

Cylindrical Gear Pair Calculation

Input data

Geometry

Normal module	mn	8.0000 mm	
Normal pressure angle	α_n	20.000 °	
Helix direction		Spur gear	
Center distance	a	500.000 mm	
Center distance upper tolerance	$\Delta a.s$	0.0000 mm	
Center distance lower tolerance	$\Delta a.i$	0.0000 mm	
		Gear 1	Gear 2
Number of teeth	z	17	108
Face width	b	100.0000	100.0000 mm
Profile shift coefficient	x	0.100	-0.100
Upper tooth thickness allowance	Esns	-0.1592	-0.1593 mm
Lower tooth thickness allowance	Esni	-0.1592	-0.1593 mm

Reference profile

Basic rack dedendum	hfP1	1.25 · mn
Basic rack root radius	pfP1	0.45 · mn
Basic rack addendum	haP1	1 · mn
Tip alteration	k1	0 · mn
Basic rack dedendum	hfP2	1.25 · mn
Basic rack root radius	pfP2	0.4 · mn
Basic rack addendum	haP2	1 · mn
Tip alteration	k2	0 · mn

Material

Material gear 1		Own Input
Youngs modulus	E1	206000 MPa
Poisson number	nu1	0.3
Thermal elongation coefficient	α_1	11.500 10 ⁻⁶ /°C
Material type		V (alloy)
Material quality		MQ
Case hardness	HV	310
Core hardness	HV	0
Limiting tooth root stress	sigFlim1	318.750 MPa
Limiting contact stress	sigHlim1	780.030 MPa
Material gear 2		Own Input
Youngs modulus	E2	206000 MPa
Poisson number	nu2	0.3
Thermal elongation coefficient	α_2	11.500 10 ⁻⁶ /°C

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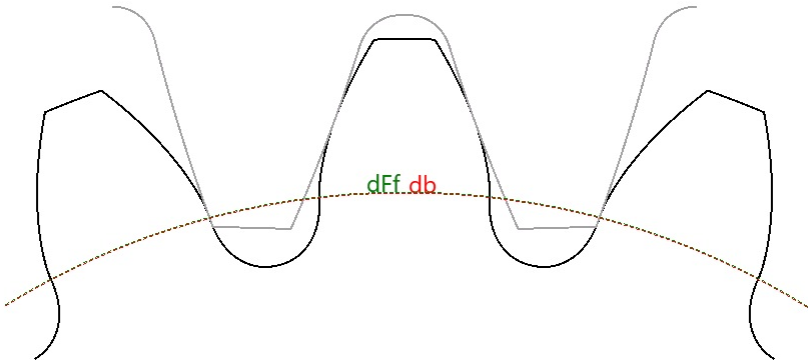
Material type	V (alloy)	
Material quality	MQ	
Case hardness	HV	260
Core hardness	HV	0
Limiting tooth root stress	sigFlim2	297.500 MPa
Limiting contact stress	sigHlim2	714.380 MPa

Loading

Speed	n1	360.000 rpm
Torque	T1	1000.0 Nm
Power	P	37699.1 W
Application factor	KA	1
Required life	H	10000.0 h

Results

Geometry



		Gear 1	Gear 2
Profile shift coefficient	x.s	0.0727	-0.1273
Profile shift coefficient	x.i	0.0727	-0.1273
Reference diameter	d.nom	136.0000	864.0000 mm
Base diameter	db.nom	127.7982	811.8944 mm
Tip diameter	da.s	153.6000	878.4000 mm
Tip diameter	da.i	153.6000	878.4000 mm
Root diameter	df.s	117.1627	841.9625 mm
Root diameter	df.i	117.1627	841.9625 mm
Root form diameter	dFf.s	127.9076	847.5898 mm
Root form diameter	dFf.i	127.9076	847.5898 mm
Normal tooth thickness at tip	san.s	4.8733	6.3761 mm
Normal tooth thickness at tip	san.i	4.8733	6.3761 mm
Spanned teeth	k	2	12
Base tangent length	Wk.s	37.728	283.000 mm
Base tangent length	Wk.i	37.728	283.000 mm
Contact diameter for base tangent length	dMWk.s	133.25	859.80 mm

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		Gear 1	Gear 2
Contact diameter for base tangent length	dMWk.i	133.25	859.80 mm
Measurement ball diameter	DM	17.0000	14.0000 mm
Radial single ball distance	MrK.s	82.901	441.145 mm
Radial single ball distance	MrK.i	82.901	441.145 mm
Distance over two balls	MdK.s	165.168	882.291 mm
Distance over two balls	MdK.i	165.168	882.291 mm
Distance over two pins	MdR.s	165.168	882.291 mm
Distance over two pins	MdR.i	165.168	882.291 mm
Contact diameter for ball distance	dMBall.s	140.85	863.43 mm
Contact diameter for ball distance	dMBall.i	140.85	863.43 mm
Transverse contact ratio	$\epsilon\alpha.s$	1.6613	
Transverse contact ratio	$\epsilon\alpha.i$	1.6613	
Overlap contact ratio	$\epsilon\beta$	0.0000	
Total contact ratio	$\epsilon\gamma.s$	1.6613	
Total contact ratio	$\epsilon\gamma.i$	1.6613	
Working center distance	aw.s	500.0000	mm
Working center distance	aw.i	500.0000	mm
Working transverse pressure angle	$\alpha_{wt.s}$	20.0000	°
Working transverse pressure angle	$\alpha_{wt.i}$	20.0000	°
Center distance for $\epsilon\alpha = 1$	amax.s	505.5549	mm
Center distance for $\epsilon\alpha = 1$	amax.i	505.5549	mm
Center distance for zero clearance	amin.s	499.5611	mm
Center distance for zero clearance	amin.i	499.5611	mm
Circumferential backlash at the reference circle	jt.s	0.3184	mm
Circumferential backlash at the reference circle	jt.i	0.3184	mm
Circumferential backlash at the working pitch circle	jwt.s	0.3184	mm
Circumferential backlash at the working pitch circle	jwt.i	0.3184	mm
Transverse backlash	jbt.s	0.2992	mm
Transverse backlash	jbt.i	0.2992	mm
Normal backlash	jbn.s	0.2992	mm
Normal backlash	jbn.i	0.2992	mm
Radial backlash	jr.s	0.4374	mm
Radial backlash	jr.i	0.4374	mm
Working pitch diameter	dw.s	136.0000	864.0000 mm
Working pitch diameter	dw.i	136.0000	864.0000 mm
Active root diameter	dNf.s	127.9757	851.5424 mm
Active root diameter	dNf.i	127.9757	851.5424 mm
Active tip diameter	dNa.s	153.6000	878.4000 mm
Active tip diameter	dNa.i	153.6000	878.4000 mm
Specific sliding at root	$\zeta f.s$	-6.8324	-1.1079
Specific sliding at root	$\zeta f.i$	-6.8324	-1.1079
Specific sliding at tip	$\zeta a.s$	0.5256	0.8723

		Gear 1	Gear 2
Specific sliding at tip	$\zeta_{a,i}$	0.5256	0.8723

Tolerances

		Gear 1	Gear 2
Tolerance class ISO 1328-1	A	8	6
Single pitch tolerance	$f_p T$	24	13 μm
Cumulative pitch tolerance	$F_p T$	69	50 μm
Profile slope tolerance	$f_{H\alpha} T$	21	11 μm
Profile form tolerance	$ff_{\alpha} T$	27	13 μm
Profile tolerance, total	$F_{\alpha} T$	34	18 μm
Helix slope tolerance	$f_{H\beta} T$	23	13 μm
Helix form tolerance	$ff_{\beta} T$	26	15 μm
Helix tolerance, total	$F_{\beta} T$	35	20 μm
Tolerance class ISO 1328-2	R	41	41
Tooth-to-tooth radial composite tolerance	$f_{id} T$	67	117 μm
Total radial composite tolerance	$F_{id} T$	75	133 μm

Strength

		Gear 1	Gear 2
Torque	T	1000.0000	6352.9412 Nm
Speed	n	360.0000	56.6667 rpm
Tip diameter	d_a	153.6000	878.4000 mm
Root diameter	d_f	117.6000	842.4000 mm
Root form diameter	d_{Ff}	127.9669	847.9580 mm
Transverse contact ratio	ε_{α}	1.6613	
Overlap contact ratio	ε_{β}	0.0000	
Total contact ratio	ε_{γ}	1.6613	
Mean meshing stiffness	$c_{\gamma\alpha}$	20.1417	N/mm/ μm
Mean meshing stiffness	$c_{\gamma\beta}$	17.1204	N/mm/ μm
Misalignment due to deformations	f_{sh}	1.9204	μm
Misalignment due to manufacturing deviations	f_{ma}	26.4197	μm
Dynamic factor	K _V	1.0501	
Mesh load factor	K _{γ}	1.0000	
Transverse load factor	K _{Hα}	1.2270	
Face load factor	K _{Hβ}	1.9169	
Elasticity factor	Z _E	189.8117	
Zone factor	Z _H	2.4946	
Helix angle factor	Z _{β}	1.0000	
Contact ratio factor	Z _{ε}	0.8829	
Roughness factor	Z _R	0.7915	0.8030
Velocity factor	Z _v	0.9323	0.9364
Lubricant factor	Z _L	1.0895	1.0837
Single pair tooth contact factor	Z _B	1.0911	1.0000
Life factor for contact stress	Z _{N_T}	0.9561	1.0296

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		Gear 1	Gear 2
Nominal contact stress	σ_{H0}	467.6957	MPa
Contact stress	σ_H	801.9986	735.0438 MPa
Pitting stress limit	σ_{HG}	599.5734	599.3792 MPa
Safety factor for pitting	S_H	0.7476	0.8154
Transverse load factor	$K_{F\alpha}$	1.2270	
Face load factor	$K_{F\beta}$	1.7104	
Load distribution influence factor	f_ε	1.0000	
Helix angle factor	Y_β	1.0000	
Tooth form factor	Y_F	1.4974	1.3338
Stress correction factor	Y_S	1.8155	2.0557
Rim thickness factor	Y_B	1.0000	1.0000
Relative notch sensitivity factor	Y_{drelT}	0.9754	0.9929
Relative surface factor	Y_{RrelT}	0.9639	0.9639
Deep tooth factor	Y_{DT}	1.0000	1.0000
Size factor	Y_X	0.9820	0.9820
Life factor for tooth root stress	Y_{NT}	0.9179	0.9525
Nominal tooth root stress	σ_{F0}	49.9721	50.4024 MPa
Tooth root stress	σ_F	110.1336	111.0818 MPa
Tooth root stress limit	σ_{FG}	540.2628	532.6624 MPa
Safety factor for tooth breakage	S_F	4.9055	4.7952