KISSsoft Release 03/2018 A

KISSsoft evaluation

File

Name : Unnamed
Changed by: J on: 25.01.2019 at: 20:30:26

Important hint: At least one warning has occurred during the calculation:

1-> Your tooth thickness tolerance (DIN 3967 cd25) is not suitable for small gears.
Choose a tolerance for precision mechanics!

2-> Your tooth thickness tolerance (DIN 3967 cd25) is not suitable for small gears.
Choose a tolerance for precision mechanics!

CALCULATION OF A CYLINDRICAL SPUR GEAR PAIR

Drawing or article number:
Gear 1: z4(Sun2Planet)
Gear 2: z1(Sun2Planet)

Calculation method DIN 3990:1987 Method B

		------- GEAR 1	-------- GEAR 2 --
Power (W)	[P]	139.570	
Speed (1/min)	[n]	1074.6	211.7
Torque (Nm)	[T]	1.240	6.297
Application factor	[KA]	1.25	
Required service life (h)	[H]	2000.00	
Gear driving (+) / driven (-)		+	-

Working flank gear 1: Left flank
Sense of rotation gear 1 clockwise

1. TOOTH GEOMETRY AND MATERIAL

(geometry calculation according to ISO 21771:2007, DIN ISO 21771)

		------- GEAR 1	-------- GEAR 2 --
Center distance (mm)	[a]	20.348	
Center distance tolerance	ISO 286:2010 Measure js7		
Normal module (mm)	[mn]	0.5000	
Pressure angle at normal section (°)	[alfn]	20.0000	
Helix angle at reference circle (°)	[beta]	0.0000	
Number of teeth	[z]	13	66
Facewidth (mm)	[b]	10.00	10.00
Hand of gear		Spur gear	
Accuracy grade	[Q-DIN 3961:1978]	6	6
Inner diameter (mm)	[di]	0.00	0.00
Inner diameter of gear rim (mm)	[dbi]	0.00	0.00

Material
Gear 1: Steel, Grade 3, HRC58-64(AGMA), Case-carburized steel, case-hardened AGMA 2001-C95
Gear 2: Steel, Grade 3, HRC58-64(AGMA), Case-carburized steel, case-hardened AGMA 2001-C95

		------- GEAR 1	-------- GEAR 2 --
Surface hardness		HRC 60	HRC 60
Fatigue strength. tooth root stress (N/mm²)	[σFlim]	515.00	515.00
Fatigue strength for Hertzian pressure (N/mm²)	[σHlim]	1895.00	1895.00
Tensile strength (N/mm²)	[σB]	1035.00	1035.00
Yield point (N/mm²)	[σS]	887.00	887.00
Young's modulus (N/mm²)	[E]	206843	206843
Poisson's ratio	[v]	0.300	0.300
Roughness average value DS, flank (µm)	[RAH]	0.63	0.63
Roughness average value DS, root (µm)	[RAF]	2.40	2.40
Mean roughness height, Rz, flank (µm)	[RZH]	5.00	5.00
Mean roughness height, Rz, root (µm)	[RZF]	16.00	16.00

Gear reference profile	1 :		
Reference profile	1.25 / 0.38 / 1.0 ISO 53:1998 Profil A		
Dedendum coefficient	[hfP*]		1.250
Root radius factor	[rhofP*]		0.380 (rhofPmax*=0.472)
Addendum coefficient	[haP*]		1.000
Tip radius factor	[rhoaP*]		0.000
Protuberance height coefficient	[hprP*]		0.000
Protuberance angle	[alfprP]		0.000
Tip form height coefficient	[hFaP*]		0.000
Ramp angle	[alfKP]		0.000
		not topping	

Gear reference profile	2 :		
Reference profile	1.25 / 0.38 / 1.0 ISO 53:1998 Profil A		
Dedendum coefficient	[hfP*]		1.250
Root radius factor	[rhofP*]		0.380 (rhofPmax*=0.472)
Addendum coefficient	[haP*]		1.000
Tip radius factor	[rhoaP*]		0.000
Protuberance height coefficient	[hprP*]		0.000
Protuberance angle	[alfprP]		0.000
Tip form height coefficient	[hFaP*]		0.000
Ramp angle	[alfKP]		0.000
		not topping	

Summary of reference profile gears:			
Dedendum reference profile	[hfP*]	1.250	1.250
Tooth root radius Refer. profile	[rofP*]	0.380	0.380
Addendum Reference profile	[haP*]	1.000	1.000
Protuberance height coefficient	[hprP*]	0.000	0.000
Protuberance angle (°)	[alfprP]	0.000	0.000
Tip form height coefficient	[hFaP*]	0.000	0.000
Ramp angle (°)	[alfKP]	0.000	0.000

Type of profile modification:	none (only running-in)		
Tip relief (µm)	[Ca]	1.6	1.6

Lubrication type		Oil bath lubrication	
Type of oil		Oil: ISO-VG 220	
Lubricant base		Mineral-oil base	
Kinem. viscosity	oil at 40 °C (mm²/s)	[nu40]	220.00
Kinem. viscosity	oil at 100 °C (mm²/s)	[nu100]	17.50
Specific density at 15 °C (kg/dm³)		[roOil]	0.895
Oil temperature (°C)		[TS]	70.000

		------- GEAR 1 --------	GEAR 2 --
Overall transmission ratio	[itot]	-5.077	
Gear ratio	[u]	5.077	
Transverse module (mm)	[mt]	0.500	
Pressure angle at pitch circle (°)	[alft]	20.000	
Working transverse pressure angle (°)	[alfwt]	24.208	
	[alfwt.e/i]	24.273 / 24.142	
Working pressure angle at normal section (°)	[alfwn]	24.208	
Helix angle at operating pitch circle (°)	[betaw]	0.000	
Base helix angle (°)	[betab]	0.000	
Reference center distance (mm)	[ad]	19.750	
Sum of profile shift coefficients	[Summexi]	1.3209	
Profile shift coefficient	[x]	0.5978	0.7231
Tooth thickness (Arc) (module) (module)	[sn*]	2.0060	2.0972
Tip alteration (mm)	[k*mn]	-0.062	-0.062
Reference diameter (mm)	[d]	6.500	33.000
Base diameter (mm)	[db]	6.108	31.010
Tip diameter (mm)	[da]	7.974	34.599
(mm)	[da.e/i]	7.974 / 7.964	34.599 / 34.589
Tip diameter allowances (mm)	[Ada.e/i]	0.000 / -0.010	0.000 / -0.010
Tip form diameter (mm)	[dFa]	7.974	34.599
(mm)	[dFa.e/i]	7.974 / 7.964	34.599 / 34.589
Active tip diameter (mm)	[dNa]	7.974	34.599
Active tip diameter (mm)	[dNa.e/i]	7.974 / 7.964	34.599 / 34.589
Operating pitch diameter (mm)	[dw]	6.697	34.000
(mm)	[dw.e/i]	6.700 / 6.693	34.017 / 33.982
Root diameter (mm)	[df]	5.848	32.473
Generating Profile shift coefficient	[xE.e/i]	0.4879/ 0.4330	0.5747/ 0.4923
Manufactured root diameter with xE (mm)	[df.e/i]	5.738 / 5.683	32.325 / 32.242
Theoretical tip clearance (mm)	[c]	0.125	0.125
Effective tip clearance (mm)	[c.e/i]	0.256 / 0.189	0.223 / 0.169
Active root diameter (mm)	[dNf]	6.254	33.095
(mm)	[dNf.e/i]	6.270 / 6.243	33.118 / 33.077
Root form diameter (mm)	[dFf]	6.197	32.732
(mm)	[dFf.e/i]	6.151 / 6.134	32.596 / 32.522
Reserve (dNf-dFf)/2 (mm)	[cF.e/i]	0.068 / 0.046	0.298 / 0.241
Addendum (mm)	[ha=mn*(haP*+x+k)]	0.737	0.800
(mm)	[ha.e/i]	0.737 / 0.732	0.800 / 0.795
Dedendum (mm)	[hf=mn*(hfP*-x)]	0.326	0.263
(mm)	[hf.e/i]	0.381 / 0.409	0.338 / 0.379
Roll angle at dFa (°)	[xsi_dFa.e/i]	48.082 / 47.936	28.353 / 28.312
Roll angle to dNa (°)	[xsi_dNa.e/i]	48.082 / 47.936	28.353 / 28.312
Roll angle to dNf (°)	[xsi_dNf.e/i]	13.280 / 12.108	21.486 / 21.267
Roll angle at dFf (°)	[xsi_dFf.e/i]	6.811 / 5.304	18.557 / 18.112
Tooth height (mm)	[h]	1.063	1.063
Virtual gear no. of teeth	[zn]	13.000	66.000
Normal tooth thickness at tip circle (mm)	[san]	0.225	0.393
(mm)	[san.e/i]	0.184 / 0.151	0.341 / 0.305
Normal tooth thickness on tip form circle (mm)	[sFan]	0.225	0.393
(mm)	[sFan.e/i]	0.184 / 0.151	0.341 / 0.305
Normal space width at root circle (mm)	[efn]	0.000	0.337
(mm)	[efn.e/i]	0.000 / 0.000	0.344 / 0.348
Max. sliding velocity at tip (m/s)	[vga]	0.160	0.095
Specific sliding at the tip	[zetaa]	0.556	0.556
Specific sliding at the root	[zetaf]	-1.252	-1.251
Mean specific sliding	[zetam]	0.556	
Sliding factor on tip	[Kga]	0.425	0.251

Sliding factor on root	[Kgf]		-0.251			-0.425		
Pitch on reference circle (mm)	[pt]			1.571				
Base pitch (mm)	[pbt]			1.476				
Transverse pitch on contact-path (mm)	[pet]			1.476				
Length of path of contact (mm)	[ga, e/i]		1.892 (	1.918 /	1.847)			
Length T1-A, T2-A (mm)	[T1A, T2A]	0.671(	0.645/	0.708)	7.673(	7.673/	7.662)	
Length T1-B (mm)	[T1B, T2B]	1.087(	1.087/	1.079)	7.257(	7.231/	7.290)	
Length T1-C (mm)	[T1C, T2C]	1.373(	1.369/	1.377)	6.971(	6.949/	6.992)	
Length T1-D (mm)	[T1D, T2D]	2.147(	2.121/	2.184)	6.197(	6.197/	6.185)	
Length T1-E (mm)	[T1E, T2E]	2.563(	2.563/	2.555)	5.781(	5.755/	5.814)	
Length T1-T2 (mm)	[T1T2]		8.344 (	8.318 /	8.369)			
Diameter of single contact point B (mm)	[d-B]	6.483(	6.483/	6.478)	34.238(	34.217/	34.267)	
Diameter of single contact point D (mm)	[d-D]	7.466(	7.437/	7.509)	33.395(	33.395/	33.386)	
Addendum contact ratio	[eps]	0.806(	0.809/	0.798)	0.476(	0.490/	0.454)	
Minimal length of contact line (mm)	[Lmin]			10.000				
Transverse contact ratio	[eps_a]			1.282				
Transverse contact ratio with allowances	[eps_a.e/m/i]		1.299 /	1.275 /	1.251			
Overlap ratio	[eps_b]			0.000				
Total contact ratio	[eps_g]			1.282				
Total contact ratio with allowances	[eps_g.e/m/i]		1.299 /	1.275 /	1.251			

2. FACTORS OF GENERAL INFLUENCE

		------- GEAR 1	-------- GEAR 2 --
Nominal circum. force at pitch circle (N)	[Ft]	381.6	
Axial force (N)	[Fa]	0.0	
Radial force (N)	[Fr]	138.9	
Normal force (N)	[Fnorm]	406.1	
Nominal circumferential force per mm (N/mm)	[w]	38.16	
Only as information: Forces at operating pitch circle:			
Nominal circumferential force (N)	[Ftw]	370.4	
Axial force (N)	[Faw]	0.0	
Radial force (N)	[Frw]	166.5	
Circumferential speed reference circle (m/s)	[v]	0.37	
Circumferential speed operating pitch circle (m/s)	[v(dw)]	0.38	
Running-in value (µm)	[yp]	0.4	
Running-in value (µm)	[yf]	0.3	
Correction factor	[CM]	0.800	
Gear blank factor	[CR]	1.000	
Basic rack factor	[CBS]	0.975	
Material coefficient	[E/Est]	1.004	
Singular tooth stiffness (N/mm/µm)	[c']	7.084	
Meshing stiffness (N/mm/µm)	[cg]	8.580	
Reduced mass (kg/mm)	[mRed]	0.00018	
Resonance speed (min-1)	[nE1]	160537	
Resonance ratio (-)	[N]	0.007	
Subcritical range			
Running-in value (µm)	[ya]	0.4	
Bearing distance l of pinion shaft (mm)	[l]	20.000	
Distance s of pinion shaft (mm)	[s]	2.000	
Outside diameter of pinion shaft (mm)	[dsh]	5.909	
Load according to Figure 6.8, DIN 3990-1:1987 (0:6.8a, 1:6.8b, 2:6.8c, 3:6.8d, 4:6.8e)	[-]	4	
Coefficient K' according to Figure 6.8, DIN 3990-1:1987	[K']	-1.00	

Without support effect			
Tooth trace deviation (active) (µm)	[Fby]	3.40	
from deformation of shaft (µm)	[fsh*B1]	2.57	
(fsh (µm) = 2.57, B1= 1.00, fHb5 (µm) = 6.00)			
Tooth without tooth trace modification			
Position of Contact pattern: favorable			
from production tolerances (µm)	[fma*B2]	8.00	
(B2= 1.00)			
Tooth trace deviation, theoretical (µm)	[Fbx]	4.00	
Running-in value (µm)	[yb]	0.60	
Dynamic factor	[KV]	1.004	
Face load factor - flank	[KHb]	1.304	
- Tooth root	[KFb]	1.265	
- Scuffing	[KBb]	1.304	
Transverse load factor - flank	[KHa]	1.000	
- Tooth root	[KFa]	1.000	
- Scuffing	[KBa]	1.000	
Helical load factor scuffing	[Kbg]	1.000	
Number of load cycles (in mio.)	[NL]	386.866	25.400

3. TOOTH ROOT STRENGTH

Calculation of Tooth form coefficients according method: B

		------- GEAR 1	-------- GEAR 2 --
Calculated with manufacturing profile shift	[xE.e]	0.4879	0.5747
Tooth form factor	[YF]	1.64	1.65
Stress correction factor	[YS]	1.96	2.08
Load application angle (°)	[alfFen]	30.94	24.24
Bending moment arm (mm)	[hF]	0.67	0.76
Tooth thickness at root (mm)	[sFn]	1.06	1.16
Tooth root radius (mm)	[roF]	0.22	0.20

(hF* = 1.342/ 1.523 sFn* = 2.116/ 2.319 roF* = 0.433/ 0.395)
(den (mm) =
7.466/ 34.238 dsFn(mm) = 5.876/ 32.505 alfsFn(°) = 30.00/ 30.00 qs = 2.444/ 2.933)

Contact ratio factor	[Yeps]	1.000		
Helix angle factor	[Ybet]	1.000		
Effective facewidth (mm)	[beff]	10.00	10.00	
Nominal stress at tooth root (N/mm²)	[sigF0]	245.89	261.29	
Tooth root stress (N/mm²)	[sigF]	390.66	415.11	
Permissible bending stress at root of Test-gear				
Notch sensitivity factor	[YdrelT]	0.999	1.004	
Surface factor	[YRrelT]	0.972	0.972	
size factor (Tooth root)	[YX]	1.000	1.000	
Finite life factor	[YNT]	1.000	1.000	
[YdrelT*YRrelT*YX*YNT]		0.971	0.976	
Alternating bending factor (mean stress influence coefficient)	[YM]	1.000		1.000
Stress correction factor	[Yst]	2.00		
Yst*sigFlim (N/mm²)	[sigFE]	1030.00	1030.00	
Permissible tooth root stress (N/mm²)	[sigFP=sigFG/SFmin]	714.54	717.74	
Limit strength tooth root (N/mm²)	[sigFG]	1000.36	1004.84	

Required safety	[SFmin]	1.40	1.40
Safety for tooth root stress	[SF=sigFG/sigF]	2.56	2.42
Transmittable power (W)	[WRating]	255.29	241.32

4. SAFETY AGAINST PITTING (TOOTH FLANK)

		------- GEAR 1	-------- GEAR 2 --
Zone factor	[ZH]		2.245
Elasticity factor (√N/mm²)	[ZE]		190.200
Contact ratio factor	[Zeps]		0.952
Helix angle factor	[Zbet]		1.000
Effective facewidth (mm)	[beff]		10.00
Nominal contact stress (N/mm²)	[sigH0]		1077.25
Contact stress at operating pitch circle (N/mm²)	[sigHw]		1378.57
Single tooth contact factor	[ZB,ZD]	1.10	1.00
Contact stress (N/mm²)	[sigHB, sigHD]	1518.62	1378.57
Lubrication coefficient at NL	[ZL]	1.020	1.018
Speed coefficient at NL	[ZV]	0.945	0.951
Roughness coefficient at NL	[ZR]	0.920	0.928
Material pairing coefficient at NL	[ZW]	1.000	1.000
Finite life factor	[ZNT]	1.000	1.053
	[ZL*ZV*ZR*ZNT]	0.887	0.946
Limited pitting is permitted:	No		
Size factor (flank)	[ZX]	1.000	1.000
Permissible contact stress (N/mm²)	[sigHP=sigHG/SHmin]	1680.37	1792.00
Pitting stress limit (N/mm²)	[sigHG]	1680.37	1792.00
Required safety	[SHmin]	1.00	1.00
Safety factor for contact stress at operating pitch circle			
	[SHw]	1.22	1.30
Safety for stress at single tooth contact	[SHBD=sigHG/sigHBD]	1.11	1.30
(Safety regarding transmittable torque)	[(SHBD)^2]	1.22	1.69
Transmittable power (W)	[WRating]	170.89	235.84

4b. MICROPITTING ACCORDING TO ISO/TR 15144-1:2014

Calculation did not run. (Lubricant: Load stage micropitting test is unknown.)

5. SCUFFING LOAD CAPACITY

Calculation method according to DIN 3990:1987

Lubrication coefficient (for lubrication type)	[XS]	1.000	
Scuffing test and load stage	[FZGtest]	FZG - Test A / 8.3 / 90 (ISO 14635 - 1)	12
Relative structure coefficient (Scuffing)	[XWrelT]	1.000	
Thermal contact factor (N/mm/s^.5/K)	[BM]	13.780	13.780
Relevant tip relief (µm)	[Ca]	1.60	1.60
Optimal tip relief (µm)	[Ceff]	6.73	
Ca taken as optimal in the calculation (0=no, 1=yes)		0	0
Effective facewidth (mm)	[beff]	10.000	
Applicable circumferential force/facewidth (N/mm)	[wBt]	62.496	

Angle factor (ε1:0.806, ε2:0.476)	[Xalfbet]	1.038
Flash temperature-criteria		
Tooth mass temperature (°C) (theMB = theoil + XS*0.47*theflamax)	[theMB]	75.22
Maximum flash temperature (°C)	[theflamax]	11.11
Scuffing temperature (°C)	[theS]	408.58
Coordinate gamma (point of highest temp.) [Gamma.A]=-0.511 [Gamma.E]=0.867	[Gamma]	0.564
Highest contact temp. (°C)	[theB]	86.33
Flash factor (°K*N^-.75*s^.5*m^-.5*mm)	[XM]	50.109
Geometry factor	[XB]	0.237
Load sharing factor	[XGam]	1.000
Dynamic viscosity (mPa*s)	[etaM]	34.11 (70.0 °C)
Coefficient of friction	[mym]	0.142
Required safety	[SBmin]	2.000
Safety factor for scuffing (flash temperature)	[SB]	20.726
Integral temperature-criteria		
Tooth mass temperature (°C) (theMC = theoil + XS*0.70*theflaint)	[theMC]	73.62
Mean flash temperature (°C)	[theflaint]	5.17
Integral scuffing temperature (°C)	[theSint]	408.58
Flash factor (°K*N^-.75*s^.5*m^-.5*mm)	[XM]	50.109
Contact ratio factor	[Xeps]	0.301
Dynamic viscosity (mPa*s)	[etaOil]	41.90 (70.0 °C)
Mean coefficient of friction	[mym]	0.154
Geometry factor	[XBE]	0.342
Meshing factor	[XQ]	1.000
Tip relief factor	[XCa]	1.010
Integral tooth flank temperature (°C)	[theint]	81.37
Required safety	[SSmin]	1.800
Safety factor for scuffing (intg.-temp.)	[SSint]	5.021
Safety referring to transmittable torque	[SSL]	29.772

6. MEASUREMENTS FOR TOOTH THICKNESS

		------- Gear 1 ------	Gear 2 --		
Tooth thickness deviation		DIN 3967 cd25	DIN 3967 cd25		
Tooth thickness allowance (normal section) (mm)	[As.e/i]	-0.040 /	-0.060	-0.054 /	-0.084
Number of teeth spanned	[k]	3.000		9.000	
Base tangent length (no backlash) (mm)	[Wk]	3.986		13.256	
Actual base tangent length ('span') (mm)	[Wk.e/i]	3.948 /	3.929	13.205 /	13.177
(mm)	[ΔWk.e/i]	-0.038 /	-0.056	-0.051 /	-0.079
Diameter of measuring circle (mm)	[dMWk.m]	7.268		33.699	
Theoretical diameter of ball/pin (mm)	[DM]	1.168		0.905	
Effective diameter of ball/pin (mm)	[DMeff]	1.250		1.000	
Radial single-ball measurement backlash free (mm)	[MrK]	4.570		17.657	
Radial single-ball measurement (mm)	[MrK.e/i]	4.540 /	4.525	17.597 /	17.564
Diameter of measuring circle (mm)	[dMMr.m]	7.102		33.754	
Diametral measurement over two balls without clearance (mm)	[MdK]	9.082		35.314	
Diametral two ball measure (mm)	[MdK.e/i]	9.023 /	8.993	35.195 /	35.128
Diametral measurement over pins without clearance (mm)	[MdR]	9.082		35.314	
Measurement over pins according to DIN 3960 (mm)	[MdR.e/i]	9.023 /	8.993	35.195 /	35.128

Measurement over 3 pins (axial) according to AGMA 2002 (mm)			
	[dk3A.e/i]	9.023 / 8.993	35.195 / 35.128
Dimensions over 3 pins without clearance (mm)	[Md3R]	9.025	0.000
Effective dimensions over 3 pins (mm)	[Md3R.e/i]	8.966 / 8.936	0.000 / 0.000
Chordal tooth thickness (no backlash) (mm)	[sc]	0.999	1.048
Actual chordal tooth thickness (mm)	[sc.e/i]	0.959 / 0.939	0.994 / 0.964
Reference chordal height from da.m (mm)	[ha]	0.773	0.805
Tooth thickness (Arc) (mm)	[sn]	1.003	1.049
(mm)	[sn.e/i]	0.963 / 0.943	0.995 / 0.965
Backlash free center distance (mm)	[aControl.e/i]	20.239 / 20.180	
Backlash free center distance, allowances (mm)	[jta]	-0.109 / -0.169	
dNf.i with aControl (mm)	[dNf0.i]	6.129	32.811
Reserve (dNf0.i-dFf.e)/2 (mm)	[cF0.i]	-0.011	0.108
Tip clearance (mm)	[c0.i(aControl)]	0.030	0.011
Center distance allowances (mm)	[Aa.e/i]	0.011 / -0.011	
Circumferential backlash from Aa (mm)	[jtw_Aa.e/i]	0.009 / -0.009	
Radial clearance (mm)	[jrw.e/i]	0.179 / 0.099	
Circumferential backlash (transverse section) (mm)	[jtw.e/i]	0.158 / 0.087	
Normal backlash (mm)	[jnw.e/i]	0.148 / 0.082	
Torsional angle at entry with fixed output:			
Entire torsional angle (°)	[j.tSys]	2.7002/ 1.4956	

7. GEAR ACCURACY

		------- GEAR 1	-------- GEAR 2 --
According to DIN 3961:1978			
One or several gear data (mn, b or d) lay beyond the limits covered by the standard.			
The tolerances are calculated on the basis of the formulae in the standard.			
However, their values are outside the official range of validity!			
Accuracy grade	[Q-DIN3961]	6	6
Profile form deviation (µm)	[ff]	4.50	4.50
Profile slope deviation (µm)	[fHa]	4.50	4.50
Total profile deviation (µm)	[Ff]	6.00	6.00
Helix form deviation (µm)	[fbf]	4.00	4.00
Helix slope deviation (µm)	[fHb]	8.00	8.00
Total helix deviation (µm)	[Fb]	9.00	9.00
Normal base pitch deviation (µm)	[fpe]	6.00	6.00
Single pitch deviation (µm)	[fp]	6.00	6.00
Adjacent pitch difference (µm)	[fu]	8.00	8.00
Total cumulative pitch deviation (µm)	[Fp]	13.00	17.00
Sector pitch deviation over z/8 pitches (µm)	[Fpz/8]	8.00	10.00
Runout (µm)	[Fr]	9.00	10.00
Tooth Thickness Variation (µm)	[Rs]	5.00	6.00
Single flank composite, total (µm)	[Fi']	16.00	18.00
Single flank composite, tooth-to-tooth (µm)	[fi']	9.00	9.00
Radial composite, total (µm)	[Fi"]	12.00	14.00
Radial composite, tooth-to-tooth (µm)	[fi"]	4.00	5.50
According to DIN 58405:1972 (Feinwerktechnik):			
Tooth-to-tooth composite error (µm)	[fi"]	5.00	6.00
Composite error (µm)	[Fi"]	14.00	18.00
Axis alignment error (µm)	[fp]	3.46	3.46
Flank direction error (µm)	[fbeta]	5.00	5.00
Runout (µm)	[Trk, Fr]	16.00	21.00

8. ADDITIONAL DATA

Maximal possible center distance (eps_a=1.0)	[aMAX]	20.522	
Mass (g)	[m]	2.94	69.16
Total mass (g)	[m]	72.10	
calculation without consideration of the exact tooth shape			
single gears ((da+df)/2...di) (kg*m²)	[TraeghMom]	1.753e-008	9.723e-006
Torsional stiffness on input for stopped output:			
Torsional stiffness (MNm/rad)	[cr]	0.001	
Torsion when subjected to nominal torque (°)	[delcr]	0.091	
Mean coeff. of friction (acc. Niemann)	[mum]	0.200	
Wear sliding coef. by Niemann	[zetw]	0.712	
Gear power loss (W)	[PVZ]	4.799	
(Meshing efficiency (%)	[etaz]	96.562)	
Sound pressure level (according to Masuda, without contact analysis)			
	[dB(A)]	28.6	

9. MODIFICATIONS AND TOOTH FORM DEFINITION

Data for the tooth form calculation :
Data not available.

10. SERVICE LIFE, DAMAGE

Required safety for tooth root	[SFmin]	1.40
Required safety for tooth flank	[SHmin]	1.00

Service life (calculated with required safeties):

System service life (h)	[Hatt]	>	1000000

Tooth root service life (h)	[HFatt]	1e+006	1e+006
Tooth flank service life (h)	[HHatt]	1e+006	1e+006

Note: The entry 1e+006 h means that the Service life > 1,000,000 h.

Damage calculated on the basis of the required service life [H] (2000.0 h)

F1%	F2%	H1%	H2%
0.00	0.0000	0.0000	0.0000

Calculation of the factors required to define reliability R(t) according to B. Bertsche with Weibull distribution; t in (h):
R(t) = 100 * Exp(-((t*fac - t0)/(T - t0))^b) %

Gear		fac	b	t0	T	R(H)%
1	Tooth root	193433	1.7	9.654e+029	1.484e+030	100.00
1	Tooth flank	193433	1.3	9.014e+029	4.295e+030	100.00
2	Tooth root	12700	1.7	9.654e+029	1.484e+030	100.00
2	Tooth flank	12700	1.3	9.014e+029	4.295e+030	100.00

Reliability of the configuration for required service life (%) 100.00 (Bertsche)

REMARKS:
- Specifications with [.e/i] imply: Maximum [e] and Minimal value [i] with consideration of all tolerances
  Specifications with [.m] imply: Mean value within tolerance

- For the backlash tolerance, the center distance tolerances and the tooth thickness deviation are taken into account. Shown is the maximal and the minimal backlash corresponding the largest resp. the smallest allowances
  The calculation is done for the operating pitch circle.
- Details of calculation method:
  cg according to method B
  KV according to method B
  KHb, KFb according method C
  KHa, KFa according to method B

End of Report lines: 518