KISSsoft Release 03/2018 A

KISSsoft evaluation

File

Name : Unnamed
Changed by: J on: 25.01.2019 at: 22:19:30

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

1-> Profile modification:
The value for the tip relief is probably too small!

Change the type of profile modification in the dialog 'Define details of strength'
to "without (only running-in)" or to "without (no running-in value)".

(In the 'System data' tab, in the 'Strength details' window.)

CALCULATION OF A CYLINDRICAL SPUR GEAR PAIR

Drawing or article number:
Gear 1: SunGear(SunPlanet1)
Gear 2: PlanetGear1(SunPlanet1)

Calculation method DIN 3990:1987 Method B

During calculation, the system takes into account the fact that this gear is a planet gear:

			2	
Speed planet carrier (1/min)	[nSteg]		6.2	
Absolute speed (1/min)	[n]	31.6		27.6
		------- GEAR 1	-------- GEAR 2 --	
Power (W)	[P]		114.352	
Speed (1/min)	[n]	25.3		22.2
Torque (Nm)	[T]	43.1		49.2
Application factor	[KA]		1.25	
Required service life (h)	[H]		2000.00	
Gear driving (+) / driven (-)		+	-	

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

1. TOOTH GEOMETRY AND MATERIAL

(geometry calculation according to DIN 3960:1987)

		------- GEAR 1	-------- GEAR 2 --	
Center distance (mm)	[a]		22.805	
Center distance tolerance	ISO 286:2010 Measure js7			
Normal module (mm)	[mn]		1.0000	
Pressure angle at normal section (°)	[alfn]		20.0000	
Helix angle at reference circle (°)	[beta]		0.0000	
Number of teeth	[z]	21		24
Facewidth (mm)	[b]	25.00		25.00
Hand of gear			Spur gear	
Accuracy grade	[Q-DIN 3961:1978]	6		6

Inner diameter (mm)	[di]	0.00	11.00
Inner diameter of gear rim (mm)	[dbi]	0.00	0.00

Material

Gear 1: Steel, Grade 1, HRC55-64(AGMA), Case-carburized steel, case-hardened AGMA 2001-C95

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

		------- GEAR 1	-------- GEAR 2 --
Surface hardness		HRC 58	HRC 60
Fatigue strength. tooth root stress (N/mm²)	[σFlim]	380.00	450.00
Fatigue strength for Hertzian pressure (N/mm²)	[σHlim]	1240.00	1550.00
Tensile strength (N/mm²)	[σB]	897.00	966.00
Yield point (N/mm²)	[σS]	757.00	822.00
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:for high load capacity gearboxe

Tip relief (µm)	[Ca]	0.0	0.0

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]	-1.143	
Gear ratio	[u]	1.143	
Transverse module (mm)	[mt]	1.000	
Pressure angle at pitch circle (°)	[alft]	20.000	
Working transverse pressure angle (°)	[alfwt]	22.008	
	[alfwt.e/i]	22.074 / 21.943	
Working pressure angle at normal section (°)	[alfwn]	22.008	
Helix angle at operating pitch circle (°)	[betaw]	0.000	
Base helix angle (°)	[betab]	0.000	
Reference center distance (mm)	[ad]	22.500	
Sum of profile shift coefficients	[Summexi]	0.3198	
Profile shift coefficient	[x]	0.2000	0.1198
Tooth thickness (Arc) (module) (module)	[sn*]	1.7164	1.6580
Tip alteration (mm)	[k*mn]	-0.015	-0.015
Reference diameter (mm)	[d]	21.000	24.000
Base diameter (mm)	[db]	19.734	22.553
Tip diameter (mm)	[da]	23.370	26.210
(mm)	[da.e/i]	23.370 / 23.360	26.210 / 26.200
Tip diameter allowances (mm)	[Ada.e/i]	0.000 / -0.010	0.000 / -0.010
Tip form diameter (mm)	[dFa]	23.370	26.210
(mm)	[dFa.e/i]	23.370 / 23.360	26.210 / 26.200
Active tip diameter (mm)	[dNa]	23.370	26.210
Active tip diameter (mm)	[dNa.e/i]	23.370 / 23.360	26.210 / 26.200
Operating pitch diameter (mm)	[dw]	21.285	24.325
(mm)	[dw.e/i]	21.294 / 21.275	24.336 / 24.314
Root diameter (mm)	[df]	18.900	21.740
Generating Profile shift coefficient	[xE.e/i]	0.1258/ 0.0846	0.0456/ 0.0044
Manufactured root diameter with xE (mm)	[df.e/i]	18.752 / 18.669	21.591 / 21.509
Theoretical tip clearance (mm)	[c]	0.250	0.250
Effective tip clearance (mm)	[c.e/i]	0.381 / 0.314	0.381 / 0.314
Active root diameter (mm)	[dNf]	20.084	23.011
(mm)	[dNf.e/i]	20.099 / 20.074	23.026 / 23.000
Root form diameter (mm)	[dFf]	19.892	22.759
(mm)	[dFf.e/i]	19.842 / 19.818	22.705 / 22.679
Reserve (dNf-dFf)/2 (mm)	[cF.e/i]	0.140 / 0.116	0.174 / 0.148
Addendum (mm)	[ha=mn*(haP*+x+k)]	1.185	1.105
(mm)	[ha.e/i]	1.185 / 1.180	1.105 / 1.100
Dedendum (mm)	[hf=mn*(hfP*-x)]	1.050	1.130
(mm)	[hf.e/i]	1.124 / 1.165	1.204 / 1.246
Roll angle at dFa (°)	[xsi_dFa.e/i]	36.351 / 36.297	33.926 / 33.876
Roll angle to dNa (°)	[xsi_dNa.e/i]	36.351 / 36.297	33.926 / 33.876
Roll angle to dNf (°)	[xsi_dNf.e/i]	11.073 / 10.691	11.806 / 11.473
Roll angle at dFf (°)	[xsi_dFf.e/i]	6.013 / 5.313	6.676 / 6.064
Tooth height (mm)	[h]	2.235	2.235
Virtual gear no. of teeth	[zn]	21.000	24.000
Normal tooth thickness at tip circle (mm)	[san]	0.644	0.694
(mm)	[san.e/i]	0.590 / 0.551	0.641 / 0.602
Normal tooth thickness on tip form circle (mm)	[sFan]	0.644	0.694

(mm)	[sFan.e/i]	0.590 /	0.551		0.641 /	0.602		
Normal space width at root circle (mm)	[efn]		0.000			0.000		
(mm)	[efn.e/i]	0.000 /	0.000		0.000 /	0.000		
Max. sliding velocity at tip (m/s)	[vga]		0.011			0.011		
Specific sliding at the tip	[zetaa]		0.680			0.680		
Specific sliding at the root	[zetaf]		-2.126			-2.129		
Mean specific sliding	[zetam]			0.680				
Sliding factor on tip	[Kga]		0.400			0.373		
Sliding factor on root	[Kgf]		-0.373			-0.400		
Pitch on reference circle (mm)	[pt]			3.142				
Base pitch (mm)	[pbt]			2.952				
Transverse pitch on contact-path (mm)	[pet]			2.952				
Length of path of contact (mm)	[ga, e/i]		4.391 (	4.419 /	4.344)			
Length T1-A, T2-A (mm)	[T1A, T2A]	1.869(	1.841/	1.907)	6.677(	6.677/	6.667)	
Length T1-B (mm)	[T1B, T2B]	3.308(	3.308/	3.298)	5.238(	5.210/	5.276)	
Length T1-C (mm)	[T1C, T2C]	3.988(	3.975/	4.001)	4.558(	4.543/	4.573)	
Length T1-D (mm)	[T1D, T2D]	4.821(	4.793/	4.859)	3.725(	3.725/	3.715)	
Length T1-E (mm)	[T1E, T2E]	6.260(	6.260/	6.251)	2.286(	2.258/	2.323)	
Length T1-T2 (mm)	[T1T2]		8.546 (	8.518 /	8.574)			
Diameter of single contact point B (mm)	[d-B]	20.813(	20.813/	20.807)	24.867(	24.844/	24.899)	
Diameter of single contact point D (mm)	[d-D]	21.963(	21.939/	21.997)	23.751(	23.751/	23.745)	
Addendum contact ratio	[eps]	0.770(	0.774/	0.762)	0.718(	0.723/	0.709)	
Minimal length of contact line (mm)	[Lmin]			25.000				
Transverse contact ratio	[eps_a]			1.487				
Transverse contact ratio with allowances	[eps_a.e/m/i]		1.497 /	1.484 /	1.471			
Overlap ratio	[eps_b]			0.000				
Total contact ratio	[eps_g]			1.487				
Total contact ratio with allowances	[eps_g.e/m/i]		1.497 /	1.484 /	1.471			

2. FACTORS OF GENERAL INFLUENCE

		------- GEAR 1 -------- GEAR 2 --
Nominal circum. force at pitch circle (N)	[Ft]	4104.0
Axial force (N)	[Fa]	0.0
Radial force (N)	[Fr]	1493.7
Normal force (N)	[Fnorm]	4367.4
Nominal circumferential force per mm (N/mm)	[w]	164.16
Only as information: Forces at operating pitch circle:		
Nominal circumferential force (N)	[Ftw]	4049.1
Axial force (N)	[Faw]	0.0
Radial force (N)	[Frw]	1636.6
Circumferential speed reference circle (m/s)	[v]	0.03
Circumferential speed operating pitch circle (m/s)	[v(dw)]	0.03
Running-in value (µm)	[yp]	0.5
Running-in value (µm)	[yf]	0.4
Correction factor	[CM]	0.800
Gear blank factor	[CR, bs/b, sr/mn]	0.903 (0.250, 5.254)
Basic rack factor	[CBS]	0.975
Material coefficient	[E/Est]	1.004
Singular tooth stiffness (N/mm/µm)	[c']	11.444
Meshing stiffness (N/mm/µm)	[cg]	15.627
Reduced mass (kg/mm)	[mRed]	0.00086
Resonance speed (min-1)	[nE1]	61188
Resonance ratio (-)	[N]	0.000
Subcritical range		

Running-in value (µm)	[ya]		0.5
Bearing distance l of pinion shaft (mm)	[l]		50.000
Distance s of pinion shaft (mm)	[s]		5.000
Outside diameter of pinion shaft (mm)	[dsh]		19.090
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]		3.90
from deformation of shaft (µm)	[fsh*B1]		1.44
(fsh (µm) = 2.88, B1= 0.50, fHb5 (µm) = 6.50)			
Tooth trace: width-crowned [Cbeta = 0.5*(fma+fsh)]			
Position of Contact pattern: favorable			
from production tolerances (µm)	[fma*B2]		4.50
(B2= 0.50)			
Tooth trace deviation, theoretical (µm)	[Fbx]		4.59
Running-in value (µm)	[yb]		0.69
Dynamic factor	[KV]		1.000
Face load factor - flank	[KHb]		1.148
- Tooth root	[KFb]		1.134
- Scuffing	[KBb]		1.148
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]	9.123	2.661

3. TOOTH ROOT STRENGTH

Calculation of Tooth form coefficients according method: B

		------- GEAR 1	-------- GEAR 2 --
Calculated with manufacturing profile shift	[xE.e]	0.1258	0.0456
Tooth form factor	[YF]	1.69	1.75
Stress correction factor	[YS]	1.84	1.80
Load application angle (°)	[alfFen]	22.61	21.93
Bending moment arm (mm)	[hF]	1.18	1.21
Tooth thickness at root (mm)	[sFn]	2.03	2.03
Tooth root radius (mm)	[roF]	0.53	0.55

(hF* = 1.182/ 1.213 sFn* = 2.031/ 2.027 roF* = 0.527/ 0.547)
(den (mm) =
21.963/ 24.867 dsFn(mm) = 19.121/ 21.980 alfsFn(°) = 30.00/ 30.00 qs = 1.927/ 1.852)

Contact ratio factor	[Yeps]	1.000	
Helix angle factor	[Ybet]	1.000	
Effective facewidth (mm)	[beff]	25.00	25.00
Nominal stress at tooth root (N/mm²)	[sigF0]	510.37	516.12
Tooth root stress (N/mm²)	[sigF]	723.47	731.62
Permissible bending stress at root of Test-gear			
Notch sensitivity factor	[YdrelT]	0.994	0.992
Surface factor	[YRrelT]	0.972	0.972

size factor (Tooth root)	[YX]	1.000	1.000	
Finite life factor	[YNT]	1.000	1.014	
	[YdrelT*YRrelT*YX*YNT]	0.966	0.978	
Alternating bending factor (mean stress influence coefficient)	[YM]	1.000		1.000
Stress correction factor	[Yst]	2.00		
Yst*sigFlim (N/mm²)	[sigFE]	760.00	900.00	
Permissible tooth root stress (N/mm²)	[sigFP=sigFG/SFmin]	524.51	628.68	
Limit strength tooth root (N/mm²)	[sigFG]	734.31	880.15	
Required safety	[SFmin]	1.40	1.40	
Safety for tooth root stress	[SF=sigFG/sigF]	1.01	1.20	
Transmittable power (W)	[WRating]	82.90	98.26	

4. SAFETY AGAINST PITTING (TOOTH FLANK)

		------- GEAR 1	-------- GEAR 2 --
Zone factor	[ZH]	2.367	
Elasticity factor (√N/mm²)	[ZE]	190.200	
Contact ratio factor	[Zeps]	0.915	
Helix angle factor	[Zbet]	1.000	
Effective facewidth (mm)	[beff]	25.00	
Nominal contact stress (N/mm²)	[sigH0]	1577.52	
Contact stress at operating pitch circle (N/mm²)	[sigHw]	1890.25	
Single tooth contact factor	[ZB,ZD]	1.02	1.01
Contact stress (N/mm²)	[sigHB, sigHD]	1936.09	1901.76
Lubrication coefficient at NL	[ZL]	1.014	1.011
Speed coefficient at NL	[ZV]	0.952	0.965
Roughness coefficient at NL	[ZR]	0.943	0.958
Material pairing coefficient at NL	[ZW]	1.000	1.000
Finite life factor	[ZNT]	1.137	1.248
	[ZL*ZV*ZR*ZNT]	1.036	1.166
Limited pitting is permitted:	No		
Size factor (flank)	[ZX]	1.000	1.000
Permissible contact stress (N/mm²)	[sigHP=sigHG/SHmin]	1284.48	1807.94
Pitting stress limit (N/mm²)	[sigHG]	1284.48	1807.94
Required safety	[SHmin]	1.00	1.00
Safety factor for contact stress at operating pitch circle			
	[SHw]	0.68	0.96
Safety for stress at single tooth contact	[SHBD=sigHG/sigHBD]	0.66	0.95
(Safety regarding transmittable torque)	[(SHBD)^2]	0.44	0.90
Transmittable power (W)	[WRating]	50.33	103.35

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]	0.00	0.00
Optimal tip relief (µm)	[Ceff]	17.93	
Ca taken as optimal in the calculation (0=no, 1=yes)		0	0
Effective facewidth (mm)	[beff]	25.000	
Applicable circumferential force/facewidth (N/mm)	[wBt]	235.699	
Angle factor	[Xalfbet]	1.007	
(ε1:0.770, ε2:0.718)			

Flash temperature-criteria		
Tooth mass temperature (°C)	[theMB]	76.73
(theMB = theoil + XS*0.47*theflamax)		
Maximum flash temperature (°C)	[theflamax]	14.31
Scuffing temperature (°C)	[theS]	408.58
Coordinate gamma (point of highest temp.)	[Gamma]	0.294
[Gamma.A]=-0.531 [Gamma.E]=0.570		
Highest contact temp. (°C)	[theB]	91.04
Flash factor (°K*N^-.75*s^.5*m^-.5*mm)	[XM]	50.109
Geometry factor	[XB]	0.201
Load sharing factor	[XGam]	0.799
Dynamic viscosity (mPa*s)	[etaM]	32.23 (70.0 °C)
Coefficient of friction	[mym]	0.385
Required safety	[SBmin]	2.000
Safety factor for scuffing (flash temperature)	[SB]	16.084

Integral temperature-criteria		
Tooth mass temperature (°C)	[theMC]	76.76
(theMC = theoil + XS*0.70*theflaint)		
Mean flash temperature (°C)	[theflaint]	9.65
Integral scuffing temperature (°C)	[theSint]	408.58
Flash factor (°K*N^-.75*s^.5*m^-.5*mm)	[XM]	50.109
Contact ratio factor	[Xeps]	0.278
Dynamic viscosity (mPa*s)	[etaOil]	41.90 (70.0 °C)
Mean coefficient of friction	[mym]	0.359
Geometry factor	[XBE]	0.417
Meshing factor	[XQ]	1.000
Tip relief factor	[XCa]	1.000
Integral tooth flank temperature (°C)	[theint]	91.24
Required safety	[SSmin]	1.800
Safety factor for scuffing (intg.-temp.)	[SSint]	4.478
Safety referring to transmittable torque	[SSL]	15.945

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]	-0.054 / -0.084	-0.054 / -0.084
Number of teeth spanned	[k]	3.000	3.000
Base tangent length (no backlash) (mm)	[Wk]	7.811	7.798
Actual base tangent length ('span') (mm)	[Wk.e/i]	7.761 / 7.732	7.748 / 7.719
(mm)	[ΔWk.e/i]	-0.051 / -0.079	-0.051 / -0.079
Diameter of measuring circle (mm)	[dMWk.m]	21.200	23.842
Theoretical diameter of ball/pin (mm)	[DM]	1.807	1.757

Effective diameter of ball/pin (mm)	[DMeff]	2.000	1.750
Radial single-ball measurement backlash free (mm)	[MrK]	12.286	13.336
Radial single-ball measurement (mm)	[MrK.e/i]	12.233 / 12.203	13.276 / 13.242
Diameter of measuring circle (mm)	[dMMr.m]	21.557	24.097
Diametral measurement over two balls without clearance (mm)	[MdK]	24.508	26.672
Diametral two ball measure (mm)	[MdK.e/i]	24.403 / 24.344	26.551 / 26.483
Diametral measurement over pins without clearance (mm)	[MdR]	24.508	26.672
Measurement over pins according to DIN 3960 (mm)	[MdR.e/i]	24.403 / 24.344	26.551 / 26.483
Measurement over 3 pins (axial) according to AGMA 2002 (mm)			
	[dk3A.e/i]	24.403 / 24.344	26.551 / 26.483
Dimensions over 3 pins without clearance (mm)	[Md3R]	24.445	0.000
Effective dimensions over 3 pins (mm)	[Md3R.e/i]	24.341 / 24.282	0.000 / 0.000
Chordal tooth thickness (no backlash) (mm)	[sc]	1.714	1.657
Actual chordal tooth thickness (mm)	[sc.e/i]	1.660 / 1.630	1.603 / 1.573
Reference chordal height from da.m (mm)	[ha]	1.218	1.131
Tooth thickness (Arc) (mm)	[sn]	1.716	1.658
(mm)	[sn.e/i]	1.662 / 1.632	1.604 / 1.574
Backlash free center distance (mm)	[aControl.e/i]	22.667 / 22.588	
Backlash free center distance, allowances (mm)	[jta]	-0.138 / -0.217	
dNf.i with aControl (mm)	[dNf0.i]	19.897	22.804
Reserve (dNf0.i-dFf.e)/2 (mm)	[cF0.i]	0.027	0.049
Tip clearance (mm)	[c0.i(aControl)]	0.107	0.107
Center distance allowances (mm)	[Aa.e/i]	0.011 / -0.011	
Circumferential backlash from Aa (mm)	[jtw_Aa.e/i]	0.008 / -0.008	
Radial clearance (mm)	[jrw.e/i]	0.228 / 0.128	
Circumferential backlash (transverse section) (mm)	[jtw.e/i]	0.179 / 0.101	
Normal backlash (mm)	[jnw.e/i]	0.168 / 0.095	
Torsional angle at entry with fixed output:			
Entire torsional angle (°)	[j.tSys]	0.9624/ 0.5436	

7. GEAR ACCURACY

		------- GEAR 1	-------- GEAR 2 --
According to DIN 3961:1978			
Accuracy grade	[Q-DIN3961]	6	6
Profile form deviation (µm)	[ff]	6.00	6.00
Profile slope deviation (µm)	[fHa]	5.00	5.00
Total profile deviation (µm)	[Ff]	8.00	8.00
Helix form deviation (µm)	[fbf]	5.50	5.50
Helix slope deviation (µm)	[fHb]	9.00	9.00
Total helix deviation (µm)	[Fb]	10.00	10.00
Normal base pitch deviation (µm)	[fpe]	7.00	7.00
Single pitch deviation (µm)	[fp]	7.00	7.00
Adjacent pitch difference (µm)	[fu]	8.00	8.00
Total cumulative pitch deviation (µm)	[Fp]	19.00	19.00
Sector pitch deviation over z/8 pitches (µm)	[Fpz/8]	12.00	12.00
Runout (µm)	[Fr]	14.00	14.00
Tooth Thickness Variation (µm)	[Rs]	8.00	8.00
Single flank composite, total (µm)	[Fi']	22.00	22.00
Single flank composite, tooth-to-tooth (µm)	[fi']	10.00	10.00
Radial composite, total (µm)	[Fi"]	17.00	17.00
Radial composite, tooth-to-tooth (µm)	[fi"]	6.00	6.00

According to DIN 58405:1972 (Feinwerktechnik):

Tooth-to-tooth composite error (µm)	[fi"]	6.00	6.00
Composite error (µm)	[Fi"]	18.00	18.00
Axis alignment error (µm)	[fp]	3.88	3.88
Flank direction error (µm)	[fbeta]	5.00	5.00
Runout (µm)	[Trk, Fr]	18.00	21.00

Axis alignment tolerances (recommendation acc. to ISO TR 10064-3:1996, Quality 6)

Maximum value for deviation error of axis (µm)	[fSigbet]	11.00 (Fb= 11.00)
Maximum value for inclination error of axes (µm)	[fSigdel]	22.00

8. ADDITIONAL DATA

Maximal possible center distance (eps_a=1.0)	[aMAX]	23.382	
Mass (g)	[m]	68.67	69.77
Total mass (g)	[m]	138.44	
calculation without consideration of the exact tooth shape			
single gears ((da+df)/2...di) (kg*m²)	[TraeghMom]	3.835e-006	6.068e-006
Torsional stiffness on input for stopped output:			
Torsional stiffness (MNm/rad)	[cr]	0.038	
Torsion when subjected to nominal torque (°)	[delcr]	0.066	
Mean coeff. of friction (acc. Niemann)	[mum]	0.158	
Wear sliding coef. by Niemann	[zetw]	1.012	
Gear power loss (W)	[PVZ]	3.141	
(Meshing efficiency (%)	[etaz]	97.253)	
Sound pressure level (according to Masuda, without contact analysis)	[dB(A)]	22.1	

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]	28.257	
Tooth root service life (h)	[HFatt]	35.06	486.5
Tooth flank service life (h)	[HHatt]	28.26	1183

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

F1%	F2%	H1%	H2%
5704.32	411.1271	7077.9675	169.0788

Damage calculated on basis of system service life [Hatt] (28.3 h)

F1%	F2%	H1%	H2%
80.59	5.8085	100.0000	2.3888

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	4561	1.7	1.544e+005	2.373e+005	0.00
1	Tooth flank	4561	1.3	1.162e+005	5.535e+005	0.00
2	Tooth root	1330	1.7	6.248e+005	9.602e+005	0.00
2	Tooth flank	1330	1.3	1.419e+006	6.758e+006	86.05

Reliability of the configuration for required service life (%) 0.00 (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: 530