Involute shaper cutter tolerances

The tolerances of involute shaper cutters are in accordance with standard DIN 1829.
The tolerances shown in the following tables are included also the class AA and
specification used normally on Samputensili production.
The followings symbols are used:

- f_f = involute profile error
- f_{Ha} = profile angle error
- F_f = cumulative profile error
- f_p = adjacent pitch error
- f_{pe} = base pitch error
- f_u = difference between adjacent pitches
- F_p = cumulative pitch error
- F_r = radial run out on pitch diameter
- F_{ra} = radial run out on the tip circle
- R_s = range of tooth thickness errors
- d_0 = pitch diameter

Module smaller than 1 — Tolerances for individual errors in microns. (1/1000 mm)

Symbol	d_0 dia. in mm.								
	10 to 50 class			Over 50 to 125 class			Over 125 to 280 class		
	AA	A	B	AA	A	B	AA	A	B
f_f	2	2,5	3,5	2	2,5	3,5	2	2,5	3,5
f_{Ha}	2	2,5	3,5	2	2,5	3,5	2	2,5	3,5
F_f	2,5	3,5	5	2,5	3,5	5	2,5	3,5	5
f_p f_{pe}	2,5	3,5	5	2,5	3,5	5	3	4	5,5
f_u	3	4,5	6	3,5	4,5	6,5	3,5	5	7
F_p	6,5	9	13	9	12	16	10	14	19
F_r F_{ra}	6	9	11	7	10	12	8	10	14
R_s	2,5	4	5	3,5	4,5	6	4,5	6	9

From 1 to 2 module

Symbol	d_0 dia. in mm.								
	10 to 50 class			Over 50 to 125 class			Over 125 to 280 class		
	AA	A	B	AA	A	B	AA	A	B
f_f	2	3	4,5	2	3	4,5	2	3	4,5
f_{Ha}	2	3	4	2	3	4	2	3	4
F_f	3	4	6	3	4	6	3	4	6
f_p f_{pe}	2,5	3,5	5	2,5	4	5	3	4	5,5
f_u	3	4,5	6	3	5	6	3,5	5	7
F_p	7	10	14	9	14	18	11	16	20
F_r F_{ra}	7	10	12	8	10	14	9	11	16
R_s	3	4,5	6	3,5	5	7	4,5	6	8

Over 2 to 3,55 module

Symbol	do dia. in mm.								
	10 to 50 class			Over 50 to 125 class			Over 125 to 280 class		
	AA	A	B	AA	A	B	AA	A	B
f_f	3	4	6	3	4	6	3	4	6
$f_{H\alpha}$	2	3	4,5	2	3	4,5	2	3	4,5
F_f	4	5	7	4	5	7	4	5	7
$f_p\ f_{pe}$	2,5	3,5	5	2,5	3,5	5	3	4	6
f_u	3	4,5	6	3	4,5	6	3,5	5	8
F_p	8	11	16	10	14	20	12	16	22
$F_r\ F_{ra}$	8	10	14	9	11	16	10	12	17
R_s	3,5	5	7	4,5	6	8	5	7	10
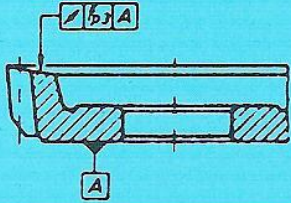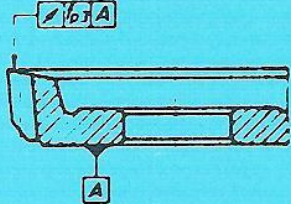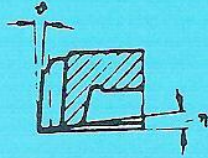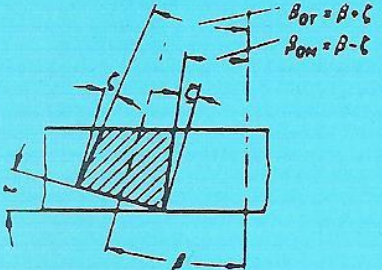
Over 3,55 to 6 module

Symbol	do dia. in mm.								
	10 to 50 class			Over 50 to 125 class			Over 125 to 280 class		
	AA	A	B	AA	A	B	AA	A	B
f_f	4	5	7	4	5	7	4	5	7
$f_{H\alpha}$	3	4	5,5	3	4	5,5	3	4	5,5
F_f	5	7	9	5	7	9	5	7	9
$f_p\ f_{pe}$	3	4	6	3	4	6	3,5	4,5	7
f_u	4	5	8	4	5	8	4	5,5	9
F_p	8	12	16	10	16	20	12	18	25
$F_r\ F_{ra}$	9	11	16	10	12	17	10	14	19
R_s	4	6	8	5	7	10	5,5	8	11

Over 6 to 10 module

Symbol	do dia. in mm.								
	50 to 125 class			Over 125 to 280 class			Over 280 to 560 class		
	AA	A	B	AA	A	B	AA	A	B
f_f	5	7	10	5	7	10	5	7	10
$f_{H\alpha}$	3,5	5	7	3,5	5	7	3,5	5	7
F_f	6	8	12	6	8	12	6	8	12
$f_p\ f_{pe}$	3,5	5	7	4	5,5	8	4	6	8
f_u	4,5	6	9	5	6,5	10	5	8	10
F_p	11	16	22	14	20	25	16	22	28
$F_r\ F_{ra}$	11	15	19	13	17	22	14	19	25
R_s	5,5	8	11	6	9	12	7	10	14

Tolerances on cutting edges

Size	Symbol	Tolerances or permissible errors in micron degrees and minutes quality classes		Graphic indications
		A	B	
Sharpening error on spur shaper cutters	f_{p3}	10	20	
Sharpening error on the highest point of the cutting edges on helical shaper cutters	f_{p3}	30	60	
Sharpening angle error	f_η	±15'	±30'	
Tip angle error	f_ϑ	±15'	±30'	
Error of sharpening angle (τ) in helical sharpers	f_τ	±30'	±1°	
Side clearance angle error	f_ζ	± 2'	± 4'	
Helix angle error	f_{β_0}	± 2'	± 4'	

(following next page)

1. Form and position tolerance of shaper hub.

Size	Symbol	µm	Graphic indications
Flatness of datum face	f_n	3	
Bore	f_c	2	
Normality of external datum face in respect of bore	f_{p1}	2	
Parallelism of internal datum face in respect of external face	f_{p2}	3	
Collar runout in respect to bore	f_{r1}	2	
Collar runout in respect to tapered shaft	f_{r1}	2	
Tolerance of cone tapering (according to DIN 7178)	–	AT 6	