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File

Name : sun_planet_1_narrow
Changed by: Angelos on: 25.12.2020 at: 13:16:23

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

1-> Mesh load factor Kγ = 1.200000
This input is unusual and will result in faulty results.
Please check if you have entered it deliberately!

2-> The circumferential speed is very high (130.2486 m/s)!
This causes the following:
The lubrication is no longer guaranteed.
The calculation is not intended for this case!

3-> Calculation of scuffing:
The entered gear pair data is outside the boundary of the calculation method!

The application of ISO/TS 6336-21 has following limitations:

1.0 m/s <= v(=130.2 m/s) <= 50.0 m/s

4-> Notice to gear 1:
NOT POSSIBLE TO MEASURE BASE TANGENT LENGTH!
The width of the gear is too small, hence the tooth thickness too big,
so that the required length for the measurement exceeds the facewidth.

5-> Notice concerning gear 1:
Dimension over pins is not measurable (facewidth is too small)!

6-> Notice concerning gear 2:
Dimension over pins is not measurable (facewidth is too small)!

Calculation of a helical-toothed cylindrical gear pair

Drawing or article number:			
Gear 1:	0.000.0		
Gear 2:	0.000.0		
Calculation method	ISO 6336:2019		
		------- Gear 1	-------- Gear 2 --
Power (kW)	[P]	187.124	
Speed (1/min)	[n]	16700.0	6012.0
Torque (Nm)	[T]	107.0	297.2
Application factor	[KA]	1.75	
Distribution factor	[Kγ]	1.20	
Required service life (h)	[H]	10000.00	
Gear driving (+) / driven (-)		+	-
Working flank gear 1:	Right flank		
Gear 1 direction of rotation:	Clockwise		

Tooth geometry and material

Geometry calculation according to		ISO 21771:2007	
		------- Gear 1 --------	Gear 2 --
Center distance (mm)	[a]	133.838	
Center distance tolerance		ISO 286:2010 Measure js7	
Normal module (mm)	[mn]	5.0000	
Normal pressure angle (°)	[αn]	25.0000	
Helix angle at reference circle (°)	[β]	25.0000	
Number of teeth	[z]	27	-75
Facewidth (mm)	[b]	22.00	15.87
Hand of gear		right	right
Accuracy grade	[Q-ISO 1328:2013]	A6	A6
Inner diameter (mm)	[di]	0.00	
External diameter (mm)	[di]		530.76
Inner diameter of gear rim (mm)	[dbi]	0.00	
Outer diameter of gear rim (mm)	[dbi]		0.00

Material

Gear 1
18CrNiMo7-6, Case-carburized steel, case-hardened
ISO 6336-5 Figure 9/10 (MQ), Core hardness >=25HRC Jominy J=12mm<HRC28

Gear 2
18CrNiMo7-6, Case-carburized steel, case-hardened
ISO 6336-5 Figure 9/10 (MQ), Core hardness >=25HRC Jominy J=12mm<HRC28

		------- Gear 1 --------	Gear 2 --
Surface hardness		HRC 61	HRC 61
Material treatment according to ISO 6336:2006 Normal, life factors ZNT and YNT >=0.85			
Fatigue strength. tooth root stress (N/mm²)	[σFlim]	430.00	430.00
Fatigue strength for Hertzian pressure (N/mm²)	[σHlim]	1500.00	1500.00
Tensile strength (N/mm²)	[σB]	1200.00	1200.00
Yield point (N/mm²)	[σS]	850.00	850.00
Young's modulus (N/mm²)	[E]	206000	206000
Poisson's ratio	[v]	0.300	0.300
Roughness average value DS, flank (µm)	[RAH]	0.60	0.60
Roughness average value DS, root (µm)	[RAF]	3.00	3.00
Mean roughness height, Rz, flank (µm)	[RZH]	4.80	4.80
Mean roughness height, Rz, root (µm)	[RZF]	20.00	20.00

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	[ρfP*]	0.380	(ρfPmax*= 0.318)
Addendum coefficient	[haP*]	1.000	
Tip radius factor	[ρaP*]	0.000	
Protuberance height coefficient	[hprP*]	0.000	
Protuberance angle	[αprP]	0.000	
Tip form height coefficient	[hFaP*]	0.000	
Ramp angle	[αKP]	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	[ρfP*]	0.380	(ρfPmax*= 0.318)
Addendum coefficient	[haP*]	1.000	
Tip radius factor	[ρaP*]	0.000	
Protuberance height coefficient	[hprP*]	0.000	
Protuberance angle	[αprP]	0.000	
Tip form height coefficient	[hFaP*]	0.000	
Ramp angle	[αKP]	0.000	
	not topping		

Information on final machining

Dedendum reference profile	[hfP*]	1.250	1.250
Tooth root radius Refer. profile	[ρfP*]	0.380	0.380
Addendum Reference profile	[haP*]	1.000	1.000
Protuberance height coefficient	[hprP*]	0.000	0.000
Protuberance angle (°)	[αprP]	0.000	0.000
Tip form height coefficient	[hFaP*]	0.000	0.000
Ramp angle (°)	[αKP]	0.000	0.000
Type of profile modification:	none (only running-in)		
Tip relief by running in (µm)	[Ca L/R]	2.0 / 2.0	2.0 / 2.0
Lubrication type	Oil injection lubrication		
Type of oil	ISO-VG 220		
Lubricant base	Mineral-oil base		
Oil nominal kinematic viscosity at 40°C (mm²/s)	[v40]	220.00	
Oil nominal kinematic viscosity at 100°C (mm²/s)	[v100]	17.50	
Specific density at 15°C (kg/dm³)	[ρ]	0.895	
Oil temperature (°C)	[TS]	70.000	

Gear pair

Overall transmission ratio	[itot]	2.778	
Gear ratio	[u]	-2.778	
Transverse module (mm)	[mt]	5.517	
Transverse pressure angle (°)	[αt]	27.226	
Working pressure angle (°)	[αwt]	28.395	
	[αwt.e/i]	28.379 /	28.411
Working pressure angle at normal section (°)	[αwn]	26.058	
Helix angle at operating pitch circle (°)	[βw]	25.237	
Base helix angle (°)	[βb]	22.521	
Reference center distance (mm)	[ad]	132.405	
Pitch on reference circle (mm)	[pt]	17.332	
Base pitch (mm)	[pbt]	15.412	
Transverse pitch on contact-path (mm)	[pet]	15.412	
Sum of profile shift coefficients	[Σxi]	-0.2922	
Transverse contact ratio	[εα]	1.342	
Transverse contact ratio with allowances	[εα.e/m/i]	1.349 /	1.343 / 1.337
Overlap ratio	[εβ]	0.427	
Total contact ratio	[εγ]	1.769	
Total contact ratio with allowances	[εγ.e/m/i]	1.777 /	1.770 / 1.764

Length of path of contact (mm)	[ga, e/i]	20.682 (20.798 / 20.605)
Length T1-A (mm)	[T1A]	24.358 (24.243 / 24.400)
Length T1-B (mm)	[T1B]	29.629 (29.629 / 29.593)
Length T1-C (mm)	[T1C]	35.801 (35.825 / 35.778)
Length T1-D (mm)	[T1D]	39.770 (39.655 / 39.812)
Length T1-E (mm)	[T1E]	45.041 (45.041 / 45.005)
Length T2-A (mm)	[T2A]	88.005 (87.932 / 88.005)
Length T2-B (mm)	[T2B]	93.276 (93.318 / 93.198)
Length T2-C (mm)	[T2C]	99.448 (99.514 / 99.382)
Length T2-D (mm)	[T2D]	103.416 (103.343 / 103.416)
Length T2-E (mm)	[T2E]	108.687 (108.729 / 108.610)
Length T1-T2 (mm)	[T1T2]	63.647 (63.689 / 63.605)
Minimal length of contact line (mm)	[Lmin]	17.182

Gear 1

Lead height (mm)	[pz]	1003.542
Axial pitch (mm)	[px]	37.168
Profile shift coefficient	[x]	0.1168
Tooth thickness, arc, in module	[sn*]	1.6797
Tip alteration (mm)	[k*mn]	0.029
Reference diameter (mm)	[d]	148.956
Base diameter (mm)	[db]	132.452
Tip diameter (mm)	[da]	160.182
(mm)	[da.e/i]	160.182 / 160.142
Tip diameter allowances (mm)	[Ada.e/i]	0.000 / -0.040
Tip form diameter (mm)	[dFa]	160.182
(mm)	[dFa.e/i]	160.182 / 160.142
Root diameter (mm)	[df]	137.624
Generating Profile shift coefficient	[xE.e/i]	0.0964/ 0.0857
Generated root diameter with xE (mm)	[df.e/i]	137.420 / 137.313
Root form diameter (mm)	[dFf]	140.942
(mm)	[dFf.e/i]	140.790 / 140.711
Internal toothing: Calculation dFf with pinion type cutter (z0= 27 , x0=0.000)		
Involute length (mm)	[l_dFa-l_dFf]	10.936
Addendum, $m_n(h_{aP}^*+x+k)$ (mm)	[ha]	5.613
(mm)	[ha.e/i]	5.613 / 5.593
Dedendum (mm)	[hf=mn*(hfP*-x)]	5.666
(mm)	[hf.e/i]	5.768 / 5.821
Tooth height (mm)	[h]	11.279
Virtual gear no. of teeth	[zn]	34.913
Normal tooth thickness at tip circle (mm)	[san]	2.675
(mm)	[san.e/i]	2.598 / 2.521
Normal tooth thickness at tip form circle (mm)	[sFan]	2.675
(mm)	[sFan.e/i]	2.598 / 2.521
Normal space width at root circle (mm)	[efn]	2.777
(mm)	[efn.e/i]	2.810 / 2.828

Gear 2

Lead height (mm)	[pz]	2787.616

Axial pitch (mm)	[px]	37.168
Profile shift coefficient	[x]	-0.4090
Tooth thickness, arc, in module	[sn*]	1.1894
Tip alteration (mm)	[k*mn]	0.000
Reference diameter (mm)	[d]	413.767
Base diameter (mm)	[db]	367.924
Tip diameter (mm)	[da]	407.857
(mm)	[da.e/i]	407.857 / 407.794
Tip diameter allowances (mm)	[Ada.e/i]	0.000 / -0.063
Tip form diameter (mm)	[dFa]	407.857
(mm)	[dFa.e/i]	407.857 / 407.794
Root diameter (mm)	[df]	430.357
Generating Profile shift coefficient	[xE.e/i]	-0.4369/ -0.4497
Generated root diameter with xE (mm)	[df.e/i]	430.764 / 430.636
Root form diameter (mm)	[dFf]	428.672
(mm)	[dFf.e/i]	429.085 / 428.955
Internal toothing: Calculation dFf with pinion type cutter (z0= 24 , x0=0.000)		
Involute length (mm)	[l_dFa-l_dFf]	11.832
Addendum, $m_n(h_{aP}^*+x+k)$ (mm)	[ha]	2.955
(mm)	[ha.e/i]	2.987 / 2.955
Dedendum (mm)	[hf=mn*(hfP*-x)]	8.295
(mm)	[hf.e/i]	8.434 / 8.499
Tooth height (mm)	[h]	11.250
Virtual gear no. of teeth	[zn]	96.981
Normal tooth thickness at tip circle (mm)	[san]	3.229
(mm)	[san.e/i]	3.101 / 3.014
Normal tooth thickness at tip form circle (mm)	[sFan]	3.229
(mm)	[sFan.e/i]	3.101 / 3.014
Normal space width at root circle (mm)	[efn]	1.535
(mm)	[efn.e/i]	1.518 / 1.509

Gear specific pair data Gear pair 1, Gear 1

Operating pitch diameter (mm)	[dw]	150.567
(mm)	[dw.e/i]	150.545 / 150.590
Active tip diameter (mm)	[dNa]	160.182
(mm)	[dNa.e/i]	160.182 / 160.142
Theoretical tip clearance (mm)	[c]	1.250
Effective tip clearance (mm)	[c.e/i]	1.493 / 1.369
Active root diameter (mm)	[dNf]	141.127
(mm)	[dNf.e/i]	141.156 / 141.048
Reserve (dNf-dFf)/2 (mm)	[cF.e/i]	0.223 / 0.129
Max. sliding velocity at tip (m/s)	[vga]	10.341
Specific sliding at the tip	[ζa]	0.131
Specific sliding at the root	[ζf]	-0.301
Mean specific sliding	[ζm]	0.187
Sliding factor on tip	[Kga]	0.079
Sliding factor on root	[Kgf]	-0.097
Roll angle at dFa (°)	[ξdFa.e/i]	38.967 / 38.936
Roll angle to dNa (°)	[ξdNa.e/i]	38.967 / 38.936
Roll angle to dNf (°)	[ξdNf.e/i]	21.110 / 20.974
Roll angle at dFf (°)	[ξdFf.e/i]	20.647 / 20.545
Diameter of single contact point B (mm)	[d-B]	145.104 (145.104 / 145.075)
Diameter of single contact point D (mm)	[d-D]	154.500 (154.381 / 154.543)
Addendum contact ratio	[ε]	0.600 (0.598 / 0.599)

Gear specific pair data Gear pair 1, Gear 2

Operating pitch diameter (mm)	[dw]	418.243
(mm)	[dw.e/i]	418.306 / 418.181
Active tip diameter (mm)	[dNa]	407.857
(mm)	[dNa.e/i]	407.857 / 407.794
Theoretical tip clearance (mm)	[c]	1.279
Effective tip clearance (mm)	[c.e/i]	1.454 / 1.329
Active root diameter (mm)	[dNf]	427.340
(mm)	[dNf.e/i]	427.383 / 427.261
Reserve (dNf-dFf)/2 (mm)	[cF.e/i]	0.912 / 0.786
Max. sliding velocity at tip (m/s)	[vga]	12.808
Specific sliding at the tip	[ζa]	0.231
Specific sliding at the root	[ζf]	-0.151
Mean specific sliding	[ζm]	0.187
Sliding factor on tip	[Kga]	0.097
Sliding factor on root	[Kgf]	-0.079
Roll angle at dFa (°)	[ξdFa.e/i]	27.387 / 27.409
Roll angle to dNa (°)	[ξdNa.e/i]	27.387 / 27.409
Roll angle to dNf (°)	[ξdNf.e/i]	33.827 / 33.864
Roll angle at dFf (°)	[ξdFf.e/i]	34.343 / 34.382
Diameter of single contact point B (mm)	[d-B]	412.516 (412.554 / 412.445)
Diameter of single contact point D (mm)	[d-D]	422.075 (422.004 / 422.075)
Addendum contact ratio	[ε]	0.743 (0.752 / 0.738)

General influence factors

		------- Gear 1 -------- Gear 2 --
Nominal circum. force at pitch circle (N)	[Ft]	1436.7
Axial force (N)	[Fa]	669.9
Radial force (N)	[Fr]	739.2
Normal force (N)	[Fnorm]	1749.1
Nominal circumferential force per mm (N/mm)	[w]	90.52
Only as information: Forces at operating pitch circle:		
Nominal circumferential force (N)	[Ftw]	1421.3
Axial force (N)	[Faw]	669.9
Radial force (N)	[Frw]	768.3
Circumferential speed reference circle (m/s)	[v]	130.25
Circumferential speed operating pitch circle (m/s)	[v(dw)]	131.66
Running-in value (µm)	[yp]	0.7
Running-in value (µm)	[yf]	0.8
Correction factor	[CM]	0.800
Gear blank factor	[CR]	1.000
Basic rack factor	[CBS]	1.073
Material coefficient	[E/Est]	1.000
Singular tooth stiffness (N/mm/µm)	[c']	15.035
Meshing stiffness (N/mm/µm)	[cγα]	18.892
Meshing stiffness (N/mm/µm)	[cγβ]	16.058
Reduced mass (kg/mm)	[mRed]	0.06786
Resonance speed (min-1)	[nE1]	5901
Resonance ratio (-)	[N]	2.830
Overcritical range		
Running-in value (µm)	[yα]	0.7
Bearing distance l of pinion shaft (mm)	[l]	44.000

Distance s of pinion shaft (mm)	[s]	4.400	
Outside diameter of pinion shaft (mm)	[dsh]	22.000	
Load in accordance with Figure 13, ISO 6336-1:2006 0:a), 1:b), 2:c), 3:d), 4:e)	[-]	4	
Coefficient K' according to Figure 13, ISO 6336-1:2006	[K']	-1.00	
Without stiffening			
Tooth trace deviation (active) (µm)	[Fβy]	4.03	
from deformation of shaft (µm)	[fsh*B1]	1.33	
fsh (µm) = 1.33 , B1=1.00 , fHβ5 (µm) = 6.50			
Tooth without tooth trace modification			
Position of contact pattern:	favorable		
from production tolerances (µm)	[fmα*B2]	12.04	
B2= 1.00			
Tooth trace deviation, theoretical (µm)	[Fβx]	4.74	
Running-in value (µm)	[yβ]	0.71	
Dynamic factor	[Kv]	1.490	
Face load factor - flank	[KHβ]	1.114	
- Tooth root	[KFβ]	1.078	
- Scuffing	[KBβ]	1.114	
Transverse load factor - flank	[KHα]	1.014	
- Tooth root	[KFα]	1.014	
- Scuffing	[KBα]	1.014	
Number of load cycles (in mio.)	[NL]	10020.000	3607.200

Tooth root load capacity

Calculation of Tooth form coefficients according method: B

Internal toothing: Calculation of YF, YS with pinion type cutter, z0= 24 , x0= 0.000 , ρaP0*= 0.380

		Gear 1	Gear 2
Calculated with generating profile shift coefficient	[xE.i]	0.0857	-0.4497
Tooth form factor	[YF]	1.02	0.76
Stress correction factor	[YS]	2.19	3.18
Load application angle (°)	[αFen]	24.94	25.93
Load distribution influence factor	[fε]	0.919	
Load application diameter (mm)	[d_{en}]	152.176	-414.574
Bending moment arm (mm)	[hF]	5.02	6.28
Tooth thickness at root (mm)	[sFn]	11.66	14.99
Tooth root radius (mm)	[ρF]	2.55	1.49
Bending moment arm (-)	[hF/mn]	1.004	1.256
Tooth thickness at root (-)	[sFn/mn]	2.333	2.998
Tooth root radius (-)	[ρF/mn]	0.511	0.297
Calculation cross section diameter (mm)	[d_{sFn}]	139.322	-430.306
Tangents on calculation cross section (°)	[α_{sFn}]	30.000	60.000
Notch parameter	[q_s]	2.284	5.042
Helix angle factor	[Yβ]	1.224	
Deep tooth factor	[YDT]	1.000	
Gear rim factor	[YB]	1.00	1.00
Effective facewidth (mm)	[beff]	22.00	15.87
Nominal stress at tooth root (N/mm²)	[σF0]	35.57	53.85
Tooth root stress (N/mm²)	[σF]	121.67	184.20

Permissible bending stress at root of Test-gear			
Notch sensitivity factor	[YdrelT]	0.998	1.020
Surface factor	[YRrelT]	0.957	0.957
Size factor, tooth root	[YX]	1.000	1.000
Finite life factor	[YNT]	0.850	0.868
$Y_{drelT}*Y_{RrelT}*Y_X*Y_{NT}$		0.812	0.847
Alternating bending factor, mean stress influence coefficient			
	[YM]	1.000	1.000
Stress correction factor	[Yst]	2.00	
Yst*σFlim (N/mm²)	[σFE]	860.00	860.00
Permissible tooth root stress σFG/SFmin (N/mm²)	[σFP]	498.52	520.23
Limit strength tooth root (N/mm²)	[σFG]	697.92	728.32
Required safety	[SFmin]	1.40	1.40
Safety for tooth root stress	[SF=σFG/σF]	5.74	3.95
Transmittable power (kW)	[kWRating]	766.70	528.50

Flank safety

		------- Gear 1	-------- Gear 2 --
Zone factor	[ZH]	2.079	
Elasticity factor (√N/mm²)	[ZE]	189.812	
Contact ratio factor	[Zε]	0.909	
Helix angle factor	[Zβ]	1.050	
Effective facewidth (mm)	[beff]	15.87	
Nominal contact stress (N/mm²)	[σH0]	234.92	
Contact stress at operating pitch circle (N/mm²)	[σHw]	441.75	
Coefficient [fZCa] 1.20 (Helical gear sets without flank modifications)			
Single tooth contact factor	[ZB,ZD]	1.12	1.00
Contact stress (N/mm²)	[σHB, σHD]	493.93	441.75
Lubrication factor for NL	[ZL]	1.020	1.020
Speed factor for NL	[ZV]	1.067	1.067
Roughness factor for NL	[ZR]	1.008	1.008
Material hardening factor for NL	[ZW]	1.000	1.000
Finite life factor	[ZNT]	0.850	0.877
	[ZL*ZV*ZR*ZNT]	0.933	0.962
Limited pitting is permitted: No			
Size factor (flank)	[ZX]	1.000	1.000
Permissible contact stress, σHG/SHmin (N/mm²)	[σHP]	1399.11	1443.56
Pitting stress limit (N/mm²)	[σHG]	1399.11	1443.56
Required safety	[SHmin]	1.00	1.00
Safety factor for contact stress at operating pitch circle	[SHw]	3.17	3.27
Safety against pressure, σHG/σHBD Single contact	[SHBD]	2.83	3.27
Safety regarding transmittable torque	[(SHBD)^2]	8.02	10.68
Transmittable power (kW)	[kWRating]	1501.40	1998.20

Micropitting according to **ISO/TS 6336-22:2018**

Calculation has not been carried out, lubricant: Load stage micropitting test not known

Scuffing load capacity

Calculation method according to		ISO/TS 6336-20/21:2017		
Helical load factor for scuffing	[KBγ]	1.000		
Lubrication coefficient for lubrication type	[XS]	1.200		
Scuffing test and load stage	[FZGtest]	FZG - Test A / 8.3 / 90 (ISO 14635 - 1)	12	
Multiple meshing factor	[Xmp]	1.000		
Relative structural factor, scuffing	[XWrelT]	1.000		
Thermal contact factor (N/mm/s^.5/K)	[BM]	13.780	13.780	
Relevant tip relief (µm)	[Ca]	2.00	2.00	
Optimal tip relief (µm)	[Ceff]	10.06		
Ca taken as optimal in the calculation (0=no, 1=yes)		0	0	
Effective facewidth (mm)	[beff]	15.872		
Applicable circumferential force/facewidth (N/mm)	[wBt]	320.078		
KBγ = 1.000 , wBt*KBγ = 320.078				
Angle factor	[Xαβ]	1.091		
ε1: 0.600 , ε2: 0.743				
Flash temperature-criteria				
Lubricant factor	[XL]	0.830		
Tooth mass temperature (°C)	[θMi]	73.33		
θMi = θoil + XS*0.47*Xmp*θflm				
Average flash temperature (°C)	[θflm]	5.90		
Scuffing temperature (°C)	[θS]	398.97		
Contact time (µsec)	[tc]	15.21		
theS increased because of short contact time by (°C)		50.17		
Γ coordinates (point of highest temperature)	[Γ]	-0.168		
[Γ.A]= -0.320 [Γ.E]= 0.258				
Highest contact temp. (°C)	[θB]	83.42		
Flash factor (°K*N^-.75*s^.5*m^-.5*mm)	[XM]	50.058		
Approach factor	[XJ]	1.004		
Load sharing factor	[XΓ]	1.000		
Dynamic viscosity (mPa*s)	[ηM]	41.90	(70.0	°C)
Coefficient of friction	[μ_m]	0.025		
Required safety	[SBmin]	2.000		
Margin of safety for scuffing, flash temperature	[SB]	24.520		
Integral temperature-criteria				
Lubricant factor	[XL]	1.000		
Tooth mass temperature (°C)	[θMC]	72.30		
θMC = θoil + XS*0.70*θflaint				
Mean flash temperature (°C)	[θflaint]	2.74		
Integral scuffing temperature (°C)	[θSint]	360.78		
Flash factor (°K*N^-.75*s^.5*m^-.5*mm)	[XM]	50.058		
Running-in factor, well run in	[XE]	1.000		
Contact ratio factor	[Xε]	0.370		
Dynamic viscosity (mPa*s)	[ηOil]	41.90	(70.0	°C)
Mean coefficient of friction	[μ_m]	0.017		
Geometry factor	[XBE]	0.037		
Meshing factor	[XQ]	1.000		
Tip relief factor	[XCa]	1.158		
Integral tooth flank temperature (°C)	[θint]	76.40		
Required safety	[SSmin]	1.800		
Safety factor for scuffing (intg.-temp.)	[SSint]	4.722		
Safety referring to transmittable torque	[SSL]	45.424		

Measurements for tooth thickness

		------- Gear 1 --------	Gear 2 --
Tooth thickness tolerance		DIN 3967 cd25	DIN 3967 cd25
Tooth thickness allowance (normal section) (mm)	[As.e/i]	-0.095 /-0.145	-0.130 /-0.190
Number of teeth spanned	[k]	6.000	-0.000
For internal toothing: k = measurement gap number			
Base tangent length (no backlash) (mm)	[Wk]	83.604	-0.000
Base tangent length with allowance (mm)	[Wk.e/i]	83.518 / 83.473	-0.000 / -0.000
(mm)	[ΔWk.e/i]	-0.086 / -0.131	0.000 / 0.000
Diameter of measuring circle (mm)	[dMWk.m]	153.272	-0.000
> Gear 1 base tangent length cannot be measured (gear too thin)			
Theoretical diameter of ball/pin (mm)	[DM]	8.971	8.702
Effective diameter of ball/pin (mm)	[DMeff]	9.000	9.000
Radial single-ball measurement backlash free (mm)	[MrK]	81.624	202.202
Radial single-ball measurement (mm)	[MrK.e/i]	81.533 / 81.485	202.406 /202.341
Diameter of measuring circle (mm)	[dMMr.m]	149.945	417.615
Diametral measurement over two balls without clearance (mm)	[MdK]	162.987	404.313
Diametral two ball measure (mm)	[MdK.e/i]	162.805 /162.709	404.721 /404.592
Diametral measurement over pins without clearance (mm)	[MdR]	163.247	-0.000
Measurement over pins according to DIN 3960 (mm)	[MdR.e/i]	163.065 /162.969	-0.000 / -0.000
Measurement over 2 pins, free, according to AGMA 2002 (mm)	[dk2f.e/i]	162.726 /162.630	0.000 / 0.000
Measurement over 2 pins, transverse, according to AGMA 2002 (mm)	[dk2t.e/i]	163.320 /163.223	0.000 / 0.000
Measurement over 3 pins, axial, according to AGMA 2002 (mm)	[dk3A.e/i]	163.065 /162.969	-0.000 / -0.000
Note: Internal gears with helical teeth cannot be measured with rollers.			
Chordal tooth thickness (no backlash) (mm)	[sc]	8.396	5.947
Normal chordal tooth thickness with allowance (mm)	[sc.e/i]	8.303 / 8.254	5.816 / 5.756
Reference chordal height from da.m (mm)	[ha]	5.700	2.953
Tooth thickness, arc (mm)	[sn]	8.399	5.947
(mm)	[sn.e/i]	8.304 / 8.254	5.817 / 5.757
Backlash free center distance (mm)	[aControl.e/i]	134.069 /134.182	
Backlash free center distance, allowances (mm)	[jta]	0.231 / 0.344	
dNf.i with aControl (mm)	[dNf0.i]	140.588	428.075
Reserve (dNf0.i-dFf.e)/2 (mm)	[cF0.i]	-0.101	0.440
Tip clearance (mm)	[c0.i(aControl)]	1.045	1.005
Center distance allowances (mm)	[Aa.e/i]	-0.020 / 0.020	
Circumferential backlash from Aa (mm)	[jtw_Aa.e/i]	0.022 / -0.022	
Radial backlash (mm)	[jrw.e/i]	0.364 / 0.211	
Circumferential backlash (transverse section) (mm)	[jtw.e/i]	0.395 / 0.229	
Normal backlash (mm)	[jn.e/i]	0.321 / 0.187	
Torsional angle on input with output fixed:			
Total torsional angle (°)	[j.tSys]	0.3008/0.1745	

Toothing tolerances

		------- Gear 1 --------	Gear 2 --
According to ISO 1328-1:2013, ISO 1328-2:1997			
Accuracy grade	[Q]	A6	A6
Single pitch deviation (µm)	[fptT]	10.00	10.00
Base circle pitch deviation (µm)	[fpbT]	9.00	9.30
Sector pitch deviation over k/8 pitches (µm)	[Fpk/8T]	20.00	24.00
Profile form deviation (µm)	[ffαT]	11.00	11.00
Profile slope deviation (µm)	[fHαT]	8.50	9.00

Total profile deviation (µm)	[FαT]	14.00	14.00
Helix form deviation (µm)	[ffβT]	10.00	10.00
Helix slope deviation (µm)	[fHβT]	9.00	9.00
Total helix deviation (µm)	[FβT]	13.00	14.00
Total cumulative pitch deviation (µm)	[FpT]	32.00	39.00
Adjacent pitch difference (µm)	[fuT]	14.00	15.00
Runout (µm)	[FrT]	29.00	35.00
Single flank composite, total (µm)	[FisT]	42.00	49.00
Single flank composite, tooth-to-tooth (µm)	[fisT]	9.50	9.50
Radial composite, total (µm)	[FidT]	51.00	60.00
Radial composite, tooth-to-tooth (µm)	[fidT]	22.00	22.00

FidT (Fi"), fidT (fi") according to ISO 1328:1997 calculated with the geometric mean values for mn and d

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

6

Maximum value for deviation error of axis (µm)	[fΣβ]	19.41	(Fβ=	14.00)
Maximum value for inclination error of axes (µm)	[fΣδ]	38.81		

Modifying and defining the tooth form

Data for the tooth form calculation :
Data not available.
Please run the calculation in the "Tooth form" tab and open the main report again.

Supplementary data

Mass (kg)	[m]	3.000	3.541
Total mass (kg)	[mGes]	6.541	
Moment of inertia for system, relative to the input:			
calculation without consideration of the exact tooth shape			
Single gears, (da+df)/2...di (kg*m²)	[J]	0.00831	0.17155
System (da+df)/2...di (kg*m²)	[J]	0.03055	
Torsional stiffness at driving gear with fixed driven gear:			
Torsional stiffness (MNm/rad)	[cr]	1.106	
Torsion when subjected to nominal torque (°)	[δcr]	0.006	
Mean coefficient of friction (as defined in Niemann)	[μ_m]	0.023	
Wear sliding coef. by Niemann	[ζw]	0.250	
Loss factor	[HV]	0.046	
Gear power loss (kW)	[PVZ]	0.197	
Meshing efficiency (%)	[ηz]	99.895	
Sound pressure level according to Masuda, without contact analysis			
	[dB(A)]	89.9	
Oil requirement for injection lubrication (l/min)	[Voil]	0.615	
with oil cooler, for assumed difference in temperature of oil (°C):			

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+06	1e+06
Tooth flank service life (h)	[HHatt]	1e+06	1e+06

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] (10000.0 h)

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

Remarks:

- Specifications with [.e/i] imply: Maximum [e] and minimum value [i] for
  Taking all tolerances into account
  Specifications with [.m] imply: Mean value within tolerance
- For the backlash tolerance, the center distance tolerances and the tooth thickness allowance are taken into account.
  The maximum and minimum clearance according to the largest or smallest allowances are defined..
  The calculation is performed for the operating pitch circle.
- Calculation of Zbet according to Corrigendum 1 ISO 6336-2:2008 with Zβ = 1/(COS(β)^0.5)
- Details of calculation method:
  cγ according to Method B
  Kv according to Method B
  KHβ and KFβ according to Method C
  fmα according to Equation 64, fsh according to 57/58, Fβx according to 52/53/54
  KHα, KFα according to Method B
- The logarithmically interpolated value taken from the values for the fatigue strength and the static strength, based on the number of load cycles, is used for coefficients ZL, ZV, ZR, ZW, ZX, YdrelT, YRrelT and YX..

End of Report lines: 645