KISSsoft
Drivetrain Design Solutions

Definitions of profile and flank line modifications and manufacturing deviations in KISSsoft

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Sharing Knowledge

Contents

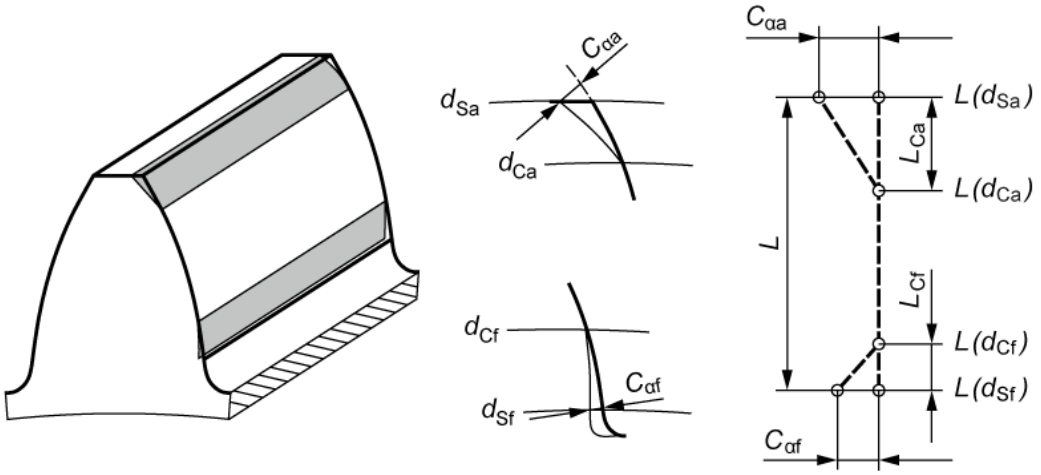
CHANGE LOG

Date	Person	Change

1 Profile and flank line modifications

1.1 Tip and root relief, linear

Picture: **Mod_tipRootReliefLinear.png**

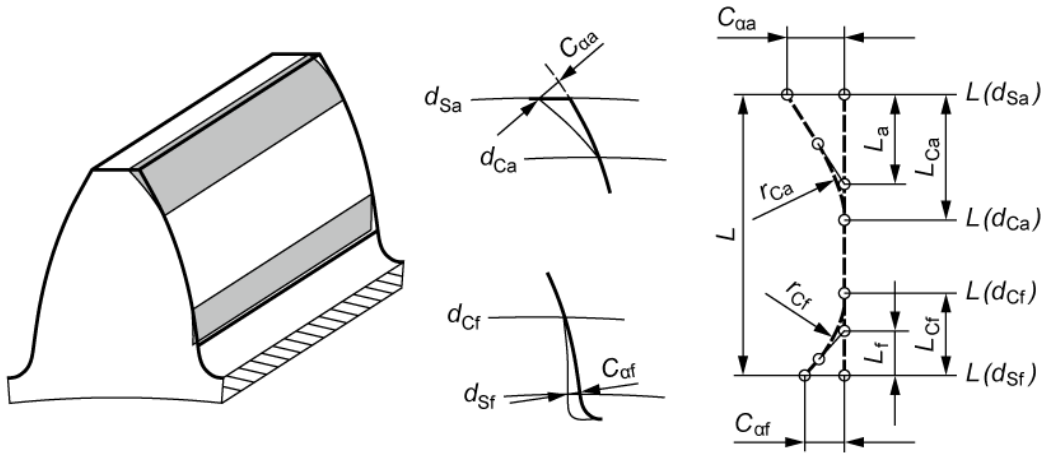


d_{Sa}	tip relief, start, at tip	d_{Sf}	root relief, start, at root
d_{Ca}	tip relief, end, at tip	d_{Cf}	root relief, end, at root
$C_{\alpha a}$	tip relief, value, normal to involute	$C_{\alpha f}$	root relief, value, normal to involute
L_{Ca}	tip relief, roll length	L_{Cf}	root relief, roll length
L	roll length		

	Value	Factor 1	Factor 2
Inputs	$C_{\alpha a}$, $C_{\alpha f}$	L_{Ca}/m_n, L_{Cf}/m_n	-
Conditions	≠ 0	> 0	-

1.2 Tip and root relief, linear with transition radius

Picture: **Mod_tipRootReliefRad.png**

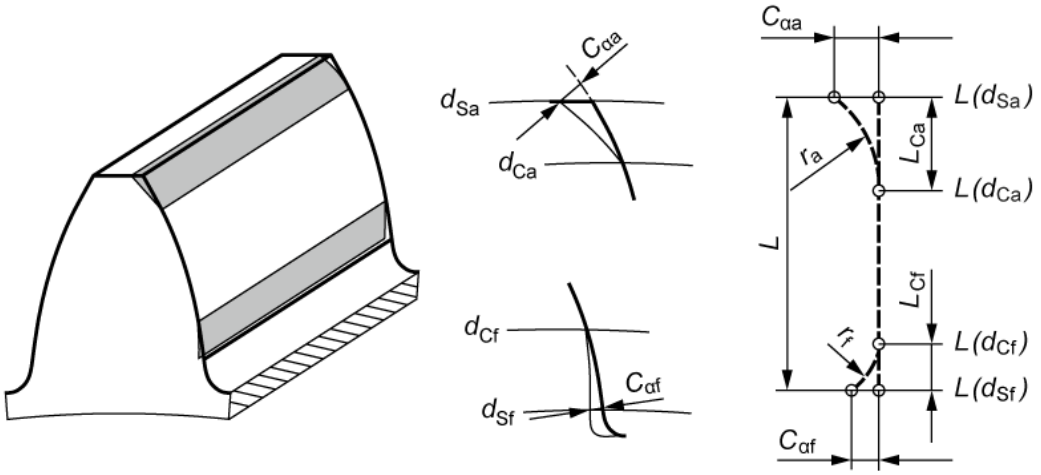


d_{Sa}	tip relief, start, at tip	d_{Sf}	root relief, start, at root
d_{Ca}	tip relief, end, at tip	d_{Cf}	root relief, end, at root
$C_{\alpha a}$	tip relief, value, normal to involute	$C_{\alpha f}$	root relief, value, normal to involute
L_{Ca}	tip relief, roll length	L_{Cf}	root relief, roll length
r_{Ca}	transition radius, at tip	r_{Cf}	transition radius, at root
L	roll length		

	Value	**Factor 1**	**Factor 2**
Inputs	$C_{\alpha a}$, $C_{\alpha f}$	L_{Ca}/m_n, L_{Cf}/m_n	r_{Ca}/m_n, r_{Cf}/m_n
Conditions	> 0	> 0	> 0

1.3 Tip and root relief, arc like

Picture: **Mod_tipRootReliefArc.png**

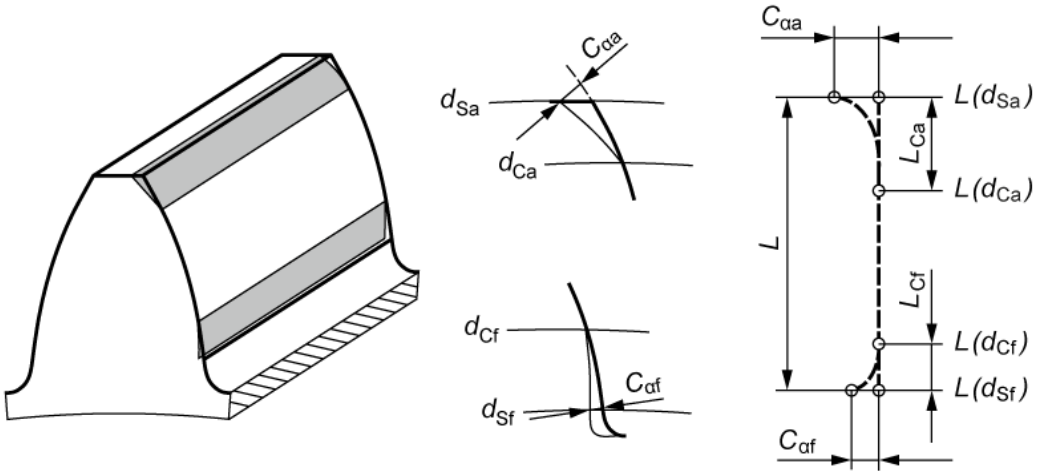


d_{Sa}	tip relief, start, at tip	d_{Sf}	root relief, start, at root
d_{Ca}	tip relief, end, at tip	d_{Cf}	root relief, end, at root
$C_{\alpha a}$	tip relief, value, normal to involute	$C_{\alpha f}$	root relief, value, normal to involute
L_{Ca}	tip relief, roll length	L_{Cf}	root relief, roll length
r_a	tip relief, radius	r_f	root relief, radius
L	roll length		

	Value	**Factor 1**	**Factor 2**
Inputs	$C_{\alpha a}$, $C_{\alpha f}$	L_{Ca}/m_n, L_{Cf}/m_n	-
Conditions	≠ 0	> 0	-

1.4 Tip and root relief, progressive

Picture: **Mod_tipRootReliefProg.png**

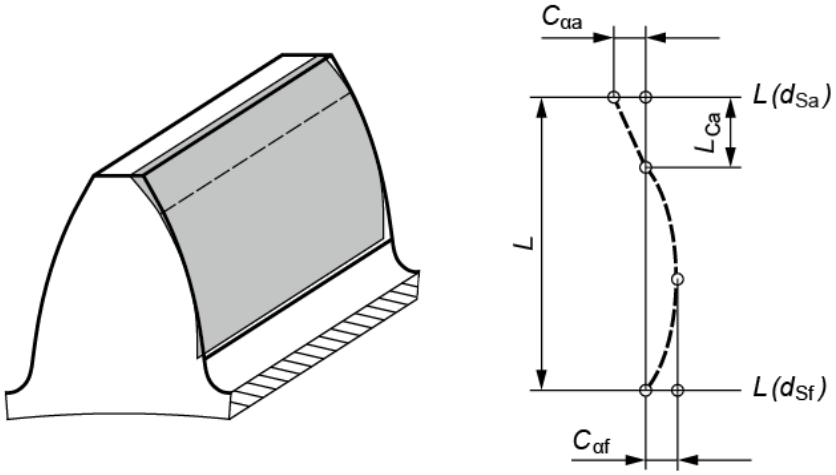


d_{Sa}	tip relief, start, at tip	d_{Sf}	root relief, start, at root
d_{Ca}	tip relief, end, at tip	d_{Cf}	root relief, end, at root
$C_{\alpha a}$	tip relief, value, normal to involute	$C_{\alpha f}$	root relief, value, normal to involute
L_{Ca}	tip relief, roll length	L_{Cf}	root relief, roll length
L	roll length		

	Value	**Factor 1**	**Factor 2**
Inputs	$C_{\alpha a}$, $C_{\alpha f}$	L_{Ca}/m_n, L_{Cf}/m_n	see manual
Conditions	≠ 0	> 0	5 < *Factor 2* < 20

1.5 Tip relief, linear with profile crowning

Picture: **Mod_tipReliefCrown.png**

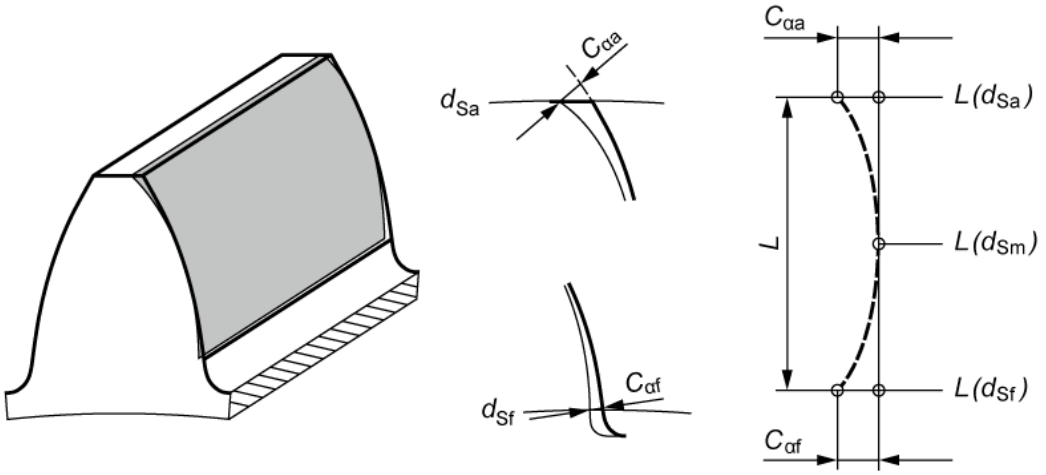


d_{Sa}	modification, start, at tip	d_{Sf}	modification, end, at root
$C_{\alpha a}$	tip relief, value, normal to involute	L_{Ca}	tip relief, roll length
$C_{\alpha f}$	profile crowning, value	L	roll length

	Value	**Factor 1**	**Factor 2**
Inputs	$C_{\alpha f}$	L_{Ca}/m_n	$1000 \cdot C_{\alpha a}/m_n$
Conditions	≠ 0	> 0	> 0

1.6 Profile crowning (roll length-centered)

Picture: **Mod_profileCrowning.png**

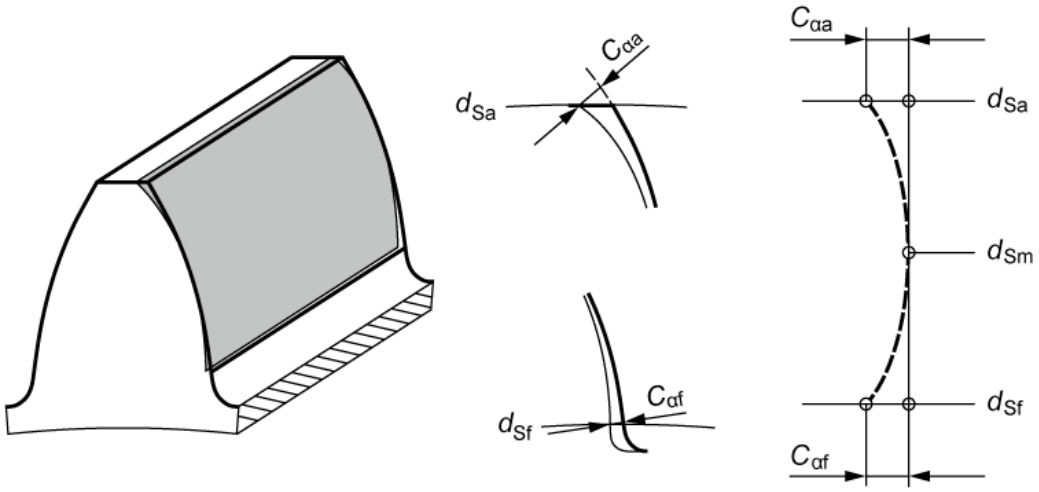


d_{Sa}	profile crowning, start, at tip	d_{Sf}	profile crowning, end, at root
$C_{\alpha a}$	profile crowning, value, at tip, normal to involute	$C_{\alpha f}$	profile crowning, value, at root, normal to involute
L	roll length		

	Value	**Factor 1**	**Factor 2**
Inputs	$C_{\alpha a} = C_{\alpha f}$	-	-
Conditions	≠ 0	-	-
Equation	$L(d_{Sm}) = 0.5 \cdot \left(L(d_{Sa}) + L\left(d_{Sf}\right)\right)$		

1.7 Profile crowning (diameter-centered)

Picture: **Mod_profileCrowningDia.png**

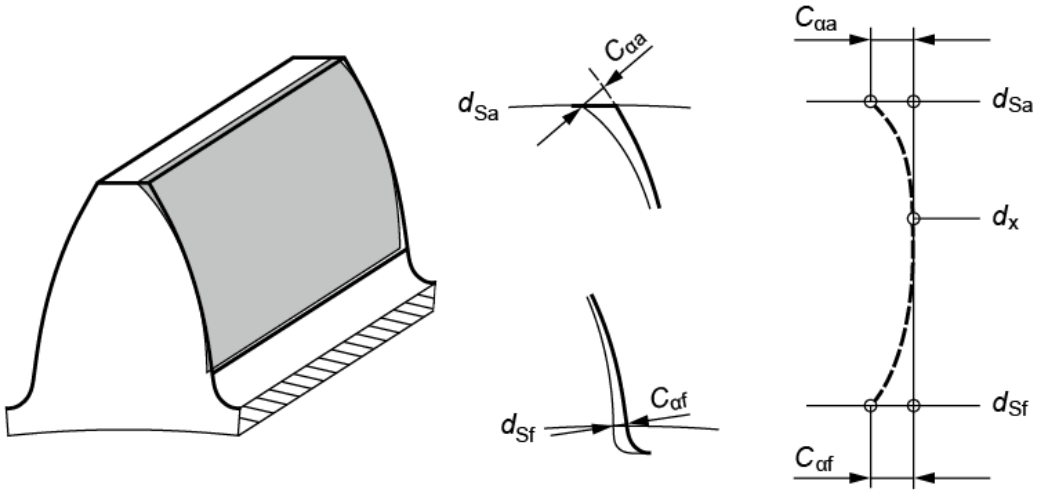


d_{Sa}	profile crowning, start, at tip	d_{Sf}	profile crowning, end, at root
$C_{\alpha a}$	profile crowning, value, at tip, normal to involute	$C_{\alpha f}$	profile crowning, value, at root, normal to involute

	Value	**Factor 1**	**Factor 2**
Inputs	$C_{\alpha a} = C_{\alpha f}$	-	-
Conditions	≠ 0	-	-
Equation	$d_{Sm} = 0.5 \cdot (d_{Sa} + d_{Sf})$		

1.8 Profile crowning, eccentric

Picture: **Mod_profileCrowningExc.png**

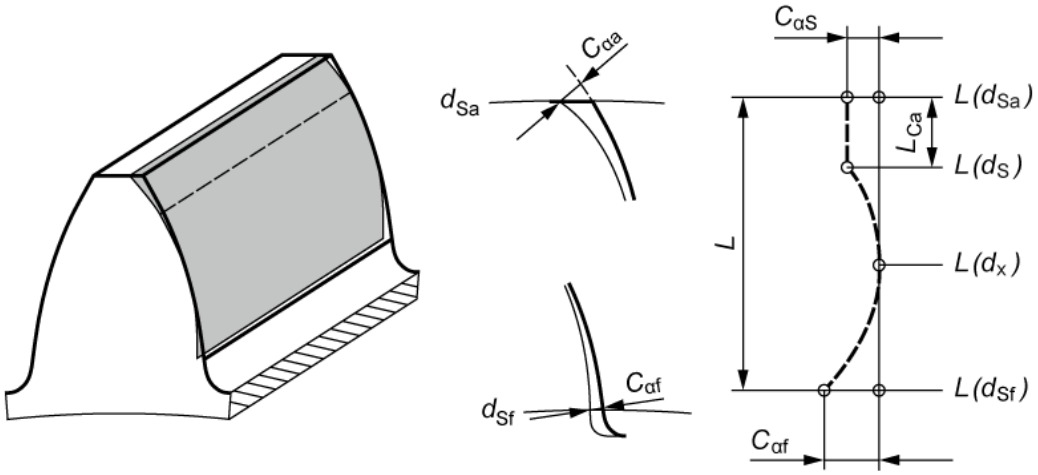


d_{Sa}	profile crowning, start, at tip	d_{Sf}	profile crowning, end, at root
$C_{\alpha a}$	profile crowning, value, at tip, normal to involute	$C_{\alpha f}$	profile crowning, value, at root, normal to involute
L_x	tip to profile crowning vertex, roll length	L	roll length

	Value	**Factor 1**	**Factor 2**
Inputs	$C_{\alpha a}$	$(d_{Sa}-d_x)/(d_{Sa}-d_{Sf})$	$C_{\alpha f} / C_{\alpha a}$
Conditions	≠ 0	< 1	≥ 0

1.9 Profile crowning, shortened

Picture: **Mod_profileCrowningShort.png**

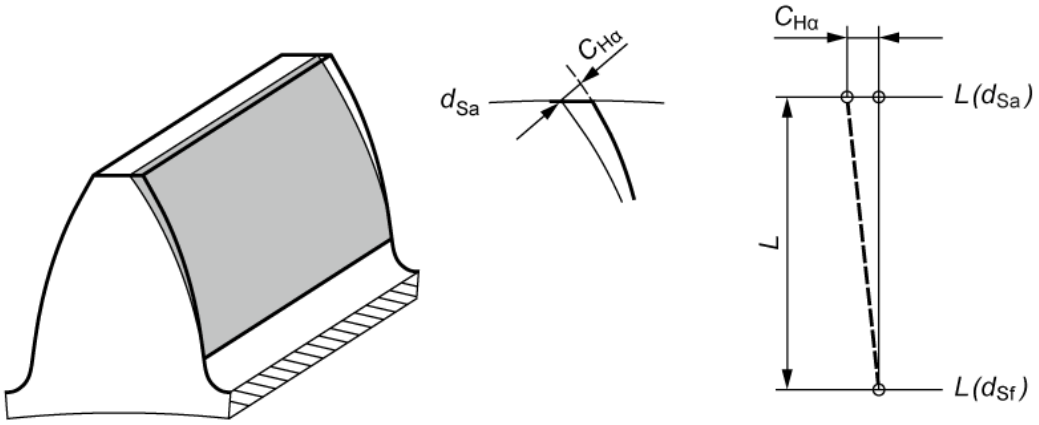


d_{Sa}	modification, start, at tip	d_{Sf}	modification, start, at root
$C_{\alpha f}$	profile crowning, value, at root, normal to involute	L_{Ca}	tip to profile crowning start, roll length
L_x	tip to profile crowning vertex, roll length	L	roll length

	Value	**Factor 1**	**Factor 2**
Inputs	$C_{\alpha f}$	$(d_{Sa}-d_x)/(d_{Sa}-d_{Sf})$	$(d_{Sa}-d_S)/(d_{Sa}-d_{Sf})$
Conditions	≠ 0	0 < *Factor 1* < 1	0 < *Factor 2* < 1

1.10 Pressure angle modification (value), Transverse profile slope modification (value)

Picture: **Mod_pressureAngle.png**

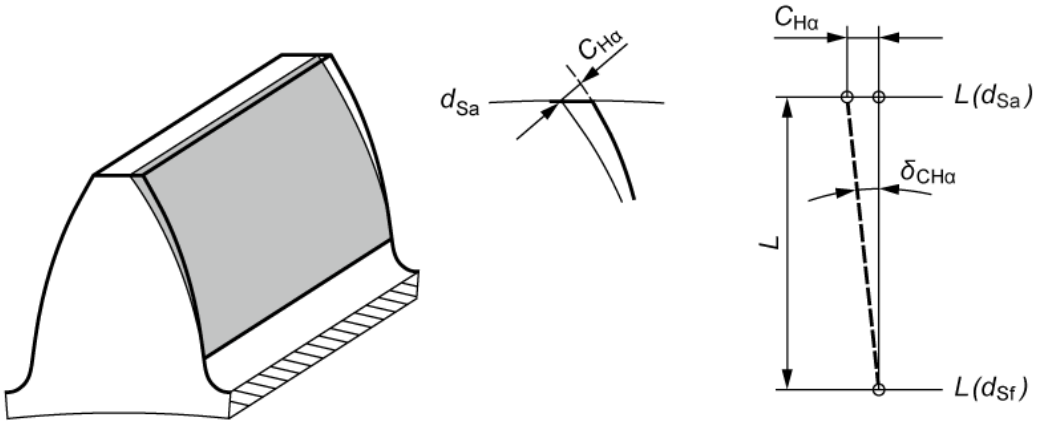


d_{Sa}	transverse profile slope modification, start, at tip	d_{Sf}	transverse profile slope modification, end, at root
$C_{H\alpha}$	transverse profile slope modification, value, normal to involute	L	roll length
$\alpha_{n\,eff}$	effective pressure angle		

	Value	Factor 1	Factor 2
Inputs	$C_{H\alpha}$	-	-
Conditions	≠ 0	-	-
Equation	$\alpha_{n\,eff} = atan\left(cos(\beta) \cdot tan\left(\alpha_t + 0.001 \cdot C_{H\alpha}/Abs\left(L(d_{Sa}) - L\left(d_{Sf}\right)\right) / tan\,\alpha_t\right)\right)$		

1.11 Pressure angle modification (angle), Transverse profile slope modification (angle)

Picture: **Mod_pressureAngleAng.png**

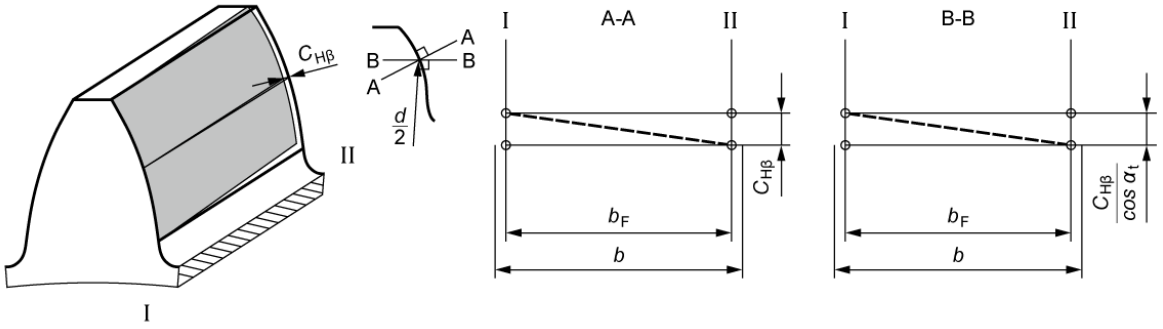


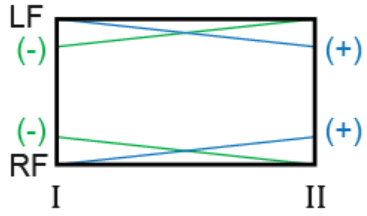
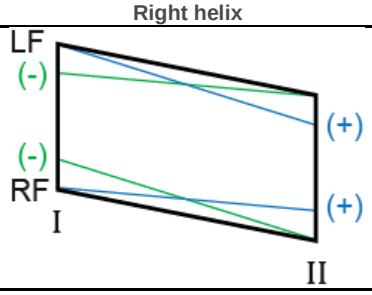
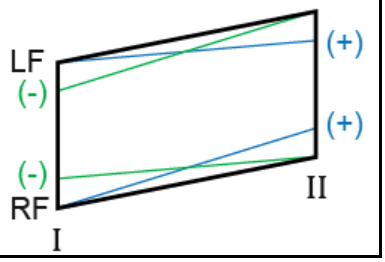
d_{Sa}	transverse profile slope modification, start, at tip	d_{Sf}	transverse profile slope modification, end, at root
$C_{H\alpha}$	transverse profile slope modification, value, normal to involute	$\delta_{CH\alpha}$	transverse profile slope modification, value, angle
L	roll length	$\alpha_{n\,eff}$	effective pressure angle

	Value	**Factor 1**	**Factor 2**
Inputs	-	$\delta_{CH\alpha}$ (in arc minutes)	-
Conditions	-	≠ 0	-
Equation	$C_{H\alpha} = 1000 \cdot tan\,\alpha_t \cdot (Factor\ 1/60/\cos\beta) \cdot Abs\left(L(d_{Sa}) - L(d_{Sf})\right)$ $\alpha_{n\,eff} = atan\left(\cos(\beta) \cdot tan\left(\alpha_t + 0.001 \cdot C_{H\alpha}/Abs\left(L(d_{Sa}) - L(d_{Sf})\right)/tan\,\alpha_t\right)\right)$		

1.12 Helix angle modification, tapered or conical

Picture: **Mod_helixAngleCon.png**



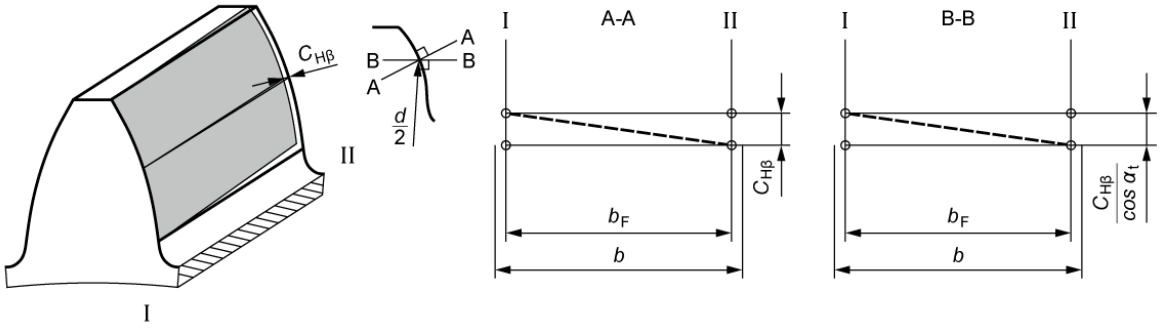
Spur	Right helix	Left helix
		

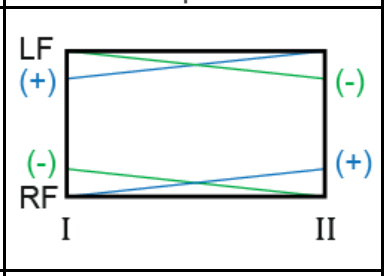
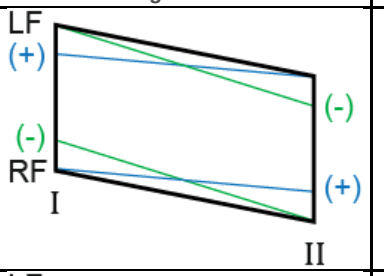
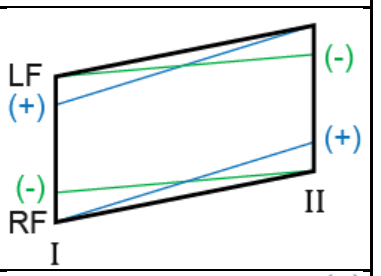
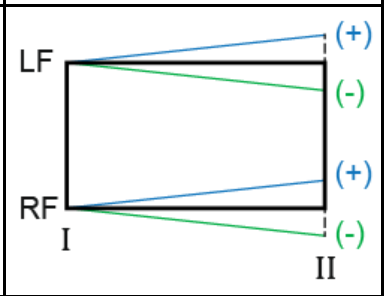
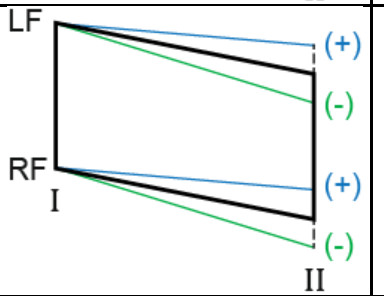
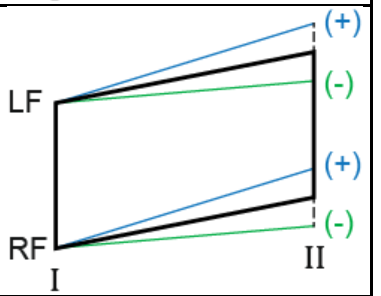
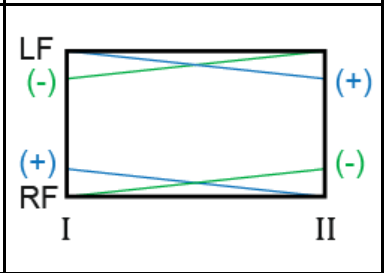
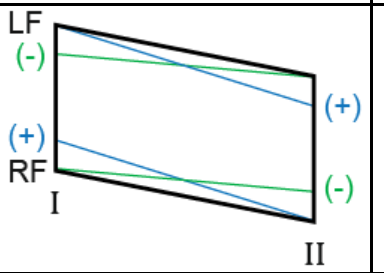
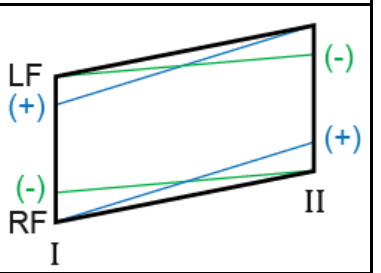
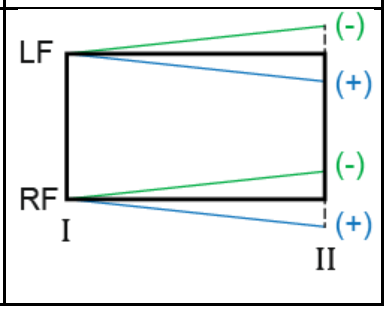
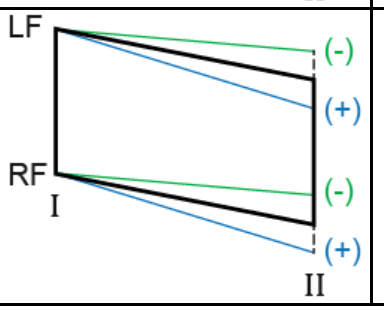
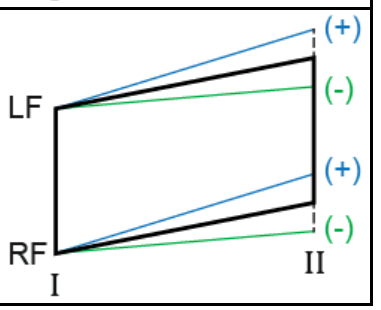
b	facewidth	b_F	usable facewidth (b-2·b_k)
$C_{H\beta}$	helix angle modification, value	β_{eff}	effective helix angle

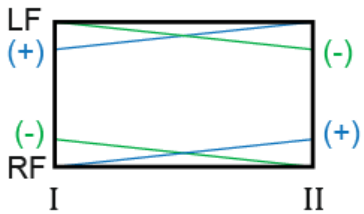
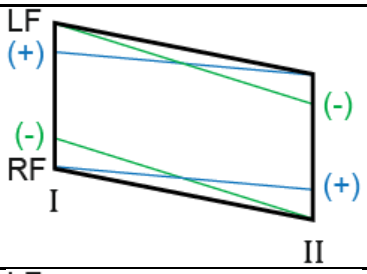
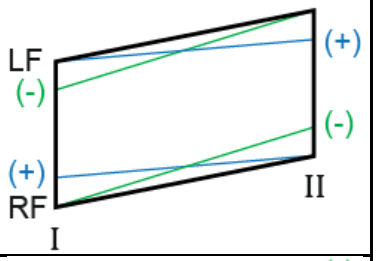
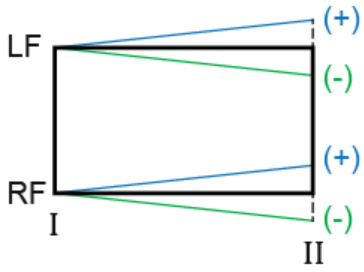
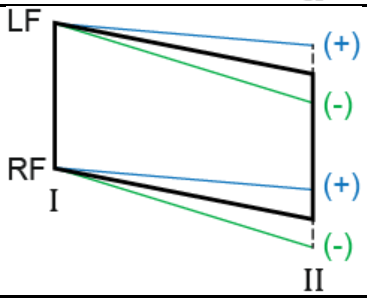
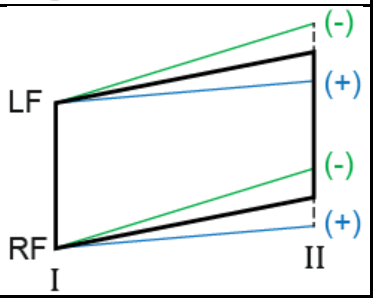
	Value	Factor 1	Factor 2
Inputs	$C_{H\beta}$	-	-
Conditions	≠ 0	-	-
Equation	Equations apply only for individual flank. Helix angle of the gear is not affected. $C_{H\beta} = 1000 \cdot b_F \cdot \cos \alpha_t \cdot \left(tan(\beta_{eff}) - tan(\beta)\right)$ $\beta_{eff} = atan\left(\left(b_F \cdot \tan \beta \pm Abs(0.001 \cdot C_{H\beta} / \cos \alpha_t)\right)/b_F\right)$		

1.13 Helix angle modification, parallel (value)

Picture: **Mod_helixAngle.png**



		Spur	Right helix	Left helix
ISO 21771	Remove material on both sides			
	Manufactured with modified helix angle			
ISO 1328, external gears (z > 0)	Remove material on both sides			
	Manufactured with modified helix angle			

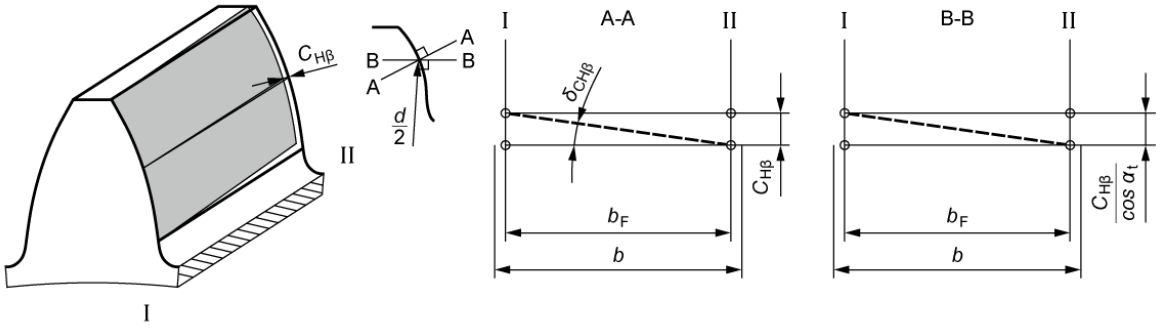
ISO 1328, internal gears (z < 0)	Remove material on both sides			
	Manufactured with modified helix angle			

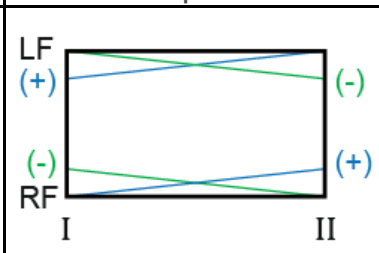
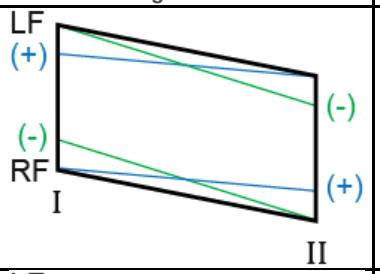
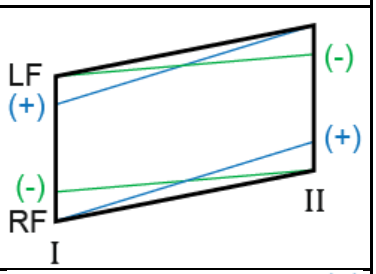
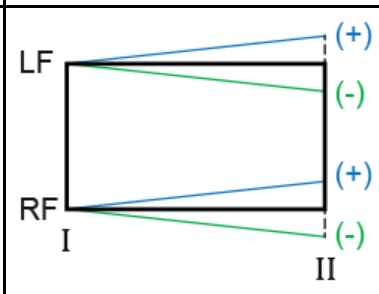
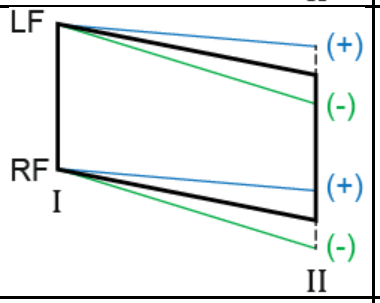
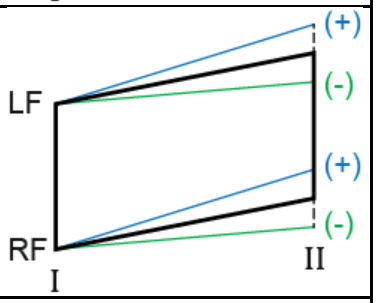
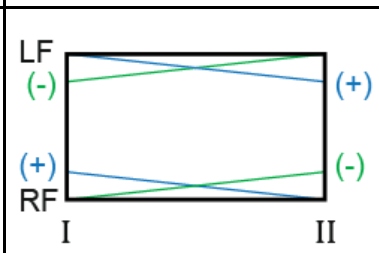
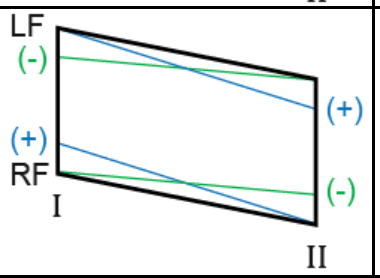
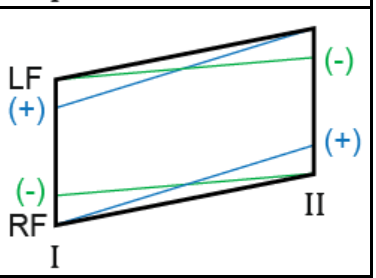
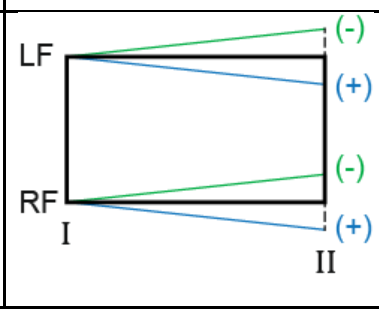
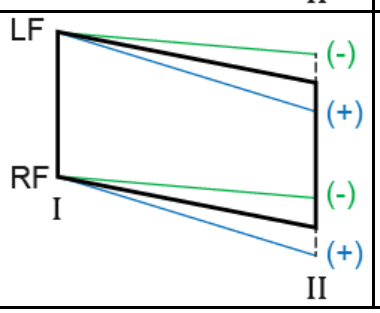
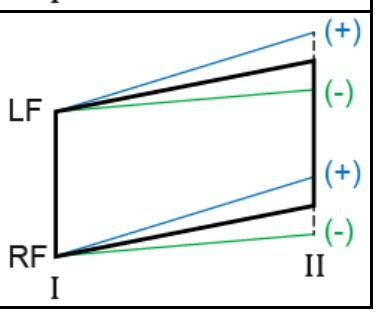
b	facewidth	b_F	usable facewidth (b-2·b_k)
$C_{H\beta}$	helix angle modification, value	β_{eff}	effective helix angle

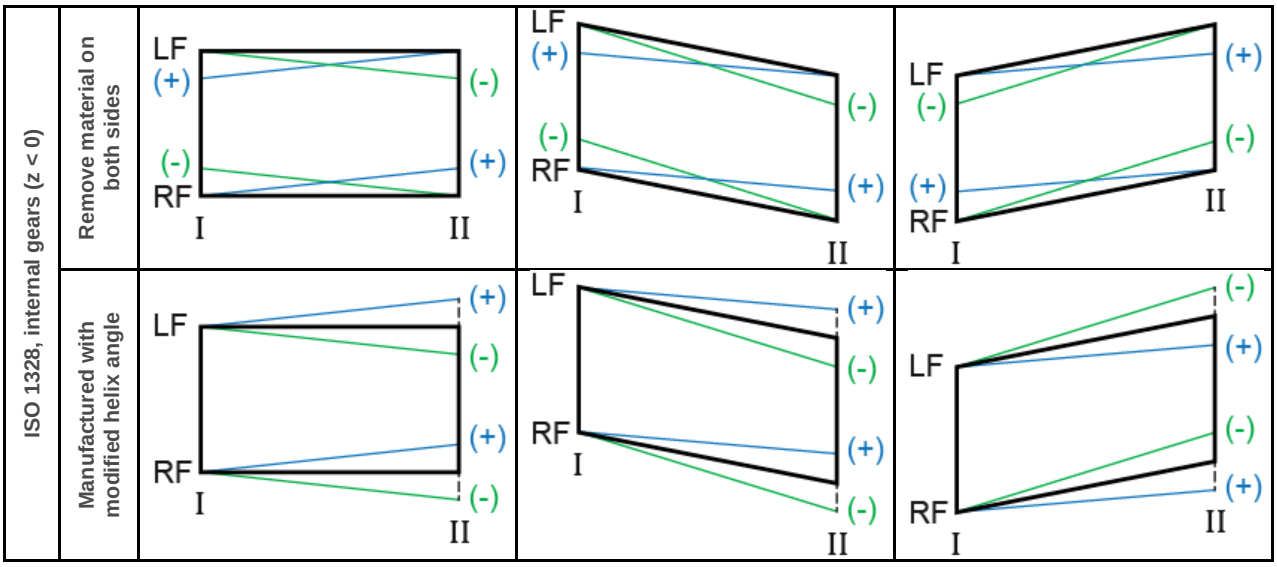
	Value	Factor 1	Factor 2
Inputs	$C_{H\beta}$	-	-
Conditions	≠ 0	-	-
Equation	$C_{H\beta} = 1000 \cdot cos\,\alpha_n \cdot b_F \cdot (tan(\beta - Factor\ 1/60) - tan(\beta))$ $\beta_{eff} = atan\left(\left(b_F \cdot tan\,\beta \pm Abs(0.001 \cdot C_{H\beta}/\,cos\,\alpha_t)\right)/b_F\right)$ More information in Instruction 117: Definition of helix angle modification		

1.14 Helix angle modification, parallel (angle)

Picture: **Mod_helixAngleAng.png**



		Spur	Right helix	Left helix
ISO 21771	Remove material on both sides			
	Manufactured with modified helix angle			
ISO 1328, external gears (z > 0)	Remove material on both sides			
	Manufactured with modified helix angle			

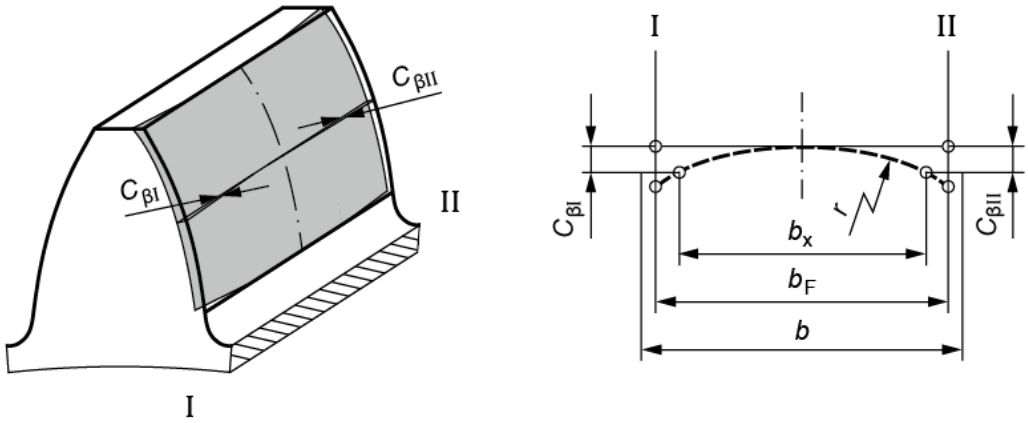


b	facewidth	b_F	usable facewidth (b-2·b_k)
$C_{H\beta}$	helix angle modification, value	$\delta_{CH\beta}$	helix angle modification, value, angle
β_{eff}	effective helix angle		

	Value	**Factor 1**	**Factor 2**
Inputs	-	$\delta_{CH\beta}$ (in arc minutes)	-
Conditions	-	≠ 0	-
Equation	$\beta_{eff} = atan\left(\left(b_F \cdot tan\,\beta \pm Abs(0.001 \cdot C_{H\beta}/\cos\alpha_t)\right)/b_F\right)$ More information in Instruction 117: Definition of helix angle modification		

1.15 Flank line crowning

Picture: **Mod_flankCrowning.png**

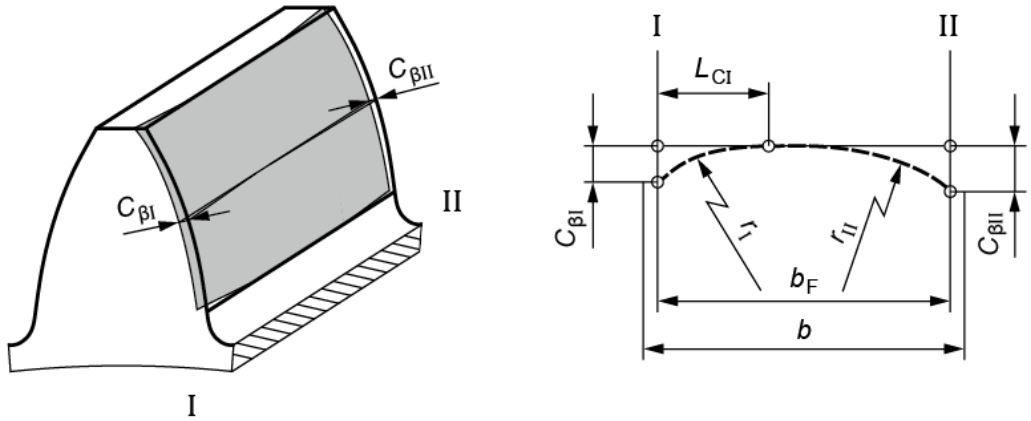


b	facewidth	b_F	usable facewidth (b-2·b_k)
b_X	reference width	$C_{\beta I}$	flank line crowning, value, at side I
$C_{\beta II}$	flank line crowning, value, at side II	r	flank line crowning, radius

	Value	**Factor 1**	**Factor 2**
Inputs	$C_{\beta I} = C_{\beta II}$	b_X/b_F	-
Conditions	≠ 0	0 < *Factor 1* ≤ 1	-

1.16 Flank line crowning, eccentric

Picture: **Mod_flankCrowningExc.png**

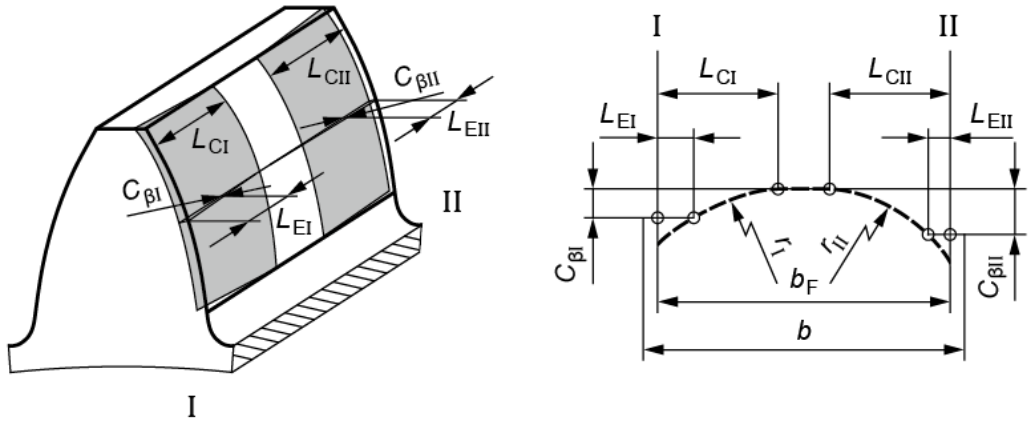


b	facewidth	b_F	usable facewidth (b-2·b_k)
$C_{\beta I}$	flank line crowning, value, at side I	$C_{\beta II}$	flank line crowning, value, at side II
r_I	flank line crowning, radius, at side I	r_{II}	flank line crowning, radius, at side II
L_{CI}	side I to crowning vertex, length		

	Value	**Factor 1**	**Factor 2**
Inputs	$C_{\beta I}$	L_{CI}/b_F	$C_{\beta II}/C_{\beta I}$
Conditions	≠ 0	0 < *Factor 1* < 1	> 0

1.17 Flank line crowning, side I and II

Picture: **Mod_flankCrowningShort.png**

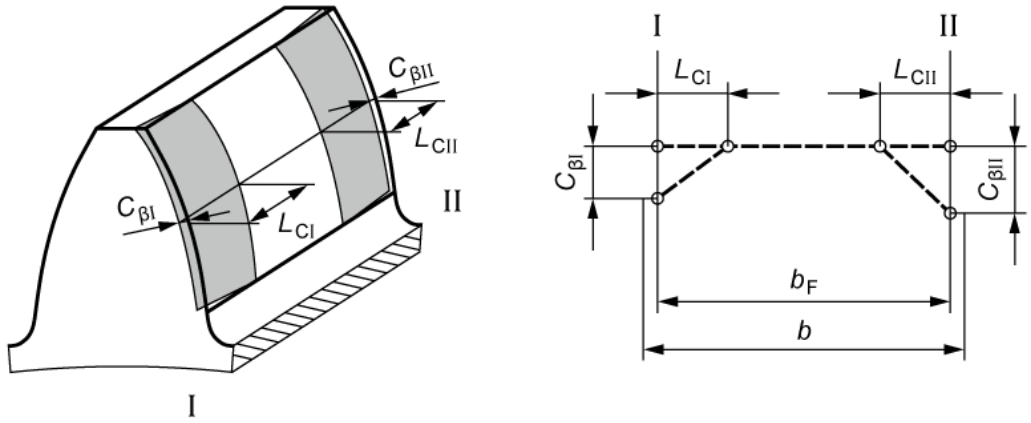


b	facewidth	b_F	usable facewidth (b-2·b_k)
$C_{\beta I}$	flank line crowning, value, at L_{EI}, at side I	$C_{\beta II}$	flank line crowning, value, at L_{EII}, at side II
r_I	flank line crowning, radius, at side I	r_{II}	flank line crowning, radius, at side II
L_{CI}	flank line crowning, length, at side I	L_{CII}	flank line crowning, length, at side II

	Value	**Factor 1**	**Factor 2**
Inputs	$C_{\beta I}$, $C_{\beta II}$	L_{CI}/b_F, L_{CII}/b_F	L_{EI}/b_F, L_{EII}/b_F
Conditions	> 0	*Factor 2* < *Factor 1* < 1	0 < *Factor 2* < *Factor 1*

1.18 End relief, linear, side I and II

Picture: **Mod_endRelief.png**

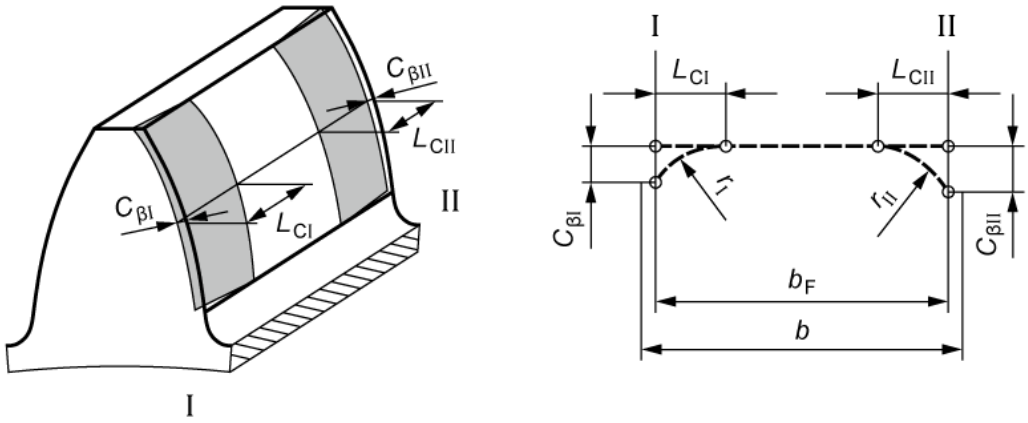


b	facewidth	b_F	usable facewidth (b-2·b_k)
$C_{\beta I}$	end relief, value, at side I	$C_{\beta II}$	end relief, value, at side II
L_{CI}	end relief, length, at side I	L_{CII}	end relief, length, at side II

	Value	**Factor 1**	**Factor 2**
Inputs	$C_{\beta I}$, $C_{\beta II}$	L_{CI}/b_F, L_{CII}/b_F	-
Conditions	> 0	0 < *Factor 1* < 1	-

1.19 End relief, arc-like, side I and II

Picture: **Mod_endReliefArc.png**

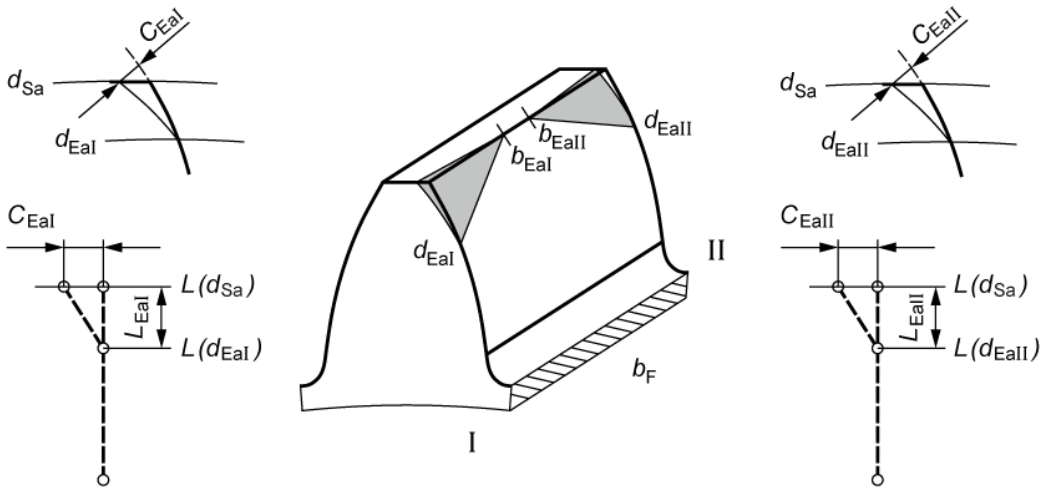


b	facewidth	b_F	usable facewidth (b-2·b_k)
$C_{\beta I}$	end relief, value, at side I	$C_{\beta II}$	end relief, value, at side II
r_I	end relief, radius, at side I	r_{II}	end relief, radius, at side II
L_{CI}	end relief, length, at side I	L_{CII}	end relief, length, at side II

	Value	**Factor 1**	**Factor 2**
Inputs	$C_{\beta I}$, $C_{\beta II}$	L_{CI}/b_F, L_{CII}/b_F	-
Conditions	> 0	0 < *Factor 1* < 1	-

1.20 Triangular end relief, side I and II

Picture: **Mod_triangularRelief.png**

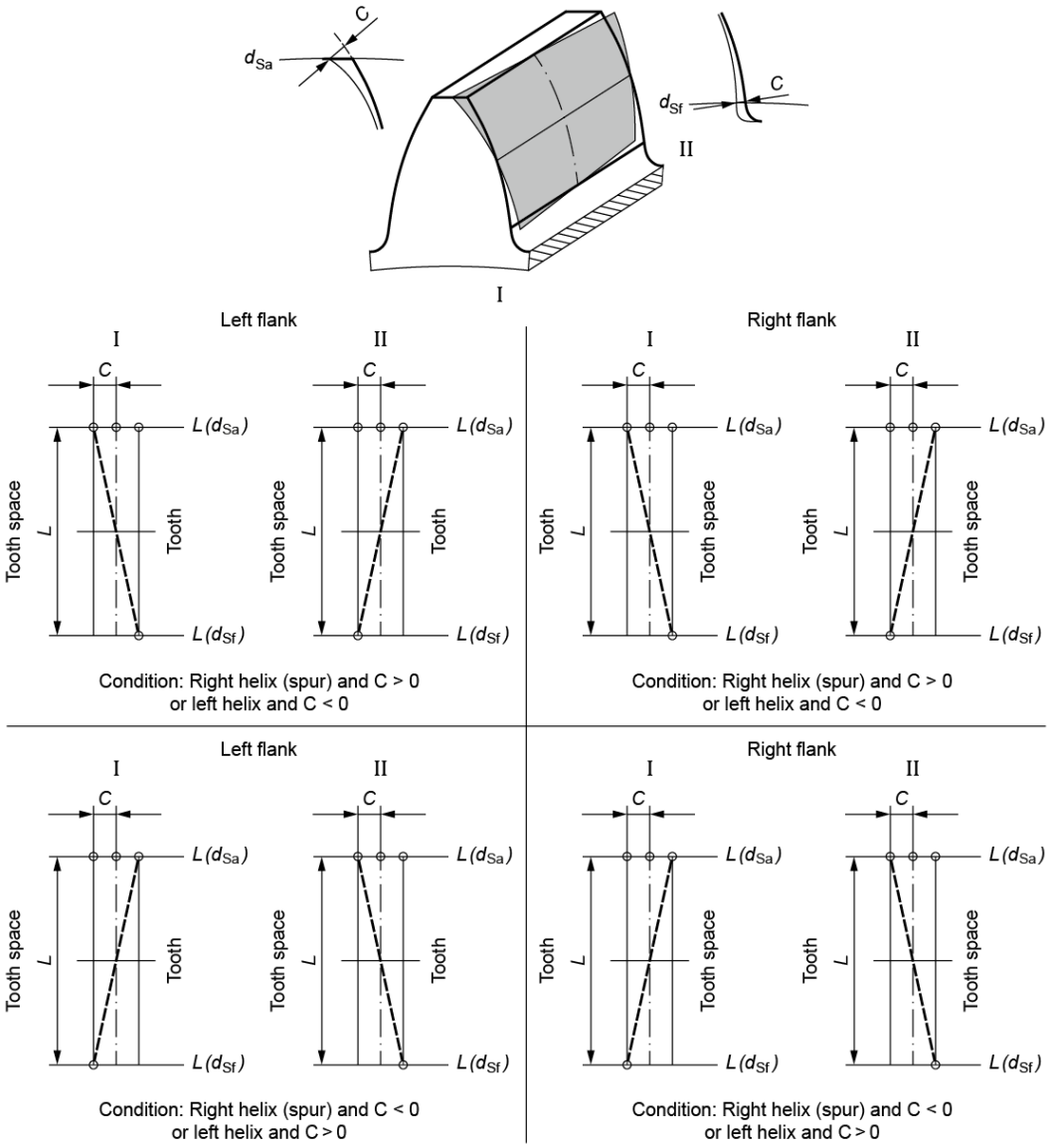


b	facewidth	b_F	usable facewidth (b-2·b_k)
d_{Sa}	triangular relief, start, at side I	d_{Sa}	triangular relief, start, at side II
d_{EaI}	triangular relief, end, at side I	d_{EaII}	triangular relief, end, at side II
C_{EaI}	triangular relief, value, at side I	C_{EaII}	triangular relief, value, at side II
b_{EaI}	triangular relief, length, at side I	b_{EaII}	triangular relief, length, at side II

	Value	**Factor 1**	**Factor 2**
Inputs	C_{EaI}, C_{EaII}	L_{EaI}/m_n, L_{EaII}/m_n	b_{EaI}/b_F, b_{EaII}/b_F
Conditions	> 0	> 0	0 < *Factor 2* < 1

1.21 Twist

Picture: **Mod_twist.png**

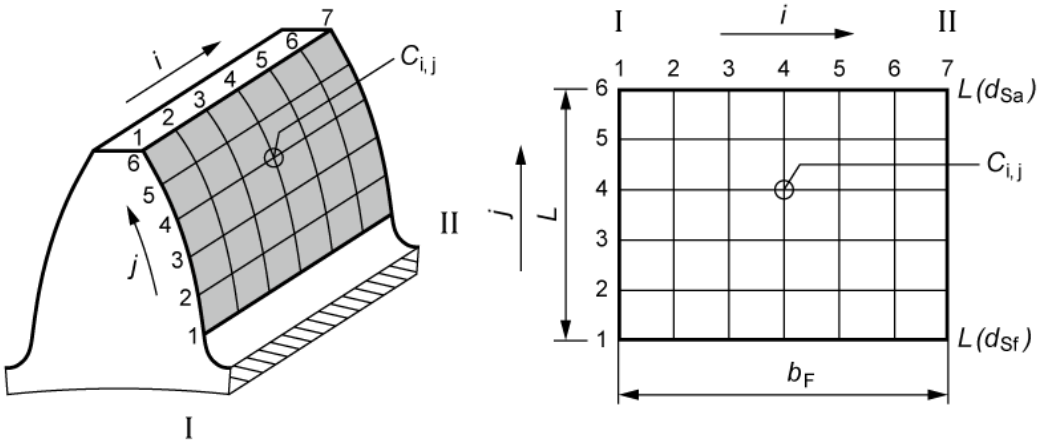


d_{Sa}	twist, start, at tip	d_{Sf}	twist, end, at root
C	twist, value		

	Value	Factor 1	Factor 2
Inputs	$4 \cdot C$	-	-
Conditions	$\neq 0$	-	-

1.22 Topological modification

Picture: **Mod_topological.png**



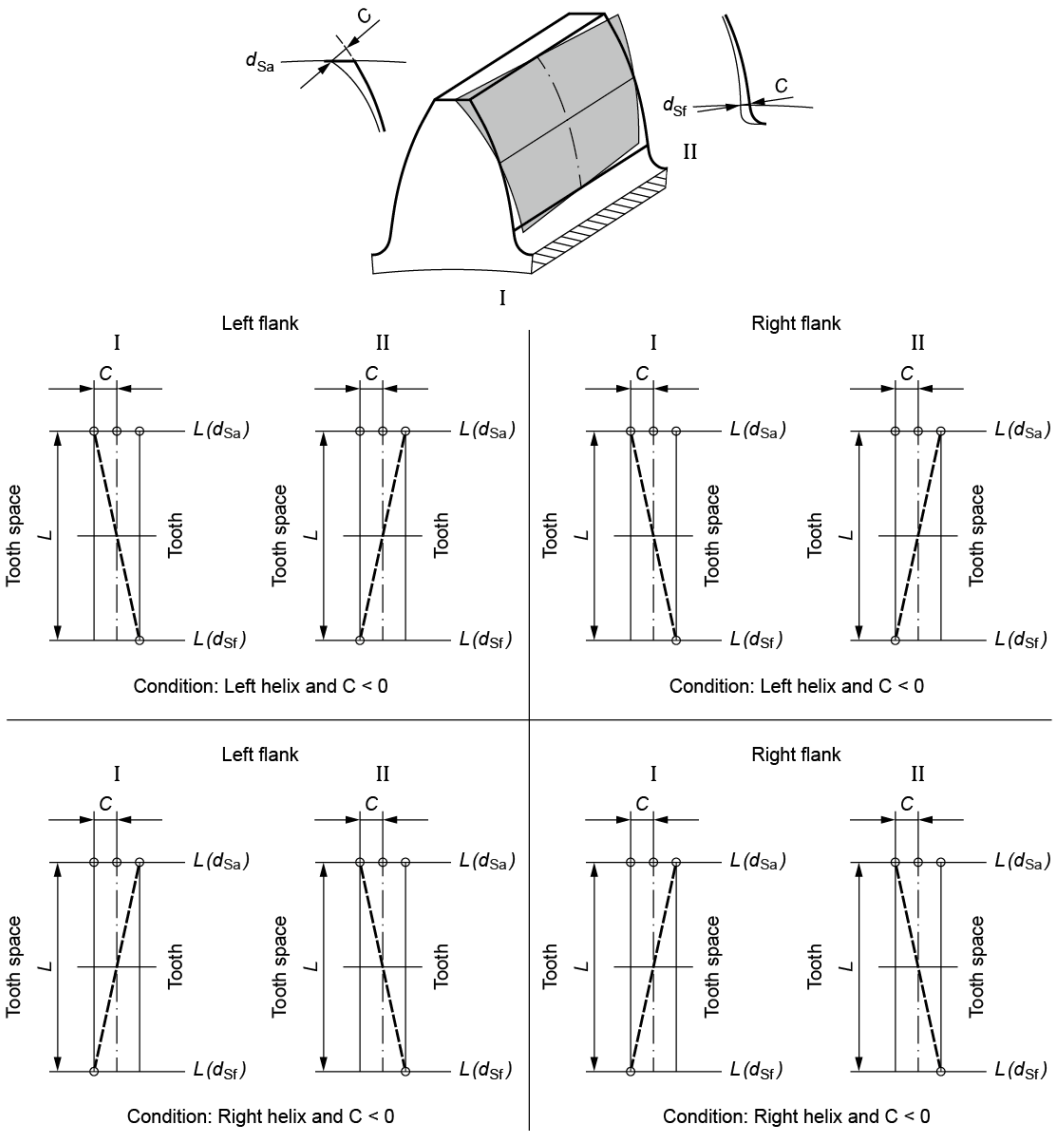
d_{Sa}	topological modification, start, at tip	d_{Sf}	topological modification, end, at root
b_F	usable facewidth (b-$2 \cdot b_k$)	$C_{i,j}$	topological modification, value, at position i,j
L	roll length		

	Value	**Factor 1**	**Factor 2**
Inputs	see manual	-	-
Conditions	> 0	-	-

2 Manufacturing deviations

2.1 Natural twist from flank line crowning C_β (generation grinding)

Picture: Mod_twistManufacturing.png

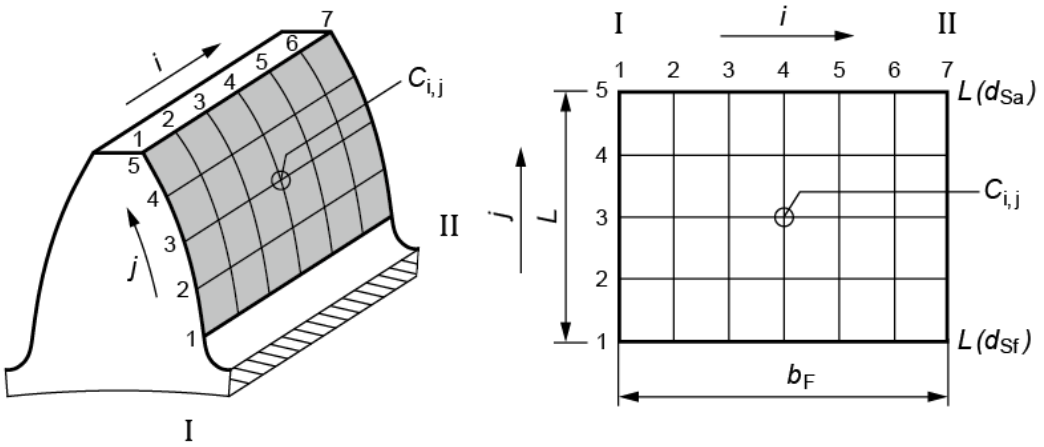


d_{Sa}	natural twist, start, at tip	d_{Sf}	natural twist, end, at root
C	natural twist, value, $f(C_\beta)$	C_β	flank line crowning

	Value	Factor 1	Factor 2
Inputs	C_β, see manual	-	-
Conditions	> 0	-	-
Info	Natural twist value C is always negative.		

2.2 Measured manufacturing deviation

Picture: **Mod_topological.png**



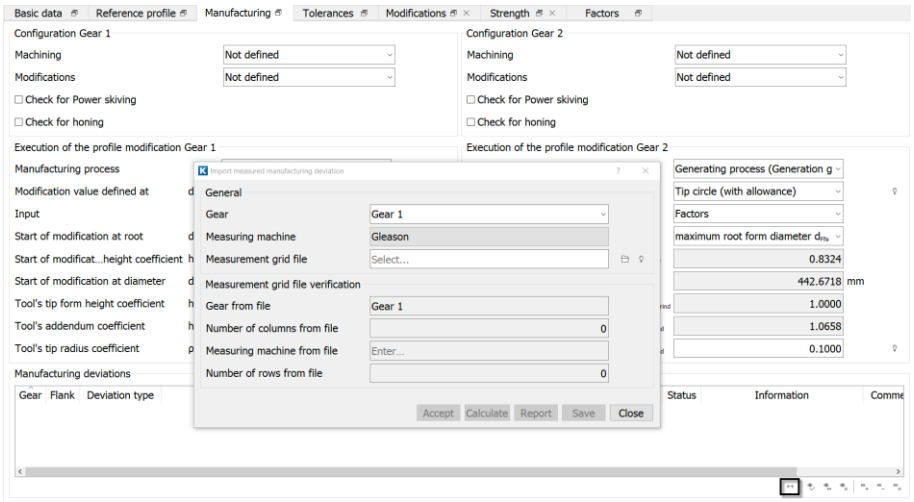
d_{Sa}	measured manufacturing deviation, start, at tip	d_{Sf}	measured manufacturing deviation, end, at root
b_F	usable facewidth (b-2·b_k)	$C_{i,j}$	measured manufacturing deviation, value, at position i,j
L	roll length		

	Value	**Factor 1**	**Factor 2**
Inputs	see manual	-	-
Conditions	> 0	-	-

The measured manufacturing deviation option enables you to import the Gleason GAMA CMM data directly and converted into the topological modification format used in KISSsoft. Thus, the format of the template for the measured manufacturing deviation modification is the same as the topological modification template. It is assumed the values in the template are defined in µm. To display the modification, select Graphics > 3D Geometry > Modifications.

By defining the modification, the user can analyze the effect of the manufacturing deviation on gear performances such as transmission error, contact stress, and other characteristics. This function is essential in the “Design – Manufacturing – Measuring Closed Loop” to ensure the manufactured gears perform desired characteristics.

It is possible to define the modification manually, but it is recommended to use the “Import measured manufacturing deviation” conversion dialogue in the Manufacturing tab.



The user should assign the CMM data that contains manufacturing deviation in the window. Currently, only the Gleason GAMA data format is allowed. Note that it should contain the deviation data shown under the column FN.

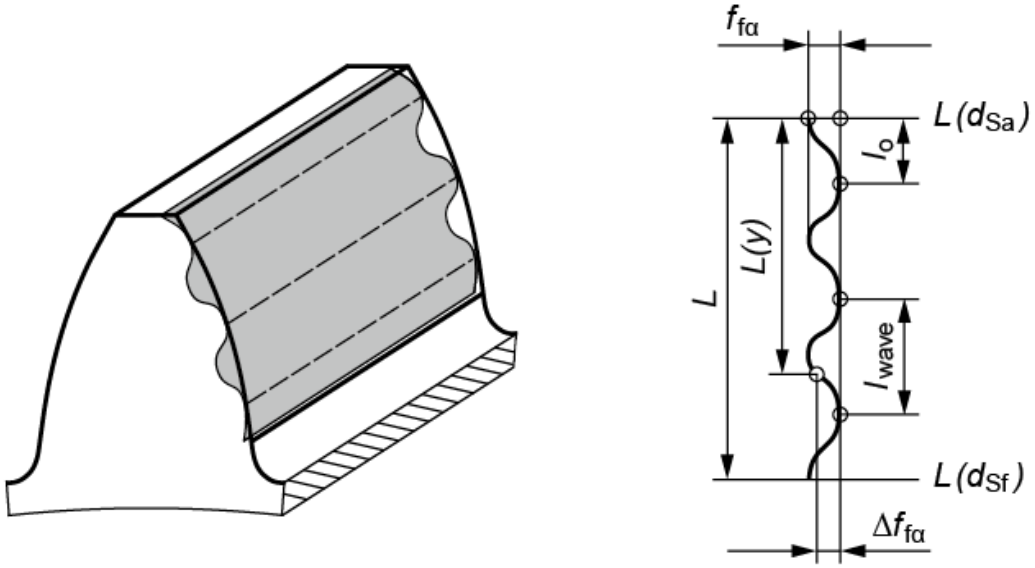
```
*****************************************************************************
*                            MEASUREMENT DATA - LIST                        *
*                            PINION CONVEX                                  *
*---------------------------------------------------------------------------*
*DRAWING NUMBER :                                                           *
*ANGULAR TOOTH-THICKNESS ERROR % ZDIF !-16.2653 [DEG] % (J,I) ! (5,3)       *
*---------------------------------------------------------------------------*
*COLUMNS % NSPG ! 9 ;  LINES % NZLG ! 5                                     *
*---------------------------------------------------------------------------*
*DATE :  15 Jun 2020                                                        *
*****************************************************************************
*   J  I          XP          YP          ZP                        FN      *
*234567890123456789012345678901234567890123456789012345678901234567890123456789*
     1  1      15.2990     -2.7665     -9.3186                      -.00691
     1  2      16.2254     -3.4014     -9.3189                      -.00569
     1  3      17.0949     -4.2238     -9.3188                      -.00589
     1  4      17.8968     -5.2083     -9.3186                      -.00722
     1  5      18.6213     -6.3386     -9.3186                      -.00699
     2  1      15.4391     -1.8344     -6.9890                      -.00496
     2  2      16.4024     -2.4126     -6.9892                      -.00422
     2  3      17.3205     -3.1807     -6.9892                      -.00384
     2  4      18.1808     -4.1149     -6.9890                      -.00501
```

After assigned the file, click “Calculate” and “Save” button to save the template files into proper folder. After saving the file, click “Accept” button, and the program will create the entry of the modifications automatically as shown below.

Gear	Flank	Deviation type	Value [µm]	Data file	Status	Information
Gear 1	both	Measured manufacturing deviation		template.dat	active	
Gear 2	both	Measured manufacturing deviation		template.dat	active	

2.3 Profile form deviation $f_{f\alpha}$

Picture: **Mod_formErrorfFa.png**

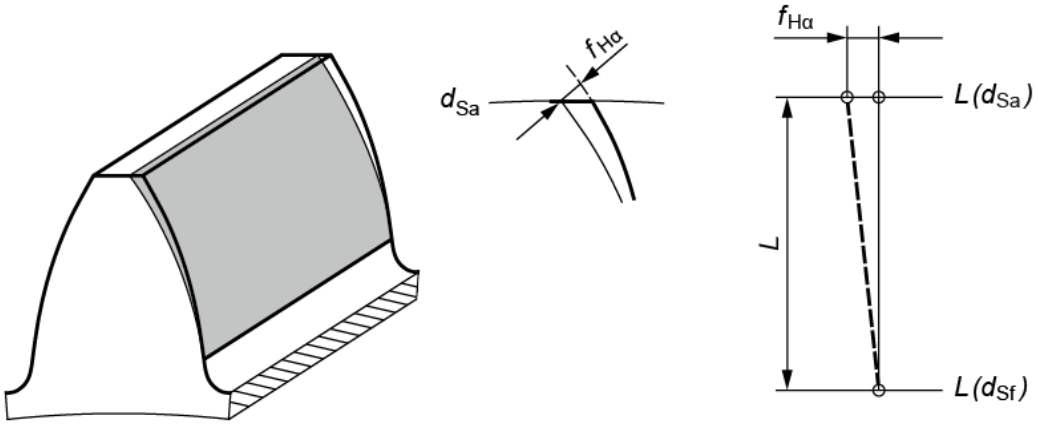


d_{Sa}	profile form deviation, start, at tip	d_{Sf}	profile form deviation, end, at root
L	roll length	l_0	phase shift
l_{wave}	wave length	$f_{f\alpha}$	profile form deviation, value

	Value	Factor 1	Factor 2
Inputs	$f_{f\alpha}$	l_{wave}/m_n	l_0/m_n
Conditions	> 0	> 0	-
Equation	$\Delta f_{f\alpha} = \frac{f_{f\alpha}}{2} \cdot \left[1 - \sin\left(90^\circ + 360^\circ \cdot \left(\frac{L(y)}{Factor\ 1 \cdot m_n} - \frac{Factor\ 2}{Factor\ 1}\right)\right)\right]$		

2.4 Profile slope deviation $f_{H\alpha}$

Picture: **Mod_formErrorfHa.png**

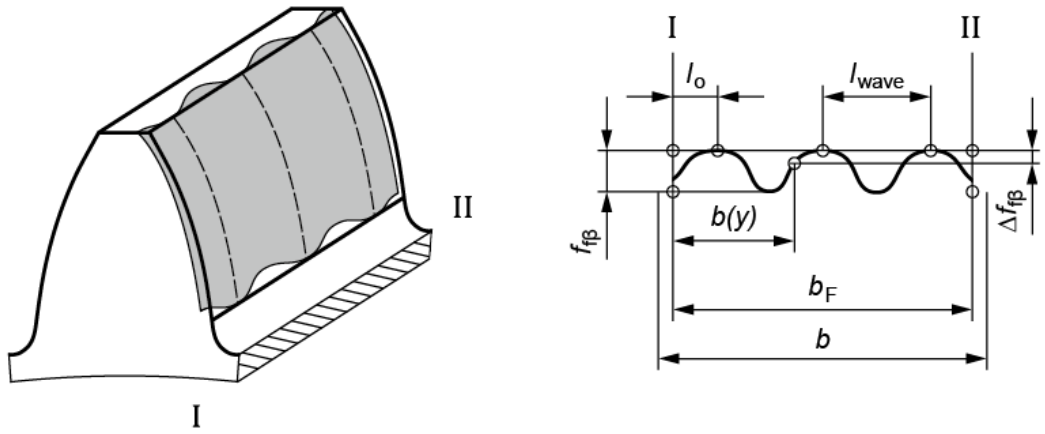


d_{Sa}	profile slope deviation, start, at tip	d_{Sf}	profile slope deviation, end, at root
$f_{H\alpha}$	profile slope deviation, value, normal to involute	L	roll length

	Value	**Factor 1**	**Factor 2**
Inputs	$f_{H\alpha}$	-	-
Conditions	≠ 0	-	-

2.5 Helix form deviation $f_{f\beta}$

Picture: **Mod_formErrorfFb.png**

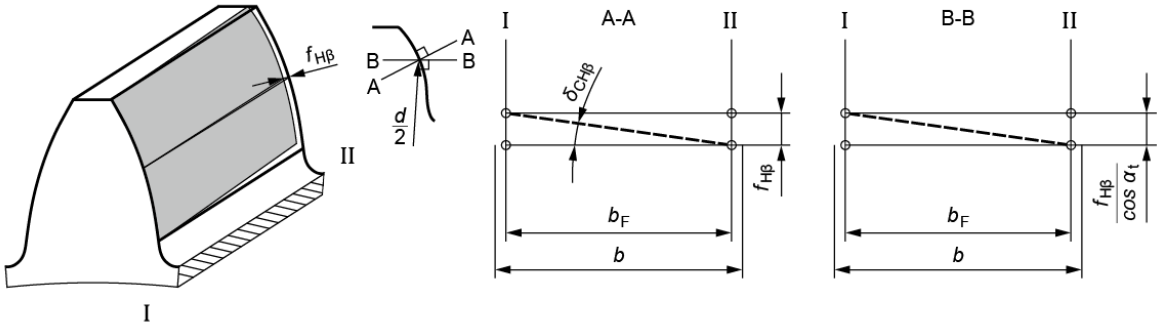


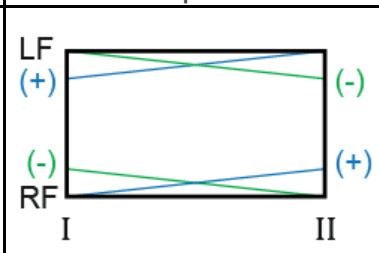
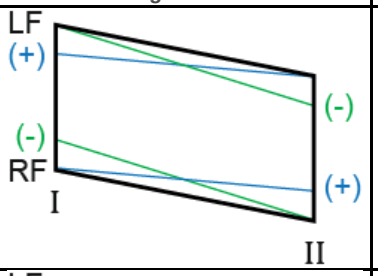
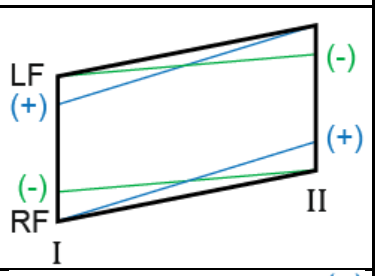
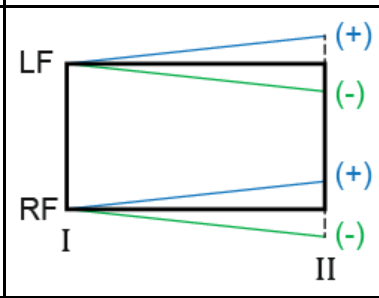
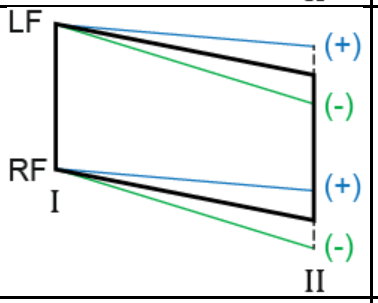
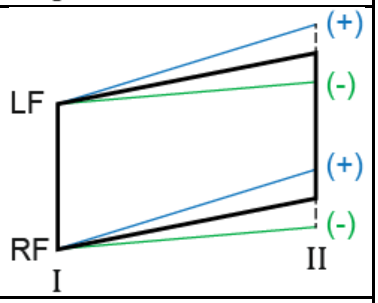
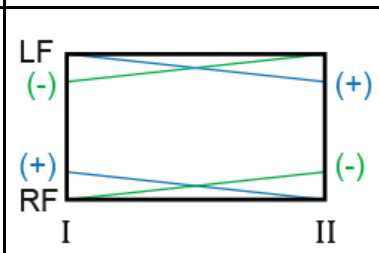
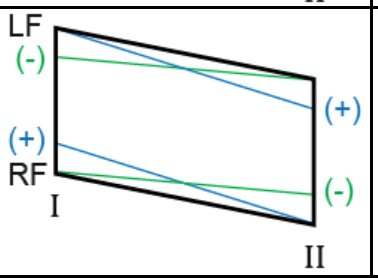
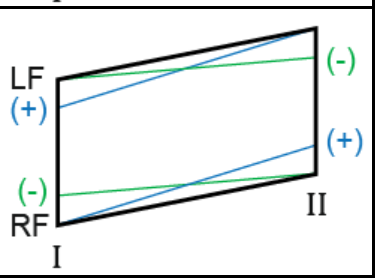
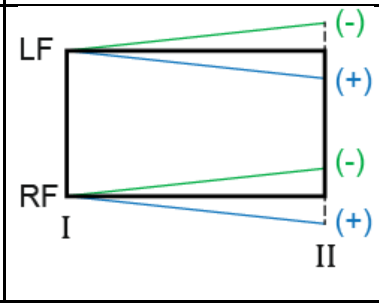
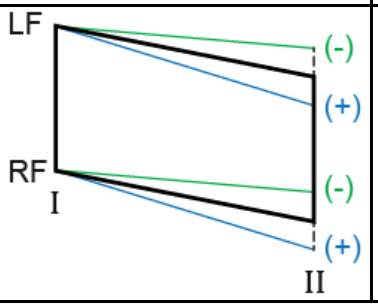
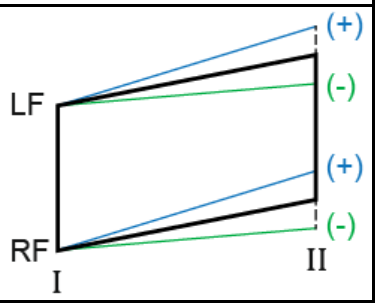
b	facewidth	b_F	usable facewidth (b-2·b_k)
l_0	phase shift	l_{wave}	wave length
$f_{f\beta}$	helix form deviation, value		

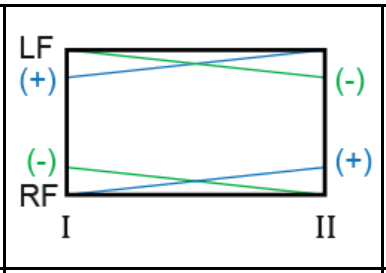
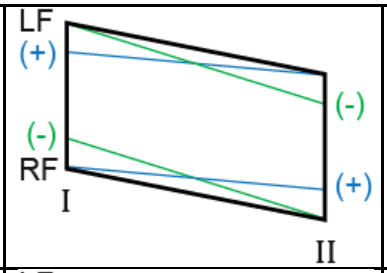
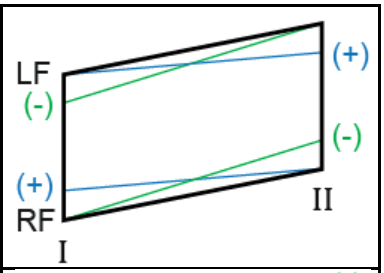
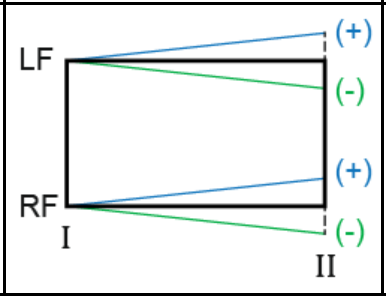
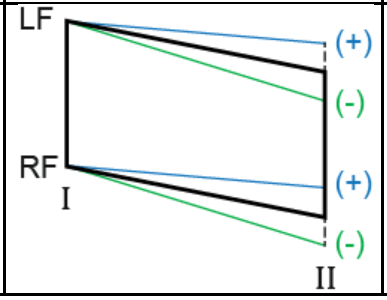
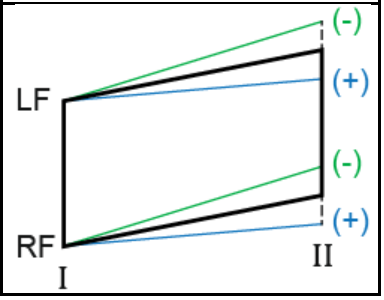
	Value	**Factor 1**	**Factor 2**
Inputs	$f_{f\beta}$	l_{wave}/m_n	l_0/m_n
Conditions	> 0	> 0	-
Equation	$\Delta f_{f\beta} = \frac{f_{f\beta}}{2} \cdot \left[1 - \sin\left(90^\circ + 360^\circ \cdot \left(\frac{b(y)}{Factor\ 1 \cdot m_n} - \frac{Factor\ 2}{Factor\ 1}\right)\right)\right]$		

2.6 Helix slope deviation $f_{H\beta}$

Picture: **Mod_formErrorfHb.png**



		Spur	Right helix	Left helix
ISO 21771	Remove material on both sides			
	Manufactured with modified helix angle			
ISO 1328, external gears (z > 0)	Remove material on both sides			
	Manufactured with modified helix angle			

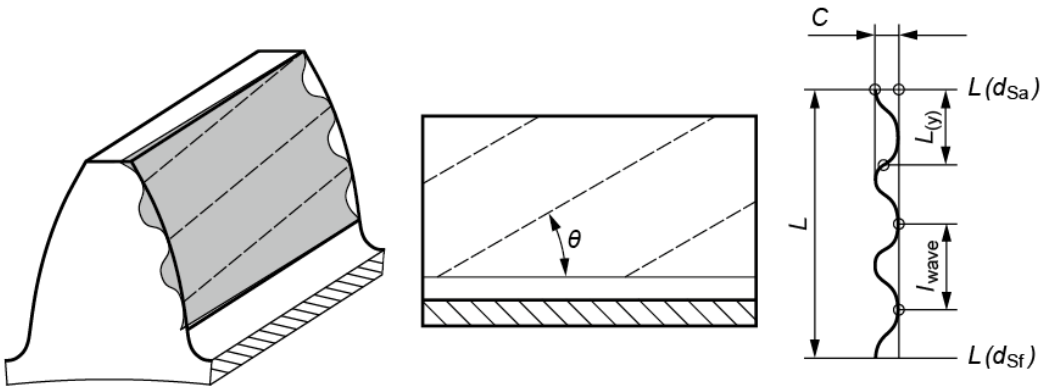
ISO 1328, internal gears (z < 0)	Remove material on both sides			
	Manufactured with modified helix angle			

b	facewidth	b_F	usable facewidth (b-2·b_k)
$f_{H\beta}$	helix slope deviation, value		

	Value	Factor 1	Factor 2
Inputs	$f_{H\beta}$	-	-
Conditions	≠ 0	-	-
Equation	$f_{H\beta} = 1000 \cdot cos\,\alpha_n \cdot b_F \cdot (tan(\beta - Factor\ 1/60) - tan(\beta))$		

2.7 Waviness from manufacturing

Picture: **Mod_cuttingError.png**



d_{Sa}	waviness from manufacturing, start, at tip	d_{Sf}	waviness from manufacturing, end, at root
L	roll length	l_{wave}	wave length
C	waviness from manufacturing, value		

	Value	**Factor 1**	**Factor 2**
Inputs	*C*	*Factor 1*	*Factor 2 (°)*
Conditions	> 0	> 0	> 0
Equation	$l_{wave} = Factor\ 1 \cdot m_n \cdot \cos(Factor\ 2)$ $\Delta C = \frac{C}{2} \cdot \left[1 - \sin\left(180^\circ + 360^\circ \cdot \left(\frac{L(y)}{l_{wave}}\right)\right)\right]$ If *Factor 2 = 0*, the waviness is applied in the direction of the base helix angle β_b.		