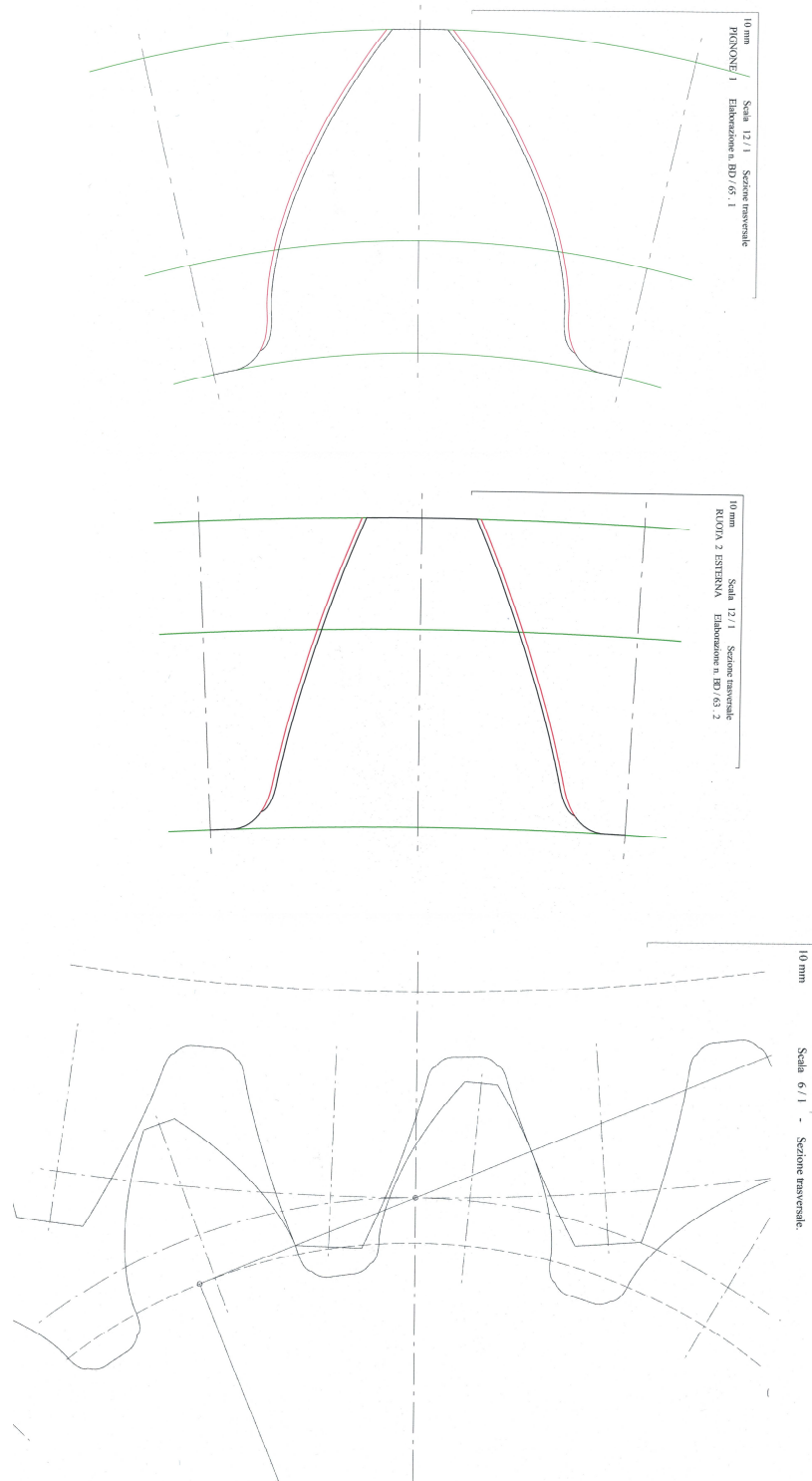# IPAR/IDIS

It is an example of the geometric calculation of helical gear pair with operating center distance of 200 mm, normal module 5, helix angle 13 ° and final grinding of both the pinion wheel.
The program gives warnings in case of inappropriate choices as possible causes of malfunction and stimulation geometric optimization of the dynamic behavior and also provides summary tables of data for the drawing. Is possible to see the real graphics of what has been designed (built) and the meshing in rotation.

Elaboration N. BC / 95 . 1
TEST PRINT - IPAR/IDIS - NORMAL SOFTWARE

COMMON GEOMETRICAL DATA. HELICAL EXTERNAL GEAR PAIR.

A'	Operating Center Distance, mm	200
Bu	Overlap face width, mm	90
Mn	Normal reference module, mm	5
Har/Mn	Addendum of the reference rack / Mn	1
αn	Reference normal pressure angle	20°
ß	Reference helix angle	13°
ßb	Base helix angle (ßb = 12° 12' 13'')	12,20352°
Mt	Reference transverse module, mm	5,131521
αt	Reference transverse pressure angle	20,48288°
X1+X2	Algebraic sum of addendum modification coefficients	0,50798
K	coefficient = (X1 + X2) - (A' - A) / Mn	0,02069
A'/A	Ratio of operating / reference center distance	1,01233
Mt'	Operating transverse module, mm	5,194805
$\alpha t'$	Operating transverse pressure angle	22,27659°
ß'	Operating helix angle	13,15478°
Jr/Jbn	Ratio of radial / base normal backlash	1,349

SPECIFIC TOOTH DATA OF THE TWO GEARS

		Pinion	Wheel
Z	Tooth number	14	63
Db	Base diameter, mm	67,29925	302,84663
D	Reference pitch diameter, mm	71,841	323,286
X	Addendum Modif. Coeff. - as for sign see «simbingl»	0,49499	0,0129935
D'	Operating pitch diameter, mm	72,727	327,273
Da	Tip diameter, mm	86,7	333,4
Ks	Tip shortening coefficient	0,00912	0,00157
S-aN	Normal tip chordal tooth thickness, mm	1,871	3,849
CR	Tip clearance, mm	1,34	1,3
DfR	Root diameter, mm	64	310,62
HR	Tooth height, mm	11,35	11,39

Elaboration N. BC / 95 . 1

MANUFACTURING - INVOLUTE AND CONTACT LIMITS

Pinion   Tool addendum profile III DIN 3972. Grinding or skiving.
             LEFT HELIX

Wheel   Tool addendum profile III DIN 3972. Grinding or skiving.
             RIGHT HELIX

		Pinion	Wheel
Ha0/Mn	Tool Addendum, either real or nominal	1,3355	1,3355
U0/Mn	Tool Protuberance	0	0
ρ a0/Mn	Tool tip radius	0,2	0,2
Ibn0/Mn	Base thickness reduction after cutting	-0,0384	-0,0384
Ibn/Mn	Base thickness reduction, final	0,02	0,02
Us	Stock removal, each side, mm	0,146	0,146
DaL	Contact limit tip diameter, mm	86,7	333,4
KsL	Tip shortening coefficient for diameter DaL	0,00912	0,00157
S-aNL	Normal tip thickness at contact limit DaL, mm	1,871	3,849
(Contact limit diameters DaL1 = Da1, DaL2 = Da2)			
DpfR	Involute limit diameter at tooth root after cutting, mm	67,61	313,41
DcfL	Contact limit diameter at tooth root, mm	68,4	317,99
Dcf	Theoretical contact limit diam. at tooth root, mm	68,4	317,99

OPERATING DATA

A, B, D, E : typical mesh. points from pinion up to wheel toth roots		Pinion	Wheel
SA1, SE2	Specific sliding at respective tooth root	-1,538	-1,537
SE1, SA2	as above: pinion on wheel root, wheel on pinion root	0,606	0,606
AkA, AkE	= Coefficients proportional to Almen factor	0,367	0,646
VsA, VsE	Sliding velocity / tangential velocity	0,258	0,455
XA, XE	Factors of relative curvature radius at points A, E	0,498	1,55
XB, XD	as above in then internal points of single contact	0,909	1,354
ε E1, ε A2	Addendum transverse contact ratios	0,8969	0,5087

$\varepsilon \alpha$	Transverse (profile) contact ratio	1,4056
$\varepsilon \beta$	Face contact ratio (overlap ratio)	1,2889
$\varepsilon \gamma$	Total contact ratio	2,6945

TEST PRINT - IPAR/IDIS - NORMAL SOFTWARE

PINION, Z = 14 teeth (meshes wheel with 63 teeth)

Nominal operating center distance	A' = 200
Center distance tolerance	+0,05 ÷ 0
Operating pitch diameter	D' = 72,727
Theoretical contact limit diameter at tooth root	Dcf = 68,4
Actual contact limit diameter at tooth root	DcfL = 68,4

Reference normal module	Mn = 5
Reference normal pressure angle	αn = 20
Reference helix angle	ß = 13
Base helix angle	ßb = 12,2035201
Tooth number	Z = 14
Addendum Modification coefficient	X = +0,49499
Reference pitch diameter	D = 71,84129
Base diameter	Db = 67,29925
Nominal tip diameter	Da = 86,7
Tip diameter tolerance	0 ÷ -0,1
Approximate tooth root diameter	Df = 64
Approximate tooth height	H = 11,35

If the cutting tool is a hob having the exact Ha0 addendum, the H value equals
the hob whole depth of cut, in order to obtain the metal stock to be removed by grinding.

Manufacturing cycle: Tool addendum profile III DIN 3972. Grinding or skiving.
LEFT HELIX

Tool Data:
Tool Addendum (actual or nominal)	Ha0/Mn = 1,3355
Tool tip radius (as an orientation)	ρa0/Mn = +0,2
- Tool with no protuberance	
Metal stock to be removed (each side!), as an orientation	Us [mm] = +0,146

Nominal Wildhaber measure	W3 = 39,65
Wildhaber measure tolerance, after cutting	+0,2 ÷ +0,14
Wildhaber measure tolerance, full finished teeth	-0,1 ÷ -0,14
Needed width for Wildhaber measure checking	Bw = 8,38

TEST PRINT - IPAR/IDIS - NORMAL SOFTWARE

WHEEL, Z = 63 teeth (meshes pinion with 14 teeth)

Nominal operating center distance	A' = 200
Center distance tolerance	+0,05 ÷ 0
Operating pitch diameter	D' = 327,273
Theoretical contact limit diameter at tooth root	Dcf = 317,99
Actual contact limit diameter at tooth root	DcfL = 317,99

Reference normal module	Mn = 5
Reference normal pressure angle	αn = 20
Reference helix angle	ß = 13
Base helix angle	ßb = 12,2035201
Tooth number	Z = 63
Addendum Modification coefficient	X = +0,01299355
Reference pitch diameter	D = 323,28579
Base diameter	Db = 302,84663
Nominal tip diameter	Da = 333,4
Tip diameter tolerance	0 ÷ -0,1
Approximate tooth root diameter	Df = 310,62
Approximate tooth height	H = 11,39

If the cutting tool is a hob having the exact Ha0 addendum, the H value equals
the hob whole depth of cut, in order to obtain the metal stock to be removed by grinding.

Manufacturing cycle: Tool addendum profile III DIN 3972. Grinding or skiving.
RIGHT HELIX

Tool Data:

Tool Addendum (actual or nominal)	Ha0/Mn = 1,3355
Tool tip radius (as an orientation)	ρa0/Mn = +0,2

 - Tool with no protuberance

Metal stock to be removed (each side!), as an orientation	Us [mm] = +0,146

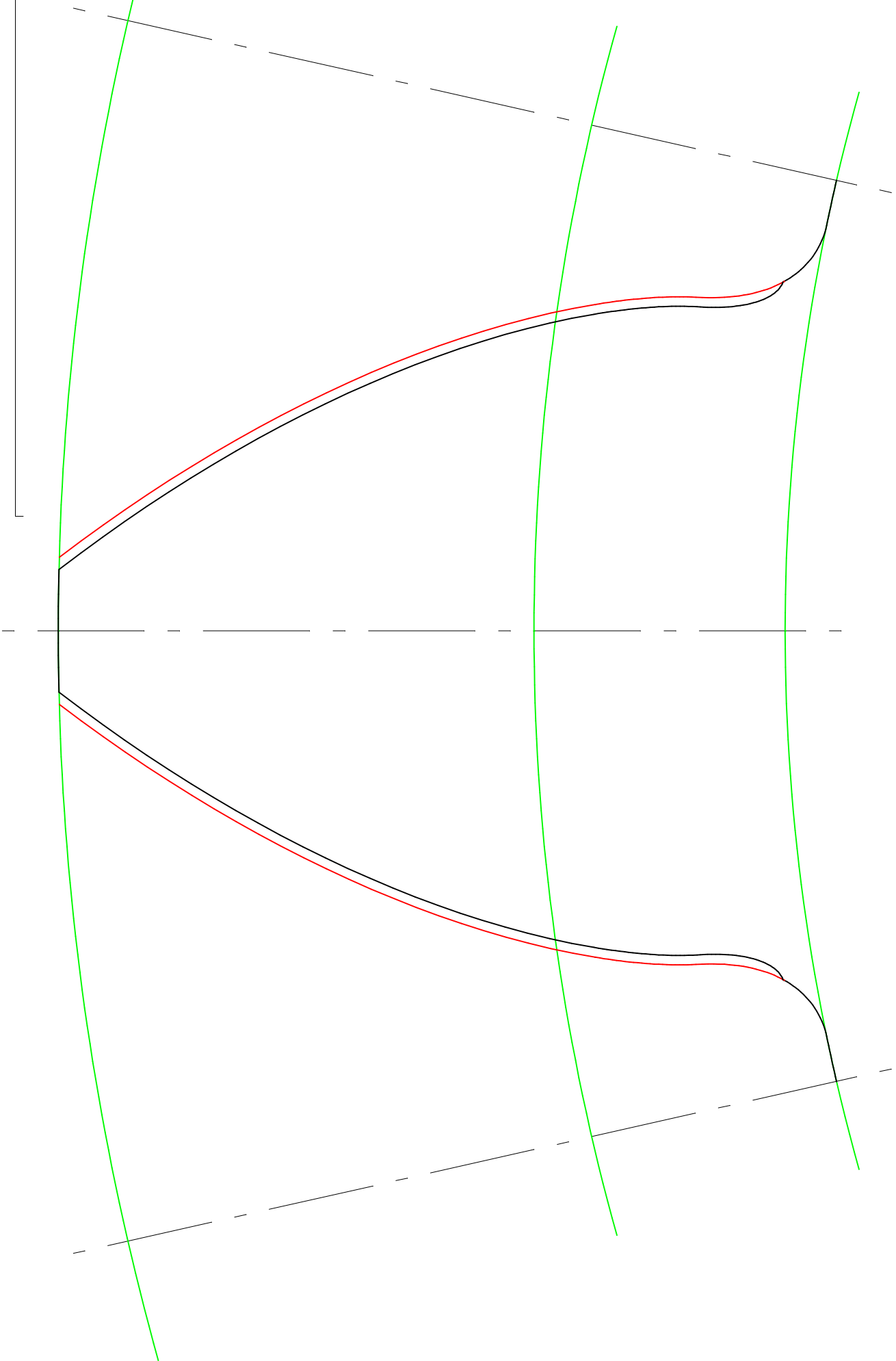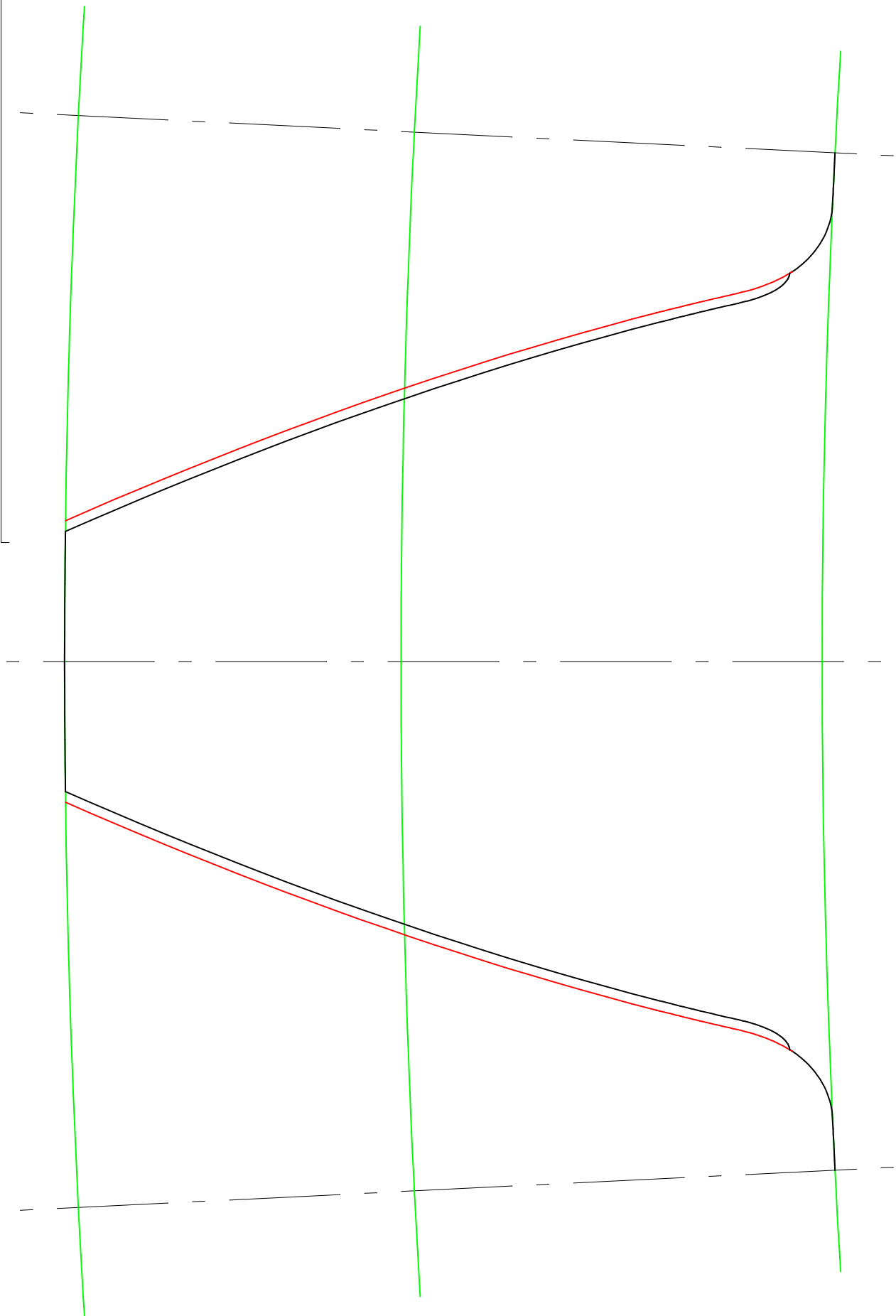|	
Nominal Wildhaber measure	W8 = 115,5
Wildhaber measure tolerance, after cutting	+0,2 ÷ +0,14
Wildhaber measure tolerance, full finished teeth	-0,1 ÷ -0,14
Needed width for Wildhaber measure checking	Bw = 24,41