

Cylindrical Gear Pair Calculation

Warning: Gear 1 has undercut. Undercut limit is xLim = 0.149077.

Input data

Geometry

Normal module	mn	8.0000	mm
Normal pressure angle	αn	20.000	°
Helix direction		Spur gear	
Center distance	a	500.000	mm
Center distance upper tolerance	Δa.s	0.0000	mm
Center distance lower tolerance	Δa.i	0.0000	mm
		<b>Gear 1</b>	<b>Gear 2</b>
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	1.4 · mn
Basic rack root radius	pfP1	0.39 · mn
Basic rack addendum	haP1	1 · mn
Tip alteration	k1	0.0625 · mn
Tip alteration	k1	0.5000 mm
Basic rack dedendum	hfP2	1.4 · mn
Basic rack root radius	pfP2	0.39 · 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	α1	11.500 10 <sup>-6</sup> /°C
Material type		Eh
Material quality		MQ
Case hardness	HRC	60
Core hardness	HRC	30
Limiting tooth root stress	sigFlim1	500.000 MPa
Limiting contact stress	sigHlim1	1500.0 MPa

# MESYS Shaft and Rolling Bearing Calculation

Change this text in mesys.ini

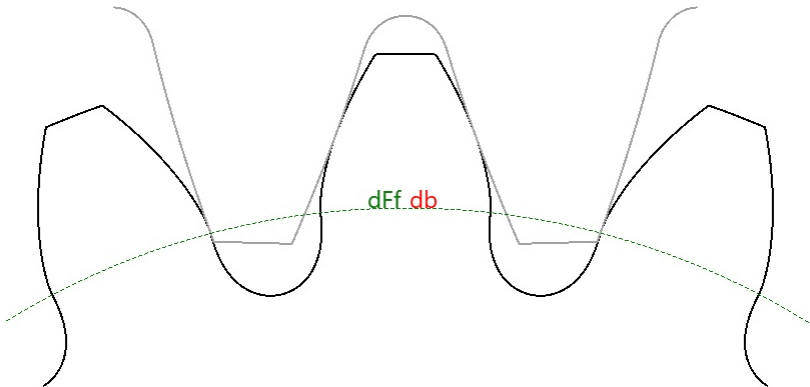
Material gear 2		Own Input	
Youngs modulus	E2	206000 MPa	
Poisson number	nu2	0.3	
Thermal elongation coefficient	$\alpha 2$	11.500 10 <sup>-6</sup> /°C	
Material type		Eh	
Material quality		MQ	
Case hardness	HRC	60	
Core hardness	HRC	30	
Limiting tooth root stress	sigFlim2	500.000 MPa	
Limiting contact stress	sigHlim2	1500.0 MPa	
<b>Loading</b>			
Required life	H	50000.0 h	
Application factor	KA	1	
Speed	n1	360.000 rpm	
Torque	T1	9000.0 Nm	
Power	P	339292 W	
<b>Strength calculation</b>			
Mesh load factor	Ky	1	
Bearing span	l	100.000 mm	
Offset of pinion center	s	0.0000 mm	
Pinion shaft diameter	dsh	100.000 mm	
Pinion shaft inner diameter	dshi	0.0000 mm	
Stiffening by pinion		No	
Profile modifications compensate deflections		No	
Limited pitting allowable		No	
Flank modification (fZCa)		None	
Contact pattern		Unproven	
Helix modification		None	
Required safety factor root	SFmin	1	
Required safety factor flank	SHmin	1	
		<b>Gear 1</b>	<b>Gear 2</b>
Tip relief	Ca	0.07	0.07 mm
Root relief	Cf	0	0 mm
Surface roughness flank	RzH	0.006	0.006 mm
Surface roughness root	RzF	0.018	0.018 mm
Web thickness	bs	0	0 mm
Number of meshes	NM	1	1
Reversed bending		No	No
Life factor limit root	YNTlim	0.85	0.85
Life factor limit flank	ZNTlim	0.85	0.85

## Results

### Geometry

# MESYS Shaft and Rolling Bearing Calculation

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		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	154.6000	878.4000 mm
Tip diameter	da.i	154.6000	878.4000 mm
Root diameter	df.s	114.7627	839.5625 mm
Root diameter	df.i	114.7627	839.5625 mm
Root form diameter	dFf.s	127.8101	845.5156 mm
Root form diameter	dFf.i	127.8101	845.5156 mm
Normal tooth thickness	sn.s	12.9896	11.8248 mm
Normal tooth thickness	sn.i	12.9896	11.8248 mm
Normal tooth thickness at tip	san.s	4.2291	6.3761 mm
Normal tooth thickness at tip	san.i	4.2291	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
Contact diameter for base tangent length	dMWk.i	133.25	859.80 mm
Measurement ball diameter	DM	17.0000	13.0000 mm
Radial single ball distance	MrK.s	82.901	439.218 mm
Radial single ball distance	MrK.i	82.901	439.218 mm
Distance over two balls	MdK.s	165.168	878.437 mm
Distance over two balls	MdK.i	165.168	878.437 mm
Distance over two pins	MdR.s	165.168	878.437 mm
Distance over two pins	MdR.i	165.168	878.437 mm
Contact diameter for ball distance	dMBall.s	140.85	861.02 mm
Contact diameter for ball distance	dMBall.i	140.85	861.02 mm
Transverse contact ratio	$\epsilon\alpha.s$	1.6992	

# MESYS Shaft and Rolling Bearing Calculation

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		Gear 1	Gear 2
Transverse contact ratio	$\epsilon_{\alpha.i}$	1.6992	
Overlap contact ratio	$\epsilon_{\beta}$	0.0000	
Total contact ratio	$\epsilon_{\gamma.s}$	1.6992	
Total contact ratio	$\epsilon_{\gamma.i}$	1.6992	
Working center distance	$a_{w.s}$	500.0000	mm
Working center distance	$a_{w.i}$	500.0000	mm
Working transverse pressure angle	$\alpha_{wt.s}$	20.0000	°
Working transverse pressure angle	$\alpha_{wt.i}$	20.0000	°
Center distance for $\epsilon_{\alpha} = 1$	$a_{max.s}$	505.8859	mm
Center distance for $\epsilon_{\alpha} = 1$	$a_{max.i}$	505.8859	mm
Center distance for zero clearance	$a_{min.s}$	499.5611	mm
Center distance for zero clearance	$a_{min.i}$	499.5611	mm
Circumferential backlash at the reference circle	$j_{t.s}$	0.3184	mm
Circumferential backlash at the reference circle	$j_{t.i}$	0.3184	mm
Circumferential backlash at the working pitch circle	$j_{wt.s}$	0.3184	mm
Circumferential backlash at the working pitch circle	$j_{wt.i}$	0.3184	mm
Transverse backlash	$j_{bt.s}$	0.2992	mm
Transverse backlash	$j_{bt.i}$	0.2992	mm
Normal backlash	$j_{bn.s}$	0.2992	mm
Normal backlash	$j_{bn.i}$	0.2992	mm
Radial backlash	$j_{r.s}$	0.4374	mm
Radial backlash	$j_{r.i}$	0.4374	mm
Working pitch diameter	$d_{w.s}$	136.0000	864.0000 mm
Working pitch diameter	$d_{w.i}$	136.0000	864.0000 mm
Active root diameter	$d_{Nf.s}$	127.9757	851.0044 mm
Active root diameter	$d_{Nf.i}$	127.9757	851.0044 mm
Active tip diameter	$d_{Na.s}$	154.6000	878.4000 mm
Active tip diameter	$d_{Na.i}$	154.6000	878.4000 mm
Specific sliding at root	$\zeta_{f.s}$	-6.8324	-1.1673
Specific sliding at root	$\zeta_{f.i}$	-6.8324	-1.1673
Specific sliding at tip	$\zeta_{a.s}$	0.5386	0.8723
Specific sliding at tip	$\zeta_{a.i}$	0.5386	0.8723

## Tolerances

		Gear 1	Gear 2
Tolerance class ISO 1328-1	A	5	5
Single pitch tolerance	$f_pT$	8.5	9 $\mu m$
Cumulative pitch tolerance	$F_pT$	24	35 $\mu m$
Profile slope tolerance	$f_{H\alpha}T$	7.5	8 $\mu m$
Profile form tolerance	$ff_{\alpha}T$	9.5	9.5 $\mu m$

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		<b>Gear 1</b>	<b>Gear 2</b>
Profile tolerance, total	F $\alpha$ T	12	12 $\mu$ m
Helix slope tolerance	fH $\beta$ T	8	9 $\mu$ m
Helix form tolerance	ff $\beta$ T	9.5	11 $\mu$ m
Helix tolerance, total	F $\beta$ T	12	14 $\mu$ m
Tolerance class ISO 1328-2	R	41	41
Tooth-to-tooth radial composite tolerance	fidT	67	117 $\mu$ m
Total radial composite tolerance	FidT	75	133 $\mu$ m

## Strength

		<b>Gear 1</b>	<b>Gear 2</b>
Torque	T	9000.0000	57176.4706 Nm
Speed	n	360.0000	56.6667 rpm
Tip diameter	da	154.6000	878.4000 mm
Root diameter	df	115.2000	840.0000 mm
Root form diameter	dFf	127.8032	845.8736 mm
Transverse contact ratio	$\epsilon\alpha$	1.6992	
Overlap contact ratio	$\epsilon\beta$	0.0000	
Total contact ratio	$\epsilon\gamma$	1.6992	
Mean meshing stiffness	c $\gamma\alpha$	18.9455	N/mm/ $\mu$ m
Mean meshing stiffness	c $\gamma\beta$	16.1036	N/mm/ $\mu$ m
Misalignment due to deformations	fsh	16.5362	$\mu$ m
Misalignment due to manufacturing deviations	fma	12.0416	$\mu$ m
Dynamic factor	KV	1.0047	
Mesh load factor	K $\gamma$	1.0000	
Transverse load factor	KH $\alpha$	1.0000	
Face load factor	KH $\beta$	1.1752	
Elasticity factor	ZE	189.8117	
Zone factor	ZH	2.4946	
Helix angle factor	Z $\beta$	1.0000	
Contact ratio factor	Z $\epsilon$	0.8757	
Roughness factor	ZR	0.9638	0.9638
Velocity factor	Zv	0.9684	0.9684
Lubricant factor	ZL	1.0474	1.0474
Single pair tooth contact factor	ZB	1.0694	1.0000
Life factor for contact stress	ZNT	0.9101	0.9632
Nominal contact stress	$\sigma$ H0	1391.6747	MPa
Contact stress	$\sigma$ H	1617.1696	1512.2137 MPa
Pitting stress limit	$\sigma$ HG	1334.5225	1412.3948 MPa
Safety factor for pitting	SH	0.8252	0.9340
Transverse load factor	KF $\alpha$	1.0000	
Face load factor	KF $\beta$	1.1395	

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		Gear 1	Gear 2
Load distribution influence factor	$f_{\epsilon}$	1.0000	
Helix angle factor	$Y_{\beta}$	1.0000	
Tooth form factor	$Y_F$	1.7667	1.3585
Stress correction factor	$Y_S$	1.7164	2.0132
Rim thickness factor	$Y_B$	1.0000	1.0000
Relative notch sensitivity factor	$Y_{drelT}$	0.9905	0.9973
Relative surface factor	$Y_{RrelT}$	0.9639	0.9639
Deep tooth factor	$Y_{DT}$	1.0000	1.0000
Size factor	$Y_X$	0.9700	0.9700
Life factor for tooth root stress	$Y_{NT}$	0.8888	0.9223
Nominal tooth root stress	$\sigma_F0$	501.6884	452.4923 MPa
Tooth root stress	$\sigma_F$	574.3929	518.0673 MPa
Tooth root stress limit	$\sigma_{FG}$	823.0404	859.9896 MPa
Safety factor for tooth breakage	$S_F$	1.4329	1.6600