	13.217			
40	320.0000	277.1281	332.53	329.60	312.45	12.642	344.311	12.672	344.411	12.732	344.552	12.828	344.798	12.923	345.034	13.028	345.270	13.133	345.505	13.217			
41	328.0000	284.0563	340.53	337.60	320.43	12.643	354.288	12.672	354.388	12.732	354.529	12.828	354.775	12.923	355.011	13.028	355.247	13.133	355.482	13.217			
42	336.0000	290.9845	348.53	345.60	328.42	12.643	364.265	12.672	364.365	12.732	364.506	12.828	364.752	12.923	364.988	13.028	365.224	13.133	365.459	13.217			
43	344.0000	297.9127	356.54	353.60	336.41	12.643	374.242	12.672	374.342	12.732	374.483	12.828	374.729	12.923	374.965	13.028	375.201	13.133	375.436	13.217			
44	352.0000	304.8409	364.54	361.60	344.40	12.643	384.219	12.672	384.319	12.732	384.460	12.828	384.706	12.923	384.942	13.028	385.178	13.133	385.413	13.217			
45	360.0000	311.7691	372.54	369.60	352.39	12.643	394.196	12.672	394.296	12.732	394.437	12.828	394.683	12.923	394.919	13.028	395.155	13.133	395.390	13.217			
46	368.0000	318.6973	380.54	377.60	360.39	12.645	404.173	12.672	404.273	12.732	404.414	12.828	404.660	12.923	404.896	13.028	405.132	13.133	405.367	13.217			
47	376.0000	325.6255	388.54	385.60	368.38	12.645	414.150	12.672	414.250	12.732	414.391	12.828	414.637	12.923	414.873	13.028	415.109	13.133	415.344	13.217			
48	384.0000	332.5537	396.55	393.60	376.37	12.645	424.127	12.672	424.227	12.732	424.368	12.828	424.614	12.923	424.850	13.0							

30.0 DEGRFF PRESSURE ANGLE EXTERNAL INVOLUTE SPLINE
TABLE12- DIMENSIONS FOR FLAT ROOT SIDE FIT , 8.00 SPLINE MODULE

Z NO. OF TEETH	D PITCH DIA	DB BASE DIA	DEE MAJOR DIA MAX	DFE FORM DIA	DIE MINOR DIA MIN	MAXIMUM EFFECTIVE CIRCULAR TOOTH THICKNESS = 12.566								DRE PIN DIA	DRE PIN TOL
						MINIMUM ACTUAL CIRCULAR TOOTH THICKNESS AND MEASUREMENT OVER PINS FOR TOLERANCE CLASS									
						4h		5h		6h		7h			
						S MIN	MRE	S MIN	MRE	S MIN	MRE	S MIN	MRE		
6	48.0000	41.5692	56.00	41.85	35.59	12.507	84.467	12.472	84.427	12.418	84.766	12.330	84.664	21.200	1.4461
7	56.0000	48.4974	64.00	40.29	43.58	12.506	86.230	12.470	86.187	12.416	86.122	12.326	86.015	19.000	1.4014
8	64.0000	55.4256	72.00	56.88	51.58	12.505	86.171	12.469	86.125	12.414	86.057	12.322	85.943	19.000	1.3864
9	72.0000	62.3538	80.00	64.58	59.57	12.505	100.600	12.468	100.553	12.412	100.482	12.319	100.364	18.000	1.2797
10	80.0000	69.2820	88.00	72.34	67.57	12.504	110.610	12.468	109.961	12.410	109.886	12.316	109.763	18.000	1.3207
11	88.0000	76.2102	96.00	80.14	75.56	12.503	117.110	12.465	117.060	12.408	116.984	12.313	116.859	18.000	1.3232
12	96.0000	83.1384	104.00	87.99	83.56	12.502	123.656	12.464	123.603	12.407	123.523	12.311	123.390	17.000	1.3774
13	104.0000	90.0666	112.00	95.85	91.55	12.502	130.894	12.463	130.842	12.405	130.761	12.308	130.626	17.000	1.3925
14	112.0000	96.9948	120.00	103.74	99.55	12.501	139.800	12.462	139.745	12.403	139.662	12.306	139.524	17.000	1.4175
15	120.0000	103.9230	128.00	111.65	107.54	12.501	147.145	12.461	147.089	12.402	147.005	12.303	146.865	17.000	1.4425
16	128.0000	110.8513	136.00	119.56	115.54	12.500	155.918	12.460	155.861	12.401	155.775	12.301	155.631	17.000	1.4675
17	136.0000	117.7795	144.00	127.49	123.54	12.500	163.342	12.459	163.284	12.399	163.197	12.299	163.052	17.000	1.4925
18	144.0000	124.7077	152.00	135.42	131.53	12.499	172.015	12.459	171.956	12.399	171.867	12.297	171.720	17.000	1.4632
19	152.0000	131.6359	160.00	143.37	139.53	12.498	176.795	12.458	176.734	12.397	176.643	12.295	176.490	16.000	1.4982
20	160.0000	138.5641	168.00	151.32	147.53	12.498	185.376	12.457	185.314	12.395	185.221	12.293	185.066	16.000	1.5115
21	168.0000	145.4923	176.00	159.27	155.52	12.498	192.907	12.456	192.844	12.394	192.751	12.291	192.594	16.000	1.5148
22	176.0000	152.4205	184.00	167.23	163.52	12.497	201.428	12.455	201.365	12.393	201.270	12.289	201.111	16.000	1.5261
23	184.0000	159.3487	192.00	175.19	171.50	12.497	209.000	12.454	208.936	12.392	208.844	12.287	208.684	16.000	1.5292
24	192.0000	166.2769	200.00	183.16	179.41	12.496	217.473	12.454	217.408	12.391	217.311	12.285	217.146	16.000	1.5349
25	200.0000	173.2051	208.00	191.12	187.51	12.496	225.080	12.453	225.015	12.390	224.917	12.284	224.753	16.000	1.5417
26	208.0000	180.1333	216.00	199.10	195.51	12.495	233.512	12.453	233.446	12.389	233.347	12.282	233.182	16.000	1.5502
27	216.0000	187.0615	224.00	207.07	203.50	12.495	241.148	12.452	241.082	12.388	240.982	12.280	240.816	16.000	1.5528
28	224.0000	193.9897	232.00	215.04	211.50	12.494	249.546	12.451	249.479	12.387	249.378	12.279	249.210	16.000	1.5603
29	232.0000	200.9179	240.00	223.02	219.50	12.494	257.208	12.451	257.140	12.386	257.039	12.277	256.869	16.000	1.5628
30	240.0000	207.8461	248.00	231.00	227.50	12.494	265.577	12.450	265.508	12.385	265.406	12.276	265.235	16.000	1.5693
31	248.0000	214.7743	256.00	238.98	235.49	12.493	273.260	12.449	273.191	12.384	273.088	12.274	272.916	16.000	1.5714
32	256.0000	221.7025	264.00	246.96	243.49	12.493	281.604	12.449	281.534	12.383	281.430	12.272	281.256	16.000	1.5774
33	264.0000	228.6307	272.00	254.94	251.49	12.493	289.306	12.448	289.236	12.382	289.131	12.271	288.957	16.000	1.5793
34	272.0000	235.5589	280.00	262.93	259.49	12.493	297.629	12.448	297.557	12.381	297.453	12.269	297.278	16.000	1.5847
35	280.0000	242.4871	288.00	270.91	267.48	12.492	305.347	12.447	305.276	12.380	305.170	12.268	304.993	16.000	1.5865
36	288.0000	249.4153	296.00	278.90	275.48	12.491	313.649	12.446	313.578	12.379	313.471	12.267	313.292	16.000	1.5914
37	296.0000	256.3435	304.00	286.88	283.48	12.491	321.384	12.445	321.312	12.378	321.205	12.265	321.025	16.000	1.5931
38	304.0000	263.2717	312.00	294.87	291.48	12.491	329.669	12.445	329.597	12.377	329.488	12.264	329.307	16.000	1.5950
39	312.0000	270.1999	320.00	302.85	299.47	12.490	337.417	12.444	337.345	12.376	337.235	12.262	337.053	16.000	1.5990
40	320.0000	277.1281	328.00	310.85	307.47	12.490	345.887	12.444	345.814	12.374	345.704	12.261	345.520	16.000	1.6031
41	328.0000	284.0563	336.00	318.83	315.47	12.490	353.447	12.444	353.374	12.375	353.263	12.260	353.079	16.000	1.6045
42	336.0000	290.9845	344.00	326.82	323.47	12.489	361.703	12.443	361.629	12.374	361.518	12.258	361.332	16.000	1.6082
43	344.0000	297.9127	352.00	334.80	331.46	12.489	369.675	12.443	369.600	12.373	369.489	12.257	369.303	16.000	1.6095
44	352.0000	304.8409	360.00	342.79	339.46	12.488	377.719	12.442	377.643	12.372	377.531	12.256	377.344	16.000	1.6130
45	360.0000	311.7691	368.00	350.79	347.46	12.488	385.500	12.442	385.425	12.371	385.311	12.255	385.123	16.000	1.6142
46	368.0000	318.6973	376.00	358.79	355.46	12.488	393.732	12.441	393.656	12.371	393.542	12.253	393.353	16.000	1.6174
47	376.0000	325.6255	384.00	366.78	363.46	12.488	401.523	12.441	401.447	12.370	401.332	12.252	401.142	16.000	1.6185
48	384.0000	332.5537	392.00	374.77	371.46	12.487	409.744	12.440	409.668	12.369	409.553	12.251	409.363	16.000	1.6216
49	392.0000	339.4819	400.00	382.76	379.45	12.487	417.584	12.440	417.507	12.368	417.392	12.250	417.201	16.000	1.6252
50	400.0000	346.4102	408.00	390.75	387.45	12.487	425.754	12.439	425.679	12.368	425.563	12.249	425.369	16.000	1.6252
51	408.0000	353.3384	416.00	398.75	395.45	12.487	433.563	12.439	433.486	12.367	433.369	12.247	433.175	16.000	1.6263
52	416.0000	360.2666	424.00	406.74	403.45	12.486	441.767	12.438	441.689	12.366	441.572	12.246	441.376	16.000	1.6288
53	424.0000	367.1948	432.00	414.73	411.44	12.486	449.581	12.438	449.503	12.365	449.385	12.245	449.189	16.000	1.6298
54	432.0000	374.1230	440.00	422.73	419.44	12.485	457.777	12.437	457.697	12.365	457.580	12.244	457.383	16.000	1.6321
55	440.0000	381.0512	448.00	430.72	427.44	12.485	465.598	12.437	465.519	12.364	465.400	12.242	465.202	16.000	1.6331
56	448.0000	387.9794	456.00	438.72	435.44	12.485	473.786	12.436	473.707	12.363	473.587	12.241	473.388	16.000	1.6353
57	456.0000	394.9076	464.00	446.71	443.44	12.485	481.614	12.436	481.534	12.363	481.414	12.240	481.214	16.000	1.6361
58	464.0000	401.8358	472.00	454.70	451.43	12.485	489.795	12.435	489.715	12.362	489.594	12.239	489.393	16.000	1.6382
59	472.0000	408.7640	480.00	462.70	459.43	12.484	497.629	12.435	497.548	12.361	497.427	12.238	497.226	16.000	1.6390
60	480.0000	415.6922	488.00	470.69	467.43	12.484	505.803	12.435	505.722	12.360	505.601	12.237	505.398	16.0	

INTERNAL
6.00 MODULE

30.0 DEGRFF PRESSURE ANGLE INTERNAL INVOLUTE SPLINE
TABLE 13- DIMENSIONS FOR FLAT ROOT SIDE FIT - 6.00 SPLINE MODULE

Z NO. OF TEETH	D PITCH DIA	DB BASE DIA	DEI MAJOR DIA MAX	DFI FORM DIA	DII MINOR DIA MIN	MINIMUM EFFECTIVE CIRCULAR SPACE WIDTH = 9.425								DRI PIN DIA	DRI PIN DIA	DRI PIN DIA
						MAXIMUM ACTUAL CIRCULAR SPACE WIDTH AND MEASUREMENT BETWEEN PINS FOR TOLERANCE CLASS										
						4H		5H		6H		7H				
						E MAX	MRI	E MAX	MRI	E MAX	MRI	E MAX	MRI			
6	36.0000	31.1749	45.37	43.20	32.58	9.478	23.436	9.511	23.522	9.559	23.644	9.639	23.847	9.500	2.400	1.9766
7	42.0000	36.3731	51.38	49.20	38.17	9.479	26.478	9.512	26.592	9.561	26.755	9.643	27.006	10.000	2.500	1.9766
8	48.0000	41.5692	57.38	55.20	43.86	9.480	33.699	9.513	33.791	9.563	33.926	9.646	34.144	10.000	2.600	1.9766
9	54.0000	46.7654	63.39	61.20	49.63	9.481	39.089	9.514	39.171	9.565	39.292	9.649	39.490	10.000	2.700	1.9766
10	60.0000	51.9615	69.39	67.20	55.45	9.481	43.509	9.515	43.613	9.566	43.766	9.651	44.010	10.000	2.800	1.9766
11	66.0000	57.1577	75.40	73.20	61.31	9.482	49.105	9.516	49.196	9.568	49.331	9.654	49.551	10.000	2.900	1.9766
12	72.0000	62.3538	81.40	79.20	67.16	9.483	55.856	9.517	55.942	9.569	56.070	9.656	56.280	10.000	3.000	1.9766
13	78.0000	67.5500	87.40	85.20	73.09	9.483	61.426	9.518	61.508	9.571	61.630	9.658	61.831	10.000	3.100	1.9766
14	84.0000	72.7461	93.41	91.20	79.01	9.484	68.030	9.519	68.111	9.572	68.231	9.661	68.424	10.000	3.200	1.9766
15	90.0000	77.9423	99.41	97.20	84.93	9.484	73.626	9.520	73.705	9.573	73.822	9.663	74.014	10.000	3.300	1.9766
16	96.0000	83.1384	105.42	103.20	90.87	9.485	80.139	9.521	80.217	9.575	80.333	9.665	80.524	10.000	3.400	1.9766
17	102.0000	88.3346	111.42	109.20	96.82	9.485	85.767	9.522	85.844	9.576	85.959	9.667	86.146	10.000	3.500	1.9766
18	108.0000	93.5307	117.42	115.20	102.77	9.486	92.215	9.523	92.291	9.577	92.404	9.668	92.592	10.000	3.600	1.9766
19	114.0000	98.7269	123.43	121.20	108.73	9.486	97.847	9.523	97.948	9.578	98.061	9.670	98.247	10.000	3.700	1.9766
20	120.0000	103.9230	129.43	127.20	114.69	9.487	104.270	9.524	104.346	9.579	104.458	9.672	104.644	10.000	3.800	1.9766
21	126.0000	109.1192	135.43	133.20	120.65	9.487	109.955	9.524	110.030	9.580	110.142	9.674	110.327	10.000	3.900	1.9797
22	132.0000	114.3154	141.43	139.20	126.62	9.487	116.312	9.525	116.388	9.581	116.500	9.675	116.685	10.000	4.000	1.9692
23	138.0000	119.5115	147.44	145.20	132.59	9.488	122.073	9.526	122.149	9.582	122.261	9.677	122.441	10.000	4.100	1.9692
24	144.0000	124.7077	153.44	151.20	138.57	9.488	128.357	9.526	128.433	9.583	128.545	9.678	128.725	10.000	4.200	1.9692
25	150.0000	129.9038	159.44	157.20	144.54	9.489	132.099	9.527	132.177	9.584	132.289	9.680	132.465	10.000	4.300	1.9692
26	156.0000	135.1000	165.44	163.20	150.52	9.489	138.406	9.527	138.483	9.585	138.599	9.682	138.792	11.200	4.400	1.9936
27	162.0000	140.2961	171.45	169.20	156.50	9.489	144.163	9.528	144.241	9.586	144.356	9.683	144.548	11.200	4.500	1.9766
28	168.0000	145.4923	177.45	175.20	162.48	9.490	150.446	9.529	150.523	9.587	150.639	9.684	150.831	11.200	4.600	1.9766
29	174.0000	150.6884	183.45	181.20	168.46	9.490	156.217	9.529	156.294	9.588	156.410	9.686	156.602	11.200	4.700	1.9766
30	180.0000	155.8846	189.45	187.20	174.45	9.491	162.470	9.530	162.556	9.589	162.672	9.687	162.864	11.200	4.800	1.9766
31	186.0000	161.0807	195.46	193.20	180.43	9.491	168.263	9.531	168.340	9.590	168.456	9.689	168.647	11.200	4.900	1.9797
32	192.0000	166.2769	201.46	199.20	186.42	9.491	174.507	9.531	174.585	9.590	174.700	9.690	174.892	11.200	5.000	1.9797
33	198.0000	171.4730	207.46	205.20	192.41	9.491	180.303	9.532	180.380	9.591	180.496	9.691	180.688	11.200	5.100	1.9797
34	204.0000	176.6692	213.46	211.20	198.39	9.492	186.532	9.532	186.609	9.592	186.725	9.692	186.917	11.200	5.200	1.9797
35	210.0000	181.8653	219.46	217.20	204.38	9.492	192.338	9.532	192.415	9.593	192.531	9.694	192.723	11.200	5.300	1.9797
36	216.0000	187.0615	225.47	223.20	210.37	9.492	198.553	9.533	198.631	9.594	198.747	9.695	198.940	11.200	5.400	1.9797
37	222.0000	192.2576	231.47	229.20	216.36	9.493	204.368	9.533	204.446	9.594	204.562	9.696	204.755	11.200	5.500	1.9797
38	228.0000	197.4538	237.47	235.20	222.35	9.493	210.572	9.534	210.650	9.595	210.766	9.697	210.960	11.200	5.600	1.9797
39	234.0000	202.6499	243.47	241.20	228.33	9.494	216.366	9.534	216.444	9.596	216.560	9.699	216.754	11.200	5.700	1.9797
40	240.0000	207.8461	249.48	247.20	234.33	9.494	222.589	9.535	222.667	9.597	222.784	9.700	222.978	11.200	5.800	1.9797
41	246.0000	213.0422	255.48	253.20	240.33	9.494	228.420	9.535	228.498	9.597	228.615	9.701	228.810	11.200	5.900	1.9740
42	252.0000	218.2384	261.48	259.20	246.32	9.494	234.604	9.536	234.682	9.598	234.799	9.702	234.994	11.200	6.000	1.9712
43	258.0000	223.4346	267.48	265.20	252.31	9.494	240.443	9.536	240.521	9.599	240.638	9.703	240.833	11.200	6.100	1.9712
44	264.0000	228.6307	273.48	271.20	258.30	9.495	246.617	9.537	246.695	9.600	246.813	9.704	247.009	11.200	6.200	1.9712
45	270.0000	233.8269	279.49	277.20	264.30	9.495	252.443	9.537	252.541	9.600	252.659	9.706	252.855	11.200	6.300	1.9712
46	276.0000	239.0230	285.49	283.20	270.29	9.495	258.629	9.538	258.708	9.601	258.826	9.707	259.023	11.200	6.400	1.9712
47	282.0000	244.2192	291.49	289.20	276.29	9.496	264.481	9.538	264.560	9.602	264.678	9.708	264.875	11.200	6.500	1.9712
48	288.0000	249.4153	297.49	295.20	282.29	9.496	270.661	9.539	270.740	9.603	270.838	9.709	271.034	11.200	6.600	1.9712
49	294.0000	254.6115	303.49	301.20	288.29	9.496	276.847	9.539	276.926	9.604	277.024	9.710	277.220	11.200	6.700	1.9712
50	300.0000	259.8076	309.49	307.20	294.29	9.496	282.651	9.539	282.730	9.604	282.849	9.711	283.048	11.200	6.800	1.9712
51	306.0000	265.0038	315.50	313.20	300.29	9.497	288.513	9.540	288.593	9.604	288.712	9.712	288.911	11.200	6.900	1.9743
52	312.0000	270.1999	321.50	319.20	306.29	9.497	294.660	9.540	294.740	9.605	294.860	9.713	295.059	11.200	7.000	1.9743
53	318.0000	275.3961	327.50	325.20	312.29	9.497	300.808	9.541	300.888	9.606	301.008	9.714	301.207	11.200	7.100	1.9743
54	324.0000	280.5922	333.50	331.20	318.29	9.498	306.956	9.541	307.036	9.606	307.156	9.715	307.355	11.200	7.200	1.9743
55	330.0000	285.7884	339.50	337.20	324.29	9.498	312.561	9.541	312.621	9.607	312.742	9.716	312.942	11.200	7.300	1.9743
56	336.0000	290.9845	345.51	343.20	330.29	9.498	318.677	9.542	318.757	9.607	318.878	9.717	319.079	11.200	7.400	1.9743
57	342.0000	296.1807	351.51	349.20	336.29	9.498	324.553	9.542	324.634	9.608	324.755	9.718	324.956	11.200	7.500	1.9743
58	348.0000	301.3768	357.51	355.20	342.29	9.498	330.684	9.543	330.765	9.609	330.886	9.719	331.087	11.200	7.600	1.9743
59	354.0000	306.5730	363.51	361.20	348.29											

30.0 DEGREE PRESSURE ANGLE EXTERNAL INVOLUTE SPLINE

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5.00 MODULE**

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TABLE 15- DIMENSIONS FOR FLAT ROOT SIDE FIT . 5.00 SPLINE MODULE

Z NO. OF TEETH	D PITCH DIA	DB BASE DIA	DEI MAJOR DIA MAX	DFI FORM DIA	DII MINOR DIA MIN	MINIMUM EFFECTIVE CIRCULAR SPACE WIDTH = 7.854												DRI PIN DIA	KI FACTOR				
						MAXIMUM ACTUAL CIRCULAR SPACE WIDTH AND MEASUREMENT BETWEEN PINS FOR TOLERANCE CLASS																	
						4H		MRI		5H		MRI		6H		MRI				7H		MRI	
						E MAX	MRI	E MAX	MRI	E MAX	MRI	E MAX	MRI	E MAX	MRI	E MAX	MRI						
6	30.0000	25.9800	37.85	36.00	27.15	7.904	19.154	7.936	19.280	7.980	19.406	8.055	19.606	8.000	19.606								
7	40.0000	30.3109	42.86	40.00	36.55	7.904	23.364	7.937	23.488	7.982	23.614	8.059	23.813	8.500	23.813								
8	45.0000	38.9711	42.86	51.00	41.36	7.907	31.926	7.939	32.011	7.983	32.135	8.062	32.336	8.500	32.336								
10	50.0000	43.3013	57.87	56.00	46.21	7.907	37.667	7.939	37.746	7.987	37.863	8.067	38.054	8.500	38.054								
11	55.0000	47.6314	62.87	61.00	51.00	7.908	42.225	7.940	42.300	7.988	42.410	8.069	42.592	8.500	42.592								
13	60.0000	51.9915	67.88	60.00	55.00	7.908	46.807	7.941	46.884	7.990	46.992	8.071	47.162	8.500	47.162								
14	65.0000	56.2917	72.88	71.00	60.91	7.909	50.571	7.942	50.651	7.991	50.773	8.073	50.970	8.500	50.970								
15	70.0000	60.6218	77.88	76.00	65.84	7.909	54.092	7.943	54.170	7.992	54.287	8.075	54.479	8.500	54.479								
18	75.0000	64.9519	82.88	81.00	70.78	7.910	60.772	7.944	60.848	7.994	60.961	8.077	61.147	8.500	61.147								
16	80.0000	69.2820	87.88	86.00	75.73	7.910	66.208	7.944	66.283	7.995	66.396	8.079	66.579	8.500	66.579								
17	85.0000	73.6121	92.88	91.00	80.68	7.911	70.608	7.945	70.683	7.996	70.791	8.081	70.972	8.500	70.972								
18	90.0000	77.9423	97.90	96.00	85.64	7.911	76.286	7.945	76.359	7.997	76.466	8.083	76.648	8.500	76.648								
19	95.0000	82.2724	102.90	101.00	90.60	7.912	81.009	7.946	81.081	7.998	81.189	8.084	81.367	8.500	81.367								
20	100.0000	86.6025	107.90	106.00	95.57	7.912	86.344	7.947	86.416	7.999	86.523	8.086	86.701	8.500	86.701								
21	105.0000	90.9327	112.90	111.00	100.56	7.912	91.086	7.947	91.158	8.000	91.264	8.087	91.441	8.500	91.441								
22	110.0000	95.2628	117.91	116.00	105.52	7.913	96.387	7.948	96.459	8.001	96.565	8.089	96.742	8.500	96.742								
23	115.0000	99.5929	122.91	121.00	110.49	7.913	101.146	7.949	101.219	8.002	101.325	8.090	101.501	8.500	101.501								
24	120.0000	103.9230	127.91	126.00	115.47	7.913	106.422	7.949	106.493	8.003	106.599	8.092	106.775	8.500	106.775								
25	125.0000	108.2532	132.91	131.00	120.45	7.914	111.196	7.950	111.270	8.004	111.376	8.093	111.551	8.500	111.551								
26	130.0000	112.5833	137.92	136.00	125.43	7.914	116.450	7.950	116.521	8.004	116.627	8.095	116.803	8.500	116.803								
27	135.0000	116.9134	142.92	141.00	130.42	7.915	121.262	7.951	121.313	8.005	121.418	8.096	121.594	8.500	121.594								
28	140.0000	121.2436	147.92	146.00	135.40	7.915	126.474	7.951	126.545	8.006	126.651	8.097	126.828	8.500	126.828								
29	145.0000	125.5737	152.92	151.00	140.39	7.915	131.278	7.952	131.349	8.007	131.455	8.099	131.630	8.500	131.630								
30	150.0000	129.9034	157.93	156.00	145.37	7.915	136.494	7.952	136.565	8.008	136.671	8.100	136.847	8.500	136.847								
31	155.0000	134.2339	162.93	161.00	150.36	7.916	141.309	7.953	141.380	8.009	141.486	8.101	141.662	8.500	141.662								
32	160.0000	138.5641	167.93	166.00	155.35	7.916	146.893	7.953	146.964	8.009	147.070	8.102	147.245	8.500	147.245								
33	165.0000	142.8942	172.93	171.00	160.34	7.916	151.725	7.954	151.796	8.010	151.902	8.104	152.077	8.500	152.077								
34	170.0000	147.2243	177.93	176.00	165.33	7.917	156.917	7.955	156.988	8.011	157.094	8.105	157.269	8.500	157.269								
35	175.0000	151.5544	182.94	181.00	170.32	7.917	162.107	7.955	162.178	8.012	162.284	8.106	162.459	8.500	162.459								
36	180.0000	155.8846	187.94	186.00	175.31	7.917	167.318	7.955	167.389	8.013	167.495	8.107	167.670	8.500	167.670								
37	185.0000	160.2147	192.94	190.00	180.30	7.918	172.528	7.956	172.599	8.014	172.705	8.108	172.880	8.500	172.880								
38	190.0000	164.5448	197.94	196.00	185.29	7.918	177.738	7.956	177.809	8.014	177.915	8.109	178.090	8.500	178.090								
39	195.0000	168.8750	202.94	201.00	190.28	7.918	182.948	7.957	183.019	8.015	183.125	8.111	183.300	8.500	183.300								
40	200.0000	173.2052	207.95	206.00	195.28	7.918	188.158	7.957	188.229	8.015	188.335	8.112	188.510	8.500	188.510								
41	205.0000	177.5351	212.95	211.00	200.27	7.919	193.368	7.957	193.439	8.016	193.545	8.113	193.720	8.500	193.720								
42	210.0000	181.8653	217.95	216.00	205.26	7.919	198.578	7.958	198.649	8.016	198.755	8.114	198.930	8.500	198.930								
43	215.0000	186.1955	222.95	221.00	210.26	7.919	203.788	7.958	203.859	8.017	203.965	8.115	204.140	8.500	204.140								
44	220.0000	190.5256	227.95	226.00	215.25	7.919	208.998	7.959	209.069	8.018	209.175	8.116	209.350	8.500	209.350								
45	225.0000	194.8557	232.96	231.00	220.25	7.920	214.208	7.959	214.279	8.018	214.385	8.117	214.560	8.500	214.560								
46	230.0000	199.1858	237.96	236.00	225.24	7.920	219.418	7.960	219.489	8.019	219.595	8.118	219.770	8.500	219.770								
47	235.0000	203.5160	242.96	241.00	230.24	7.920	224.628	7.960	224.699	8.020	224.805	8.119	224.980	8.500	224.980								
48	240.0000	207.8461	247.96	246.00	235.23	7.920	229.838	7.960	229.909	8.020	230.015	8.120	230.190	8.500	230.190								
49	245.0000	212.1762	252.96	251.00	240.23	7.921	235.048	7.961	235.119	8.021	235.225	8.122	235.400	8.500	235.400								
50	250.0000	216.5064	257.96	256.00	245.22	7.921	240.258	7.961	240.329	8.021	240.435	8.122	240.610	8.500	240.610								
51	255.0000	220.8365	262.97	261.00	250.22	7.921	245.468	7.961	245.539	8.022	245.645	8.123	245.820	8.500	245.820								
52	260.0000	225.1666	267.97	266.00	255.21	7.921	250.678	7.962	250.749	8.023	250.855	8.124	251.030	8.500	251.030								
53	265.0000	229.4967	272.97	271.00	260.21	7.922	255.888	7.962	255.959	8.023	256.065	8.125	256.240	8.500	256.240								
54	270.0000	233.8269	277.97	276.00	265.20	7.922	261.098	7.963	261.169	8.024	261.275	8.126	261.450	8.500	261.450								
55	275.0000	238.1570	282.97	281.00	270.20	7.922	266.308	7.963	266.379	8.024	266.485	8.126	266.660	8.500	266.660								
56	280.0000	242.4871	287.97	286.00	275.20	7.922	271.518	7.963	271.589	8.025	271.695	8.127	271.870	8.500	271.870								
57	285.0000	246.8172	292.97	291.00	280.19	7.923	276.728	7.964	276.799	8.025	276.905	8.128	277.080	8.500	277.080								
58	290.0000	251.1473	297.97	296.00	285.19	7.923	281.938	7.964	282.009	8.026	282.115	8.129	282.290	8.500	282.290								
59	295.0000	255.4775	302.98	301.00	290.19	7.923	287.148	7.964	287.219	8.026	287.325	8.130	287.500	8.500	287.500								
60	300.0000	259.8076	307.98	306.00	295.18	7.923	292.358	7.965	292.429	8.027	292.535	8.131	292.710	8.500	292.710								
61	305.0000	264.1377	312.98	311.00	300.18	7.923	297.568	7.965	297.639	8.028	297.745	8.132	297.920	8.500	297.920								
62	310.0000	268.4679	317.98	316.00	305.18	7.924	302.778	7.965	302.849	8.028	302.955	8.133	303.130	8.500	303.130								
63	315.0000	272.7980	322.98	321.00	310.17	7.924	307.988	7.966	308.059	8.029	308.165	8.134	308.340	8.500	308.340								
64	320.0000	277.1281	327.99	326.00	315.17	7.924	313.198	7.966	313.269	8.029	313.375	8.135	313.550	8.500	313.550								
65	325.0000	281.4583	332.99	331.00	320.17	7.924	318.408	7.966	318.479	8.030	318.585	8.135	318.760	8.500	318.760								
66	330.0000	285.7884	337.99	336.00	325.17	7.924	323.618	7.967	323.689	8.030	323.795	8.136	323.970	8.500	323.970								
67	335.0000	290.1185	342.99	341.00	330.17	7.925	328.828	7.967	328.899	8.031	329.005	8.137	329.180	8.500	329.180								
68	340.0000	294.4486	347.99	346.00	335.16	7.925	334.038	7.968	334.109	8.032	334.215	8.138	334.390	8.500	334.390								
69	345.0000	298.7788	352.99	351.00	340.16	7.925	339.248	7.968	339.319	8.032	339.425	8.138	339.600	8.500	339.600								
70	350.0000	303.1089	357.99	356.00	345.16	7.925	344.458	7.968	344.529	8.033	344.635	8.139	344.810	8.500	344.810								
71	355.0000	307.4390	363.00	361.00	350.15	7.925	349.668	7.969	349.739	8.033	349.845	8.140	349.970	8.500	349.970								
72	360.0000	311.7691	368.00	366.00	355.15	7.926	354.878	7.969	354.949	8.034	355.055	8.141	355.230	8.500	355.230								
73	365.0000	316.0993	373.00	371.00	360.15	7.926	360.088	7.969	360.159	8.034	360.265	8.142	360.440	8.500	360.440								
74	370.0000	320.4294	378.00	376.00	365.15	7.926	365.298	7.970	365.369														

30.0 DEGREE PRESSURE ANGLE EXTERNAL INVOLUTE SPLINE
TABLE 16- DIMENSIONS FOR FLAT ROOT STIFF FIT, 5.00 SPLINE MODULE

Z NO. OF TEETH	D PITCH DIA	DB BASE DIA	DEE MAJOR DIA MAX	DFE FORM DIA	DIE MINOR DIA MIN	MAXIMUM EFFECTIVE CIRCULAR TOOTH THICKNESS = 7.854								DRE PIN DIA	FAC TOR
						MINIMUM ACTUAL CIRCULAR TOOTH THICKNESS AND MEASUREMENT OVER PITS FOR TOLERANCE CLASS									
						4h				5h					
						S MIN	M RE	S MIN	M RE	S MIN	M RE	S MIN	M RE		
6	10.0000	25.9408	35.00	26.15	22.15	7.804	52.911	7.772	52.876	7.724	52.824	7.652	52.737	13.200	1.488
7	15.0000	30.3109	40.00	30.81	27.15	7.803	55.352	7.772	55.316	7.724	55.264	7.649	55.172	12.500	1.704
8	20.0000	34.6410	45.00	35.55	32.14	7.802	59.907	7.771	59.868	7.724	59.809	7.646	59.710	11.800	1.920
9	25.0000	38.9711	50.00	40.36	37.14	7.801	62.734	7.770	62.693	7.723	62.633	7.644	62.532	11.200	2.136
10	30.0000	43.3013	55.00	45.21	42.13	7.801	68.412	7.769	68.370	7.721	68.306	7.641	68.201	11.200	2.352
11	35.0000	47.6314	60.00	50.09	47.13	7.800	73.048	7.768	73.006	7.720	72.942	7.639	72.834	11.200	2.568
12	40.0000	51.9615	65.00	54.99	52.12	7.800	77.200	7.767	77.155	7.718	77.087	7.637	76.974	10.600	2.784
13	45.0000	56.2917	70.00	59.91	57.12	7.799	81.725	7.766	81.679	7.717	81.610	7.635	81.495	10.600	2.999
14	50.0000	60.6218	75.00	64.84	62.12	7.799	87.284	7.765	87.242	7.716	87.171	7.633	87.053	10.600	3.215
15	55.0000	64.9519	80.00	69.78	67.11	7.798	91.879	7.765	91.831	7.714	91.760	7.631	91.641	10.600	3.430
16	60.0000	69.2820	85.00	74.73	72.11	7.798	97.361	7.764	97.312	7.713	97.239	7.629	97.117	10.600	3.646
17	65.0000	73.6122	90.00	79.68	77.11	7.797	102.000	7.763	101.951	7.712	101.877	7.627	101.754	10.600	3.861
18	70.0000	77.9423	95.00	84.64	82.10	7.797	107.420	7.763	107.370	7.711	107.295	7.625	107.169	10.600	4.077
19	75.0000	82.2724	100.00	89.60	87.10	7.796	112.099	7.762	112.048	7.710	111.972	7.624	111.845	10.600	4.292
20	80.0000	86.6025	105.00	94.57	92.10	7.796	117.470	7.761	117.419	7.709	117.342	7.622	117.213	10.600	4.508
21	85.0000	90.9327	110.00	99.54	97.10	7.796	122.544	7.761	122.491	7.708	122.411	7.620	122.278	10.000	4.723
22	90.0000	95.2628	115.00	104.52	102.09	7.795	127.869	7.760	127.815	7.707	127.735	7.619	127.600	10.000	4.938
23	95.0000	99.5929	120.00	109.49	107.09	7.795	133.001	7.759	132.947	7.706	132.866	7.617	132.720	10.000	5.154
24	100.0000	103.9230	125.00	114.47	112.09	7.794	138.097	7.759	138.042	7.705	137.960	7.616	137.812	10.000	5.369
25	105.0000	108.2531	130.00	119.45	117.09	7.794	143.651	7.758	143.596	7.704	143.513	7.615	143.374	10.000	5.584
26	110.0000	112.5832	135.00	124.43	122.08	7.794	148.921	7.758	148.865	7.704	148.781	7.613	148.641	10.000	5.799
27	115.0000	116.9133	140.00	129.42	127.08	7.793	154.093	7.757	154.037	7.703	153.952	7.612	153.803	10.000	6.014
28	120.0000	121.2434	145.00	134.40	132.08	7.793	159.942	7.757	159.884	7.702	159.799	7.611	159.650	10.000	6.229
29	125.0000	125.5735	150.00	139.39	137.08	7.793	165.730	7.756	165.673	7.701	165.587	7.609	165.443	10.000	6.444
30	130.0000	129.9036	155.00	144.37	142.07	7.792	171.060	7.756	171.002	7.700	170.916	7.608	170.771	10.000	6.659
31	135.0000	134.2337	160.00	149.36	147.07	7.792	176.762	7.755	176.704	7.699	176.617	7.607	176.471	10.000	6.874
32	140.0000	138.5638	165.00	154.35	152.07	7.792	182.077	7.755	182.018	7.699	181.931	7.605	181.783	10.000	7.089
33	145.0000	142.8939	170.00	159.34	157.07	7.792	187.791	7.754	187.732	7.698	187.644	7.604	187.495	10.000	7.304
34	150.0000	147.2240	175.00	164.33	162.07	7.791	193.092	7.754	193.032	7.697	192.943	7.603	192.794	10.000	7.519
35	155.0000	151.5541	180.00	169.32	167.06	7.791	198.816	7.753	198.756	7.696	198.666	7.602	198.516	10.000	7.734
36	160.0000	155.8842	185.00	174.31	172.06	7.791	204.005	7.753	203.944	7.696	203.854	7.601	203.703	10.000	7.949
37	165.0000	160.2143	190.00	179.30	177.08	7.790	209.839	7.752	209.778	7.695	209.687	7.600	209.536	10.000	8.164
38	170.0000	164.5444	195.00	184.29	182.06	7.790	215.017	7.752	214.956	7.694	214.864	7.599	214.713	10.000	8.379
39	175.0000	168.8745	200.00	189.29	187.06	7.790	220.854	7.751	220.793	7.694	220.701	7.597	220.550	10.000	8.594
40	180.0000	173.2046	205.00	194.28	192.05	7.790	226.028	7.751	225.966	7.693	225.873	7.596	225.721	10.000	8.809
41	185.0000	177.5347	210.00	199.27	197.05	7.789	231.878	7.750	231.816	7.692	231.722	7.595	231.570	10.000	9.024
42	190.0000	181.8648	215.00	204.26	202.05	7.789	237.038	7.750	236.975	7.692	236.881	7.594	236.729	10.000	9.239
43	195.0000	186.1949	220.00	209.26	207.05	7.789	242.895	7.750	242.832	7.691	242.738	7.593	242.586	10.000	9.454
44	200.0000	190.5250	225.00	214.25	212.05	7.789	248.047	7.749	247.983	7.690	247.888	7.592	247.735	10.000	9.669
45	205.0000	194.8551	230.00	219.25	217.04	7.788	253.910	7.749	253.847	7.690	253.751	7.591	253.598	10.000	9.884
46	210.0000	199.1852	235.00	224.24	222.04	7.788	259.055	7.748	258.991	7.689	258.895	7.590	258.742	10.000	10.099
47	215.0000	203.5153	240.00	229.24	227.04	7.788	264.924	7.748	264.860	7.688	264.764	7.589	264.611	10.000	10.314
48	220.0000	207.8454	245.00	234.23	232.04	7.788	270.063	7.748	269.998	7.688	269.902	7.588	269.749	10.000	10.529
49	225.0000	212.1755	250.00	239.23	237.04	7.787	275.937	7.747	275.872	7.687	275.775	7.587	275.622	10.000	10.744
50	230.0000	216.5056	255.00	244.22	242.04	7.787	281.067	7.747	281.002	7.687	280.905	7.586	280.752	10.000	10.959
51	235.0000	220.8357	260.00	249.22	247.03	7.787	276.949	7.746	276.884	7.686	276.787	7.585	276.634	10.000	11.174
52	240.0000	225.1658	265.00	254.21	252.03	7.787	282.078	7.746	282.013	7.686	281.916	7.584	281.763	10.000	11.389
53	245.0000	229.4959	270.00	259.21	257.03	7.786	287.060	7.746	287.004	7.685	286.907	7.583	286.754	10.000	11.604
54	250.0000	233.8260	275.00	264.20	262.03	7.786	292.082	7.745	292.016	7.684	291.919	7.582	291.766	10.000	11.819
55	255.0000	238.1561	280.00	269.20	267.03	7.786	296.970	7.745	296.904	7.684	296.807	7.582	296.654	10.000	12.034
56	260.0000	242.4862	285.00	274.20	272.03	7.786	301.088	7.745	301.021	7.683	300.924	7.581	300.771	10.000	12.249
57	265.0000	246.8163	290.00	279.19	277.03	7.785	306.080	7.744	306.013	7.683	305.916	7.580	305.763	10.000	12.464
58	270.0000	251.1464	295.00	284.19	282.02	7.785	310.993	7.744	310.926	7.682	310.829	7.579	310.676	10.000	12.679
59	275.0000	255.4765	300.00	289.19	287.02	7.785	315.949	7.744	315.882	7.681	315.785	7.578	315.632	10.000	12.894
60	280.0000	259.8066	305.00	294.18	292.02	7.785	321.008	7.743	320.941	7.681	320.844	7.577	320.691	10.000	13.109
61	285.0000	264.1367	310.00	299.18	297.02	7.785	325.997	7.743	325.930	7.680	325.833	7.576	325.680	10.000	13.324
62	290.0000	268.4668	315.00	304.18	302.02	7.784	330.902	7.743	330.835	7.680	330.738	7.575	330.585	10.0.	

30.0 DEGR FF PRESSURE ANGLE INTERNAL INVOLUTE SPLINE
TABLE 17- DIMENSIONS FOR FLAT ROOT SIDE FIT - 4.00 SPLINE MODULE

Z NO. OF TEETH	D PITCH DIA	DB BASE DIA	DEI MAJOR DIA MAX	DFI FORM DIA	DII MINOR DIA MIN	MINIMUM EFFECTIVE CIRCULAR SPACE WIDTH = 6.283												DRI PIN DIA	K1 FACTOR				
						MAXIMUM ACTUAL CIRCULAR SPACE WIDTH AND MEASUREMENT BETWEEN PINS FOR TOLERANCE CLASS																	
						4H				5H				6H						7H			
						E MAX	MRI	E MAX	MRI	E MAX	MRI	E MAX	MRI	E MAX	MRI	E MAX	MRI						
7	24.0000	20.7846	30.32	28.80	21.72	6.330	15.787	6.358	15.858	6.400	15.961	6.470	16.124	6.500	16.259	6.530	16.389	7.100	1.7059				
8	28.0000	24.2447	34.33	32.80	25.44	6.331	17.516	6.359	17.622	6.402	17.768	6.473	17.988	6.500	18.129	6.530	18.269	7.100	1.7289				
9	32.0000	27.7128	38.33	36.80	29.24	6.331	22.355	6.360	22.437	6.403	22.556	6.475	22.746	6.500	22.887	6.530	23.027	7.100	1.7519				
10	36.0000	31.1769	42.34	40.80	33.09	6.332	25.958	6.361	26.031	6.405	26.138	6.478	26.310	6.500	26.451	6.530	26.591	7.100	1.7749				
11	40.0000	34.6410	46.34	44.80	36.97	6.332	28.888	6.362	28.981	6.406	29.115	6.480	29.328	6.500	29.469	6.530	29.609	7.100	1.7979				
12	44.0000	38.1051	50.34	48.80	40.87	6.333	32.630	6.363	32.711	6.408	32.830	6.482	33.021	6.500	33.162	6.530	33.302	7.100	1.8209				
13	48.0000	41.5692	54.35	52.80	44.79	6.333	37.136	6.364	37.212	6.409	37.325	6.484	37.507	6.500	37.648	6.530	37.788	7.100	1.8439				
14	52.0000	45.0333	58.35	56.80	48.73	6.334	40.854	6.364	40.926	6.410	41.033	6.486	41.208	6.500	41.349	6.530	41.489	7.100	1.8669				
15	56.0000	48.4974	62.36	60.80	52.67	6.334	45.259	6.365	45.330	6.411	45.434	6.488	45.606	6.500	45.747	6.530	45.887	7.100	1.8899				
16	60.0000	51.9615	66.36	64.80	56.62	6.335	48.993	6.366	49.061	6.412	49.163	6.490	49.330	6.500	49.471	6.530	49.611	7.100	1.9129				
17	64.0000	55.4256	70.36	68.80	60.58	6.335	53.336	6.367	53.403	6.413	53.504	6.492	53.670	6.500	53.811	6.530	53.951	7.100	1.9359				
18	68.0000	58.8897	74.36	72.80	64.54	6.336	57.089	6.367	57.156	6.414	57.255	6.493	57.419	6.500	57.560	6.530	57.700	7.100	1.9589				
19	72.0000	62.3538	78.37	76.80	68.51	6.336	61.388	6.368	61.455	6.415	61.554	6.495	61.717	6.500	61.858	6.530	61.998	7.100	1.9819				
20	76.0000	65.8179	82.37	80.80	72.48	6.336	65.477	6.368	65.527	6.416	65.625	6.496	65.787	6.500	65.928	6.530	66.068	7.100	2.0049				
21	80.0000	69.2820	86.37	84.80	76.44	6.337	69.477	6.369	69.493	6.417	69.590	6.498	69.752	6.500	69.893	6.530	70.033	7.100	2.0279				
22	84.0000	72.7461	90.37	88.80	80.44	6.337	73.218	6.370	73.283	6.418	73.380	6.499	73.541	6.500	73.682	6.530	73.822	7.100	2.0509				
23	88.0000	76.2102	94.38	92.80	84.41	6.338	76.110	6.370	76.179	6.419	76.281	6.501	76.440	6.500	76.581	6.530	76.721	7.500	2.0739				
24	92.0000	79.6743	98.38	96.80	88.40	6.338	79.928	6.371	79.996	6.420	80.097	6.502	80.255	6.500	80.396	6.530	80.536	7.500	2.0969				
25	96.0000	83.1384	102.38	100.80	92.38	6.339	84.152	6.371	84.220	6.421	84.321	6.503	84.479	6.500	84.620	6.530	84.760	7.500	2.1199				
26	100.0000	86.6025	106.38	104.80	96.38	6.339	87.981	6.372	88.048	6.422	88.149	6.504	88.316	6.500	88.457	6.530	88.597	7.500	2.1429				
27	104.0000	90.0666	110.39	108.80	100.35	6.339	92.185	6.372	92.253	6.422	92.354	6.506	92.520	6.500	92.661	6.530	92.801	7.500	2.1659				
28	108.0000	93.5307	114.39	112.80	104.33	6.339	96.024	6.373	96.092	6.423	96.192	6.507	96.358	6.500	96.499	6.530	96.639	7.500	2.1889				
29	112.0000	96.9948	118.39	116.80	108.32	6.339	100.213	6.373	100.280	6.424	100.381	6.508	100.547	6.500	100.688	6.530	100.828	7.500	2.2119				
30	116.0000	100.4589	122.39	120.80	112.31	6.340	104.061	6.374	104.128	6.425	104.228	6.509	104.394	6.500	104.535	6.530	104.675	7.500	2.2349				
31	120.0000	103.9230	126.39	124.80	116.30	6.340	108.236	6.374	108.303	6.425	108.403	6.511	108.570	6.500	108.711	6.530	108.851	7.500	2.2579				
32	124.0000	107.3872	130.40	128.80	120.29	6.340	112.093	6.375	112.160	6.426	112.260	6.512	112.426	6.500	112.567	6.530	112.707	7.500	2.2809				
33	128.0000	110.8513	134.40	132.80	124.28	6.341	116.256	6.375	116.323	6.427	116.423	6.513	116.589	6.500	116.730	6.530	116.870	7.500	2.3039				
34	132.0000	114.3154	138.40	136.80	128.27	6.341	120.120	6.376	120.187	6.427	120.287	6.514	120.453	6.500	120.594	6.530	120.734	7.500	2.3269				
35	136.0000	117.7795	142.40	140.80	132.26	6.341	124.273	6.376	124.340	6.428	124.440	6.515	124.607	6.500	124.748	6.530	124.888	7.500	2.3499				
36	140.0000	121.2436	146.40	144.80	136.24	6.341	128.144	6.376	128.211	6.429	128.311	6.516	128.477	6.500	128.618	6.530	128.758	7.500	2.3729				
37	144.0000	124.7077	150.41	148.80	140.25	6.342	132.247	6.377	132.355	6.429	132.455	6.517	132.622	6.500	132.763	6.530	132.903	7.500	2.3959				
38	148.0000	128.1718	154.41	152.80	144.24	6.342	136.145	6.377	136.232	6.430	136.332	6.518	136.500	6.500	136.641	6.530	136.781	7.500	2.4189				
39	152.0000	131.6359	158.41	156.80	148.23	6.342	140.301	6.378	140.368	6.431	140.468	6.519	140.636	6.500	140.777	6.530	140.917	7.500	2.4419				
40	156.0000	135.1000	162.41	160.80	152.23	6.342	144.181	6.378	144.251	6.431	144.352	6.520	144.519	6.500	144.660	6.530	144.800	7.500	2.4649				
41	160.0000	138.5641	166.41	164.80	156.22	6.343	148.312	6.378	148.380	6.432	148.481	6.521	148.648	6.500	148.789	6.530	148.929	7.500	2.4879				
42	164.0000	142.0282	170.41	168.80	160.22	6.343	152.200	6.379	152.268	6.433	152.369	6.522	152.537	6.500	152.678	6.530	152.818	7.500	2.5109				
43	168.0000	145.4923	174.42	172.80	164.21	6.343	156.323	6.379	156.390	6.433	156.492	6.523	156.660	6.500	156.801	6.530	156.941	7.500	2.5339				
44	172.0000	148.9564	178.42	176.80	168.21	6.343	160.215	6.380	160.283	6.434	160.385	6.524	160.553	6.500	160.694	6.530	160.834	7.500	2.5569				
45	176.0000	152.4205	182.42	180.80	172.20	6.344	164.332	6.380	164.400	6.434	164.502	6.525	164.670	6.500	164.811	6.530	164.951	7.500	2.5799				
46	180.0000	155.8846	186.42	184.80	176.20	6.344	168.229	6.380	168.297	6.435	168.399	6.526	168.567	6.500	168.708	6.530	168.848	7.500	2.6029				
47	184.0000	159.3487	190.42	188.80	180.19	6.344	172.340	6.381	172.408	6.435	172.511	6.527	172.681	6.500	172.822	6.530	172.962	7.500	2.6259				
48	188.0000	162.8128	194.42	192.80	184.19	6.344	176.242	6.381	176.310	6.436	176.412	6.528	176.582	6.500	176.723	6.530	176.863	7.500	2.6489				
49	192.0000	166.2769	198.43	196.80	188.18	6.345	180.348	6.381	180.417	6.437	180.519	6.529	180.690	6.500	180.831	6.530	180.971	7.500	2.6719				
50	196.0000	169.7410	202.43	200.80	192.18	6.345	184.253	6.382	184.322	6.437	184.424	6.530	184.595	6.500	184.736	6.530	184.876	7.500	2.6949				
51	200.0000	173.2051	206.43	204.80	196.18	6.345	188.355	6.382	188.424	6.438	188.527	6.531	188.698	6.500	188.839	6.530	188.979	7.500	2.7179				
52	204.0000	176.6692	210.43	208.80	200.17	6.345	192.264	6.382	192.333	6.438	192.436	6.531	192.607	6.500	192.748	6.530	192.888	7.500	2.7409				
53	208.0000	180.1333	214.43	212.80	204.17	6.345	196.362	6.383	196.431	6.439	196.534	6.532	196.706	6.500	196.847	6.530	196.987						

30.0 DEGREE PRESSURE ANGLE EXTERNAL INVOLUTE SPLINE
TABLE 18- DIMENSIONS FOR FLAT ROOT SIDE FIT • 4.00 SPLINE MODULE

Z NO. OF TEETH	D PITCH DIA	DB BASE DIA	DEE MAJOR DIA MAX	DFE FORM DIA	DIE MINOR DIA MIN	MAXIMUM EFFECTIVE CIRCULAR TOOTH THICKNESS = 6.283										DRE PIN DIA	KEY WIDTH DIA
						MINIMUM ACTUAL CIRCULAR TOOTH THICKNESS AND MEASUREMENT OVER PINS FOR TOLERANCE CLASS											
						4h											
						S MIN	M RE	S MIN	M RE	S MIN	M RE	S MIN	M RE	S MIN	M RE		
6	24.0000	20.7846	24.00	20.92	17.68	6.236	42.414	6.204	42.382	6.164	42.334	6.094	42.254	6.004	42.154	10.000	1.4891
7	24.0000	24.2487	32.00	24.64	21.67	6.236	44.274	6.207	44.241	6.165	44.191	6.094	44.107	6.004	44.007	10.000	1.5179
8	32.0000	27.7128	36.00	28.44	25.67	6.235	48.064	6.206	48.028	6.163	47.974	6.091	47.863	6.001	47.743	9.500	1.2517
10	40.0000	31.1749	40.00	32.29	29.66	6.235	50.277	6.205	50.240	6.161	50.184	6.088	50.091	6.000	50.000	9.000	1.2533
		34.6410	44.00	36.17	33.66	6.234	54.981	6.204	54.942	6.160	54.884	6.084	54.786	6.000	54.688	9.000	1.3000
11	44.0000	38.1051	48.00	40.07	37.66	6.233	58.531	6.204	58.491	6.159	58.432	6.084	58.333	6.000	58.233	9.000	1.3009
12	48.0000	41.5692	52.00	43.99	41.65	6.233	63.092	6.203	63.052	6.157	62.990	6.082	62.888	6.000	62.788	9.000	1.3600
13	52.0000	45.0333	56.00	47.93	45.65	6.232	65.422	6.202	65.380	6.156	65.316	6.080	65.210	6.000	65.110	9.500	1.3603
14	56.0000	48.4974	60.00	51.87	49.64	6.232	69.874	6.201	69.830	6.155	69.765	6.078	69.656	6.000	69.556	9.500	1.4200
15	60.0000	51.9615	64.00	55.82	53.64	6.232	73.546	6.200	73.502	6.154	73.435	6.074	73.325	6.000	73.225	9.500	1.4203
16	64.0000	55.4256	68.00	59.74	57.64	6.231	77.932	6.200	77.887	6.153	77.819	6.075	77.706	6.000	77.606	9.500	1.4462
17	68.0000	58.8897	72.00	63.74	61.64	6.231	81.643	6.199	81.598	6.152	81.529	6.073	81.415	6.000	81.315	9.500	1.4469
18	72.0000	62.3538	76.00	67.71	65.63	6.230	85.979	6.199	85.933	6.151	85.864	6.072	85.747	6.000	85.647	9.500	1.4671
19	76.0000	65.8179	80.00	71.68	69.63	6.230	89.722	6.198	89.675	6.150	89.605	6.070	89.487	6.000	89.387	9.500	1.4714
20	80.0000	69.2820	84.00	75.66	73.63	6.230	94.020	6.197	93.972	6.149	93.901	6.069	93.781	6.000	93.681	9.500	1.4852
21	84.0000	72.7461	88.00	79.64	77.63	6.229	97.787	6.197	97.739	6.148	97.667	6.067	97.547	6.000	97.447	9.500	1.4891
22	88.0000	76.2102	92.00	83.61	81.62	6.229	102.054	6.196	102.005	6.147	101.932	6.066	101.810	6.000	101.710	9.500	1.5009
23	92.0000	79.6743	96.00	87.60	85.62	6.228	104.470	6.196	104.420	6.146	104.345	6.064	104.219	6.000	104.119	9.500	1.5333
24	96.0000	83.1384	100.00	91.58	89.62	6.228	108.708	6.195	108.658	6.145	108.579	6.063	108.452	6.000	108.352	9.500	1.5430
25	100.0000	86.6025	104.00	95.56	93.62	6.228	112.509	6.195	112.458	6.145	112.381	6.062	112.253	6.000	112.153	9.500	1.5457
26	104.0000	90.0666	108.00	99.55	97.61	6.228	116.725	6.194	116.673	6.144	116.596	6.061	116.466	6.000	116.366	9.500	1.5542
27	108.0000	93.5307	112.00	103.53	101.61	6.227	120.543	6.194	120.491	6.143	120.413	6.059	120.282	6.000	120.182	9.500	1.5567
28	112.0000	96.9948	116.00	107.52	105.61	6.227	124.742	6.193	124.689	6.142	124.610	6.058	124.478	6.000	124.378	9.500	1.5641
29	116.0000	100.4589	120.00	111.51	109.61	6.227	128.756	6.193	128.703	6.142	128.624	6.057	128.490	6.000	128.390	9.500	1.5664
30	120.0000	103.9230	124.00	115.50	113.61	6.226	132.756	6.192	132.703	6.141	132.623	6.056	132.489	6.000	132.389	9.500	1.5730
31	124.0000	107.3872	128.00	119.49	117.60	6.226	136.598	6.192	136.544	6.140	136.463	6.055	136.328	6.000	136.228	9.500	1.5751
32	128.0000	110.8513	132.00	123.48	121.60	6.226	140.749	6.191	140.715	6.139	140.634	6.053	140.498	6.000	140.398	9.500	1.5810
33	132.0000	114.3154	136.00	127.47	125.60	6.225	144.620	6.191	144.586	6.139	144.504	6.052	144.367	6.000	144.267	9.500	1.5829
34	136.0000	117.7795	140.00	131.46	129.60	6.225	148.781	6.190	148.746	6.138	148.663	6.051	148.505	6.000	148.405	9.500	1.5882
35	140.0000	121.2436	144.00	135.45	133.60	6.225	152.640	6.190	152.595	6.138	152.512	6.050	152.363	6.000	152.263	9.500	1.5900
36	144.0000	124.7077	148.00	139.45	137.59	6.225	156.791	6.190	156.736	6.137	156.652	6.049	156.512	6.000	156.412	9.500	1.5948
37	148.0000	128.1718	152.00	143.44	141.59	6.224	160.659	6.189	160.602	6.136	160.518	6.048	160.378	6.000	160.278	9.500	1.5966
38	152.0000	131.6359	156.00	147.43	145.59	6.224	164.801	6.189	164.744	6.135	164.660	6.047	164.518	6.000	164.418	9.500	1.6008
39	156.0000	135.1000	160.00	151.42	149.59	6.224	168.755	6.188	168.697	6.135	168.613	6.046	168.469	6.000	168.369	9.500	1.6023
40	160.0000	138.5641	164.00	155.42	153.59	6.224	172.809	6.188	172.752	6.134	172.666	6.045	172.523	6.000	172.423	9.500	1.6063
41	164.0000	142.0282	168.00	159.42	157.59	6.223	176.649	6.188	176.632	6.134	176.546	6.044	176.402	6.000	176.302	9.500	1.6077
42	168.0000	145.4923	172.00	163.41	161.58	6.223	180.817	6.187	180.759	6.133	180.673	6.043	180.528	6.000	180.428	9.500	1.6114
43	172.0000	148.9564	176.00	167.41	165.58	6.223	184.703	6.187	184.645	6.133	184.558	6.042	184.412	6.000	184.312	9.500	1.6127
44	176.0000	152.4205	180.00	171.40	169.58	6.223	188.824	6.186	188.766	6.132	188.678	6.041	188.532	6.000	188.432	9.500	1.6150
45	180.0000	155.8846	184.00	175.40	173.58	6.223	192.715	6.186	192.656	6.131	192.568	6.040	192.421	6.000	192.321	9.500	1.6173
46	184.0000	159.3487	188.00	179.39	177.58	6.222	196.831	6.186	196.772	6.131	196.683	6.040	196.535	6.000	196.435	9.500	1.6204
47	188.0000	162.8128	192.00	183.39	181.58	6.222	200.726	6.185	200.667	6.130	200.578	6.039	200.429	6.000	200.329	9.500	1.6215
48	192.0000	166.2769	196.00	187.38	185.58	6.222	204.937	6.185	204.777	6.130	204.688	6.038	204.538	6.000	204.438	9.500	1.6244
49	196.0000	169.7410	200.00	191.38	189.57	6.222	208.738	6.185	208.678	6.129	208.588	6.037	208.437	6.000	208.337	9.500	1.6255
50	200.0000	173.2051	204.00	195.38	193.57	6.221	212.842	6.184	212.782	6.129	212.692	6.036	212.541	6.000	212.441	9.500	1.6281
51	204.0000	176.6692	208.00	199.37	197.57	6.221	216.746	6.184	216.685	6.128	216.595	6.035	216.443	6.000	216.343	9.500	1.6291
52	208.0000	180.1333	212.00	203.37	201.57	6.221	220.847	6.184	220.787	6.128	220.696	6.034	220.543	6.000	220.443	9.500	1.6316
53	212.0000	183.5974	216.00	207.37	205.57	6.221	224.755	6.183	224.694	6.127	224.602	6.034	224.449	6.000	224.349	9.500	1.6326
54	216.0000	187.0615	220.00	211.36	209.56	6.221	228.852	6.183	228.791	6.127	228.699	6.033	228.546	6.000	228.446	9.500	1.6349
55	220.0000	190.5256	224.00	215.36	213.56	6.220	232.763	6.183	232.701	6.126	232.609	6.032	232.455	6.000	232.355	9.500	1.6359
56	224.0000	193.9897	228.00	219.36	217.56	6.220	236.857	6.182	236.795	6.126	236.702	6.031	236.547	6.000	236.447	9.500	1.6380
57	228.0000	197.4538	232.00	223.35	221.55	6.220	240.770	6.182	240.708.7								

INTERNAL
3.00 MODULE

30.0 DEGREE PRESSURE ANGLE INTERNAL INVOLUTE SPLINE
TABLE 19- DIMENSIONS FOR FLAT ROOT SINE FIT - 3.00 SPLINE MODULE

Z NO. OF TEETH	D PITCH DIA	DB BASE DIA	DEI MAJOR DIA MAX	DFI FORM DIA	DII MINOR DIA MIN	MINIMUM EFFECTIVE CIRCULAR SPACE WIDTH = 4.712												DRI PIN DIA	K1 PITCH DIA		
						MAXIMUM ACTUAL CIRCULAR SPACE WIDTH AND MEASUREMENT BETWEEN PINS FOR TOLERANCE CLASS															
						4H				5H				6H						7H	
						E MAX	MRI	E MAX	MRI	E MAX	MRI	E MAX	MRI	E MAX	MRI	E MAX	MRI				
6	18.0000	15.5885	22.79	21.60	16.79	4.755	11.749	4.780	11.825	4.818	11.920	4.882	12.071	4.950	12.280	5.000	12.540	5.000	12.800		
7	21.0000	18.1845	25.80	24.60	19.08	4.755	13.294	4.781	13.380	4.820	13.499	4.884	13.680	4.950	13.920	5.000	14.160	5.000	14.400		
8	24.0000	20.7846	28.80	27.60	21.03	4.755	14.839	4.782	14.965	4.821	15.068	4.885	15.232	4.950	15.480	5.000	15.720	5.000	15.960		
9	27.0000	23.3827	31.81	30.60	23.02	4.757	16.384	4.783	16.510	4.823	16.636	4.889	16.800	4.950	17.040	5.000	17.280	5.000	17.520		
10	30.0000	25.9804	34.81	33.60	25.03	4.757	17.929	4.783	18.055	4.823	18.181	4.889	18.345	4.950	18.585	5.000	18.825	5.000	19.065		
11	33.0000	28.5788	37.81	36.60	27.03	4.758	19.474	4.785	19.600	4.825	19.726	4.889	19.890	4.950	20.130	5.000	20.370	5.000	20.610		
12	36.0000	31.1769	40.82	39.60	29.03	4.758	21.019	4.785	21.145	4.825	21.271	4.889	21.435	4.950	21.675	5.000	21.915	5.000	22.155		
13	39.0000	33.7750	43.82	42.60	31.03	4.758	22.564	4.785	22.690	4.825	22.816	4.889	22.980	4.950	23.220	5.000	23.460	5.000	23.700		
14	42.0000	36.3731	46.82	45.60	33.03	4.759	24.109	4.787	24.235	4.827	24.361	4.891	24.525	4.950	24.765	5.000	25.005	5.000	25.245		
15	45.0000	38.9711	49.82	48.60	35.03	4.759	25.654	4.787	25.780	4.827	25.906	4.891	26.070	4.950	26.310	5.000	26.550	5.000	26.790		
16	48.0000	41.5692	52.83	51.60	37.03	4.760	27.199	4.788	27.325	4.828	27.451	4.892	27.615	4.950	27.855	5.000	28.095	5.000	28.335		
17	51.0000	44.1673	55.83	54.60	39.03	4.760	28.744	4.788	28.870	4.828	28.996	4.892	29.160	4.950	29.400	5.000	29.640	5.000	29.880		
18	54.0000	46.7654	58.83	57.60	41.03	4.760	30.289	4.788	30.415	4.828	30.541	4.892	30.705	4.950	30.945	5.000	31.185	5.000	31.425		
19	57.0000	49.3634	61.83	60.60	43.03	4.761	31.834	4.790	31.960	4.830	32.086	4.894	32.250	4.950	32.490	5.000	32.730	5.000	32.970		
20	60.0000	51.9615	64.84	63.60	45.03	4.761	33.379	4.790	33.505	4.830	33.631	4.894	33.795	4.950	34.035	5.000	34.275	5.000	34.515		
21	63.0000	54.5596	67.84	66.60	47.03	4.761	34.924	4.791	35.050	4.831	35.176	4.895	35.340	4.950	35.580	5.000	35.820	5.000	36.060		
22	66.0000	57.1577	70.84	69.60	49.03	4.762	36.469	4.791	36.595	4.831	36.721	4.895	36.885	4.950	37.125	5.000	37.365	5.000	37.605		
23	69.0000	59.7558	73.84	72.60	51.03	4.762	38.014	4.792	38.140	4.832	38.266	4.896	38.430	4.950	38.670	5.000	38.910	5.000	39.150		
24	72.0000	62.3538	76.84	75.60	53.03	4.762	39.559	4.792	39.685	4.832	39.811	4.896	39.975	4.950	40.215	5.000	40.455	5.000	40.695		
25	75.0000	64.9519	79.85	78.60	55.03	4.762	41.104	4.793	41.230	4.833	41.356	4.897	41.520	4.950	41.760	5.000	42.000	5.000	42.240		
26	78.0000	67.5500	82.85	81.60	57.03	4.763	42.649	4.793	42.775	4.833	42.901	4.897	43.065	4.950	43.305	5.000	43.545	5.000	43.785		
27	81.0000	70.1481	85.85	84.60	59.03	4.763	44.194	4.793	44.320	4.834	44.446	4.897	44.610	4.950	44.850	5.000	45.090	5.000	45.330		
28	84.0000	72.7461	88.85	87.60	61.03	4.763	45.739	4.794	45.865	4.834	45.991	4.898	46.155	4.950	46.395	5.000	46.635	5.000	46.875		
29	87.0000	75.3442	91.85	90.60	63.03	4.764	47.284	4.794	47.410	4.835	47.536	4.898	47.700	4.950	47.940	5.000	48.180	5.000	48.420		
30	90.0000	77.9423	94.86	93.60	65.03	4.764	48.829	4.795	48.955	4.835	49.081	4.899	49.245	4.950	49.485	5.000	49.725	5.000	49.965		
31	93.0000	80.5404	97.86	96.60	67.03	4.764	50.374	4.795	50.500	4.836	50.626	4.900	50.790	4.950	51.030	5.000	51.270	5.000	51.510		
32	96.0000	83.1384	100.86	99.60	69.03	4.764	51.919	4.795	52.045	4.836	52.171	4.900	52.335	4.950	52.575	5.000	52.815	5.000	53.055		
33	99.0000	85.7365	103.86	102.60	71.03	4.765	53.464	4.795	53.590	4.837	53.716	4.901	53.880	4.950	54.120	5.000	54.360	5.000	54.600		
34	102.0000	88.3346	106.86	105.60	73.03	4.765	55.009	4.796	55.135	4.837	55.261	4.901	55.425	4.950	55.665	5.000	55.905	5.000	56.145		
35	105.0000	90.9327	109.86	108.60	75.03	4.765	56.554	4.797	56.680	4.838	56.806	4.902	56.970	4.950	57.210	5.000	57.450	5.000	57.690		
36	108.0000	93.5307	112.87	111.60	77.03	4.765	58.099	4.797	58.225	4.838	58.351	4.902	58.515	4.950	58.755	5.000	58.995	5.000	59.235		
37	111.0000	96.1288	115.87	114.60	79.03	4.765	59.644	4.797	59.770	4.839	59.896	4.903	60.060	4.950	60.300	5.000	60.540	5.000	60.780		
38	114.0000	98.7269	118.87	117.60	81.03	4.766	61.189	4.798	61.315	4.839	61.441	4.903	61.605	4.950	61.845	5.000	62.085	5.000	62.325		
39	117.0000	101.3250	121.87	120.60	83.03	4.766	62.734	4.798	62.860	4.840	62.986	4.904	63.150	4.950	63.390	5.000	63.630	5.000	63.870		
40	120.0000	103.9230	124.87	123.60	85.03	4.766	64.279	4.798	64.405	4.840	64.531	4.904	64.695	4.950	64.935	5.000	65.175	5.000	65.415		
41	123.0000	106.5211	127.87	126.60	87.03	4.766	65.824	4.799	65.950	4.841	66.076	4.905	66.240	4.950	66.480	5.000	66.720	5.000	66.960		
42	126.0000	109.1192	130.88	129.60	89.03	4.767	67.369	4.799	67.495	4.841	67.621	4.905	67.785	4.950	68.025	5.000	68.265	5.000	68.505		
43	129.0000	111.7173	133.88	132.60	91.03	4.767	68.914	4.799	69.040	4.842	69.166	4.906	69.330	4.950	69.570	5.000	69.810	5.000	70.050		
44	132.0000	114.3154	136.88	135.60	93.03	4.767	70.459	4.800	70.585	4.842	70.711	4.906	70.875	4.950	71.115	5.000	71.355	5.000	71.595		
45	135.0000	116.9134	139.88	138.60	95.03	4.767	72.004	4.800	72.130	4.842	72.256	4.906	72.420	4.950	72.660	5.000	72.900	5.000	73.140		
46	138.0000	119.5115	142.88	141.60	97.03	4.767	73.549	4.800	73.675	4.843	73.801	4.907	73.965	4.950	74.205	5.000	74.445	5.000	74.685		
47	141.0000	122.1096	145.88	144.60	99.03	4.768	75.094	4.801	75.220	4.843	75.346	4.907	75.510	4.950	75.750	5.000	75.990	5.000	76.230		
48	144.0000	124.7077	148.88	147.60	101.03	4.768	76.639	4.801	76.765	4.843	76.891	4.907	77.055	4.950	77.295	5.000	77.535	5.000	77.775		
49	147.0000	127.3057	151.88	150.60	103.03	4.768	78.184	4.802	78.310	4.844	78.436	4.908	78.600	4.950	78.840	5.000	79.080	5.000	79.320		
50	150.0000	129.9038	154.88	153.60	105.03	4.768	79.729	4.802	79.855	4.844	79.981	4.908	80.145	4.950	80.385	5.000	80.625	5.000	80.865		
51	153.0000	132.5019	157.89	156.60	107.03	4.768	81.274	4.802	81.400	4.845	81.526	4.909	81.690	4.950	81.930	5.000	82.170	5.000	82.410		
52	156.0000	135.1000	160.89	159.60	109.03	4.769	82.819	4.803	82.945	4.845	83.071	4.910	83.235	4.950	83.475	5.000	83.715	5.000	83.955		
53	159.0000	137.6980	163.89	162.60	111.03	4.769	84.364	4.803	84.490	4.846	84.616	4.910									

30.0 DEGREE PRESSURE ANGLE EXTERNAL INVOLUTE SPLINE
TABLE 20- DIMENSIONS FOR FLAT FOOT SIDE FIT - 3.00 SPLINE MODULE

Z NO. OF TEETH	D PITCH DIA	DB BASE DIA	DEE MAJOR DIA MAX	DFE FORM DIA	DIE MINOR DIA MIN	SV MAXIMUM EFFECTIVE CIRCULAR TOOTH THICKNESS = 4.712												DRE PIN DIA	DRE PIN FACTO
						MINIMUM ACTUAL CIRCULAR TOOTH THICKNESS AND MEASUREMENT OVER PINS FOR TOLERANCE CLASS													
						4h		5h		6h		7h							
						S MIN	MRE	S MIN	MRE	S MIN	MRE	S MIN	MRE						
6	18.0000	15.5845	21.00	15.49	13.21	4.670	31.918	4.645	31.889	4.607	31.846	4.543	31.773	4.000	31.773	1.5772			
7	21.0000	18.1845	24.00	18.48	16.20	4.669	33.197	4.644	33.167	4.605	33.121	4.540	33.046	4.000	33.046	1.5772			
8	24.0000	20.7846	27.00	21.33	19.20	4.669	35.977	4.643	35.945	4.603	35.896	4.538	35.848	4.000	35.848	1.5772			
9	27.0000	23.3827	30.00	24.22	22.19	4.668	38.559	4.642	38.526	4.602	38.476	4.536	38.393	4.000	38.393	1.5772			
10	30.0000	25.9808	33.00	27.13	25.19	4.668	41.100	4.641	41.064	4.601	41.011	4.534	40.922	4.000	40.922	1.5772			
11	33.0000	28.5784	36.00	30.05	28.19	4.667	43.761	4.640	43.725	4.600	43.671	4.532	43.581	4.000	43.581	1.5772			
12	36.0000	31.1769	39.00	32.99	31.18	4.667	47.180	4.639	47.143	4.598	47.087	4.530	46.996	4.000	46.996	1.5772			
13	39.0000	33.7750	42.00	35.94	34.18	4.666	49.897	4.638	49.859	4.597	49.803	4.528	49.708	4.000	49.708	1.5772			
14	42.0000	36.3731	45.00	38.90	37.18	4.666	52.745	4.638	52.706	4.596	52.648	4.527	52.551	4.000	52.551	1.5772			
15	45.0000	38.9711	48.00	41.87	40.18	4.666	55.950	4.637	55.910	4.595	55.850	4.525	55.749	4.000	55.749	1.5772			
16	48.0000	41.5692	51.00	44.84	43.17	4.665	58.237	4.637	58.196	4.594	58.135	4.524	58.032	4.000	58.032	1.5772			
17	51.0000	44.1673	54.00	47.81	46.17	4.665	61.020	4.636	60.979	4.593	60.917	4.523	60.813	4.000	60.813	1.5772			
18	54.0000	46.7654	57.00	50.78	49.17	4.664	64.271	4.636	64.229	4.593	64.165	4.521	64.060	4.000	64.060	1.5772			
19	57.0000	49.3634	60.00	53.76	52.17	4.664	67.077	4.635	67.035	4.592	66.971	4.519	66.864	4.000	66.864	1.5772			
20	60.0000	51.9615	63.00	56.74	55.16	4.664	70.299	4.635	70.256	4.591	70.191	4.518	70.082	4.000	70.082	1.5772			
21	63.0000	54.5596	66.00	59.73	58.16	4.663	73.124	4.634	73.081	4.590	73.015	4.517	72.905	4.000	72.905	1.5772			
22	66.0000	57.1577	69.00	62.71	61.16	4.663	76.333	4.634	76.279	4.589	76.213	4.516	76.101	4.000	76.101	1.5772			
23	69.0000	59.7558	72.00	65.70	64.16	4.663	79.164	4.633	79.119	4.588	79.052	4.514	78.940	4.000	78.940	1.5772			
24	72.0000	62.3538	75.00	68.68	67.15	4.663	82.364	4.633	82.299	4.588	82.231	4.513	82.117	4.000	82.117	1.5772			
25	75.0000	64.9519	78.00	71.67	70.15	4.662	85.104	4.632	85.152	4.587	85.083	4.512	84.969	4.000	84.969	1.5772			
26	78.0000	67.5500	81.00	74.66	73.15	4.662	87.530	4.632	87.484	4.586	87.413	4.511	87.296	4.000	87.296	1.5772			
27	81.0000	70.1481	84.00	77.65	76.15	4.662	90.394	4.631	90.347	4.585	90.276	4.510	90.158	4.000	90.158	1.5772			
28	84.0000	72.7461	87.00	80.64	79.15	4.661	93.543	4.631	93.495	4.585	93.424	4.509	93.304	4.000	93.304	1.5772			
29	87.0000	75.3442	90.00	83.63	82.15	4.661	96.415	4.631	96.367	4.584	96.296	4.508	96.175	4.000	96.175	1.5772			
30	90.0000	77.9423	93.00	86.62	85.14	4.661	99.553	4.630	99.505	4.584	99.432	4.507	99.311	4.000	99.311	1.5772			
31	93.0000	80.5404	96.00	89.62	88.14	4.661	102.474	4.630	102.386	4.583	102.313	4.506	102.191	4.000	102.191	1.5772			
32	96.0000	83.1384	99.00	92.61	91.14	4.660	105.563	4.629	105.514	4.583	105.440	4.505	105.317	4.000	105.317	1.5772			
33	99.0000	85.7365	102.00	95.60	94.14	4.660	108.451	4.629	108.402	4.582	108.328	4.504	108.204	4.000	108.204	1.5772			
34	102.0000	88.3346	105.00	98.60	97.14	4.660	111.572	4.629	111.522	4.581	111.447	4.503	111.322	4.000	111.322	1.5772			
35	105.0000	90.9327	108.00	101.59	100.14	4.660	114.464	4.628	114.414	4.581	114.341	4.502	114.215	4.000	114.215	1.5772			
36	108.0000	93.5307	111.00	104.59	103.13	4.660	117.579	4.628	117.529	4.580	117.453	4.501	117.327	4.000	117.327	1.5772			
37	111.0000	96.1288	114.00	107.58	106.13	4.659	120.480	4.627	120.429	4.580	120.353	4.500	120.226	4.000	120.226	1.5772			
38	114.0000	98.7269	117.00	110.58	109.13	4.659	123.586	4.627	123.535	4.579	123.458	4.499	123.330	4.000	123.330	1.5772			
39	117.0000	101.3250	120.00	113.57	112.13	4.659	126.492	4.627	126.440	4.579	126.363	4.498	126.235	4.000	126.235	1.5772			
40	120.0000	103.9230	123.00	116.57	115.13	4.659	129.592	4.626	129.541	4.578	129.463	4.497	129.334	4.000	129.334	1.5772			
41	123.0000	106.5211	126.00	119.56	118.13	4.658	132.502	4.626	132.451	4.577	132.373	4.496	132.242	4.000	132.242	1.5772			
42	126.0000	109.1192	129.00	122.56	121.12	4.658	135.508	4.626	135.456	4.577	135.377	4.496	135.246	4.000	135.246	1.5772			
43	129.0000	111.7173	132.00	125.55	124.12	4.658	138.512	4.625	138.460	4.576	138.381	4.495	138.249	4.000	138.249	1.5772			
44	132.0000	114.3154	135.00	128.55	127.12	4.658	141.603	4.625	141.551	4.576	141.471	4.494	141.339	4.000	141.339	1.5772			
45	135.0000	116.9134	138.00	131.55	130.12	4.658	144.521	4.625	144.468	4.575	144.389	4.493	144.256	4.000	144.256	1.5772			
46	138.0000	119.5115	141.00	134.54	133.12	4.657	147.608	4.624	147.555	4.575	147.475	4.492	147.341	4.000	147.341	1.5772			
47	141.0000	122.1096	144.00	137.54	136.12	4.657	150.530	4.624	150.476	4.574	150.396	4.492	150.261	4.000	150.261	1.5772			
48	144.0000	124.7077	147.00	140.54	139.12	4.657	153.612	4.624	153.559	4.574	153.478	4.491	153.343	4.000	153.343	1.5772			
49	147.0000	127.3057	150.00	143.54	142.11	4.657	156.537	4.623	156.483	4.573	156.402	4.490	156.266	4.000	156.266	1.5772			
50	150.0000	129.9038	153.00	146.53	145.11	4.657	159.414	4.623	159.360	4.573	159.279	4.489	159.143	4.000	159.143	1.5772			
51	153.0000	132.5019	156.00	149.53	148.11	4.656	162.544	4.623	162.489	4.572	162.408	4.489	162.271	4.000	162.271	1.5772			
52	156.0000	135.1000	159.00	152.53	151.11	4.656	165.620	4.623	165.565	4.572	165.483	4.488	165.346	4.000	165.346	1.5772			
53	159.0000	137.6980	162.00	155.53	154.11	4.656	168.550	4.622	168.495	4.572	168.413	4.487	168.275	4.000	168.275	1.5772			
54	162.0000	140.2961	165.00	158.52	157.11	4.656	171.624	4.622	171.568	4.571	171.485	4.486	171.347	4.000	171.347	1.5772			
55	165.0000	142.8942	168.00	161.52	160.11	4.656	174.554	4.622	174.501	4.571	174.418	4.486	174.279	4.000	174.279	1.5772			
56	168.0000	145.4923	171.00	164.52	163.11	4.656	177.627	4.621	177.571	4.570	177.487	4.485	177.348	4.000	177.348	1.5772			
57	171.0000	148.0903	174.00	167.52	166.10	4.655	180.562	4.621	180.506	4.570	180.422	4.485	180.282	4.000	180.282	1.5772			
58	174.0000	150.6884	177.00	170.51	169.10	4.655	183.630	4.621	183.574	4.569	183.489	4.483	183.348	4.000	183.348	1.5772			
59	177.0000	153.2865	180.00	173.51	172.10	4.655	186.567	4.621	186.511	4.569	186.426	4.483	186.285	4.000	186.285	1.5772			
60	180.0000	155.8846	183.00	176.51	175.10	4.655	189.432</												