KISSsoft

Spline

12 Spline (DIN 5480)

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Description	KISSsoft example

KISSsoft Release 2024

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Contents

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1 Messages

ⓘ   Calculation is consistent.

2 Overview

Shaft   DIN 5480 - W 70.00x3.00x22x6f
Hub   DIN 5480 - N 70.00x3.00x22x7H

Drawing or article number:
Shaft: 0.000.0
Hub: 0.000.0

3 Tooth geometry

		---------- Shaft -----------	----------- Hub ---------
Normal module (mm)	[mn]	3.0000	
Normal Diametral Pitch (1/in)	[Pnd]	8.46667	
Reference diameter (mm)	[dB]	70.00	
Normal pressure angle (°)	[αn]	30.000	
Number of teeth	[z]	22	-22
Helix angle at reference circle (°)	[β]	0.0000	
Facewidth (mm)	[b]	100.00	100.00
Hand of gear		Spur gear	

4 Materials

Shaft

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

Hub

34 CrMo 4, Through hardened steel, alloyed, through hardened, ISO 6336-5 Figure 5/6 (MQ)

	---------- Shaft -----------	----------- Hub ---------
Surface hardness	HRC 61	HBW 238

5 Geometry

5.1 Reference profiles

Reference profile Gear 1

Reference profile		DIN 5480:2006 0.60 / 0.16 / 0.45 Hobbing
Dedendum coefficient	[hfP*]	0.600
Root radius factor	[ρfP*]	0.160
	[ρfPmax*]	0.760
Addendum coefficient	[haP*]	0.450
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	
Smallest radius of curvature, root rounding (mm)	[ρmin.e/i]	0.509 /0.510

Reference profile Gear 2

Reference profile		DIN 5480:2006 0.65 / 0.16 / 0.45 Shaping
Dedendum coefficient	[hfP*]	0.650

		---------- Shaft ------------------------ Hub ---------	
Root radius factor	[ρfP*]	0.160	
	[ρfPmax*]	0.710	
Addendum coefficient	[haP*]	0.450	
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	

5.1.1 Information on final machining

		---------- Shaft ------------------------ Hub ---------	
Dedendum reference profile	[hfP*]	0.600	0.650
Tooth root radius reference profile	[ρfP*]	0.160	0.160
Addendum reference profile	[haP*]	0.450	0.450
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

5.2 Basic data

		---------- Shaft ------------------------ Hub ---------	
Transverse module (mm)	[mt]	3.000	
Transverse pressure angle (°)	[αt]	30.000	
Base helix angle (°)	[βb]	0.000	
Sum of profile shift coefficients	[Σxi]	0.0000	
Profile shift coefficient	[x]	0.1167	-0.1167
Profile shift (x·m) (mm)	[x*m]	0.3501	-0.3501
Generating profile shift coefficient	[xE.e/i]	0.1066/0.1014	-0.1210/-0.1282
Normal space width at root circle (mm)	[efn]	2.634	2.370
(mm)	[efn.e/i]	2.637 /2.638	2.368 /2.365
Pitch on reference circle (mm)	[pt]	9.425	
Base pitch (mm)	[pbt]	8.162	
Transverse pitch on contact-path (mm)	[pet]	8.162	
Tooth height (mm)	[h]	3.150	3.300
Theoretical tip clearance (mm)	[c]	0.600	0.450
Effective tip clearance (mm)	[c.e/i]	0.730 /0.613	0.591 /0.480
Normal tooth thickness at tip circle (mm)	[san]	3.171	3.112
(mm)	[san.e/i]	3.256 /3.115	3.203 /3.073

5.3 Diameters and their allowances

		---------- Shaft ------------------------ Hub ---------	
Pitch diameter (mm)	[d]	66.000	-66.000
Base diameter (mm)	[db]	57.158	-57.158
Tip diameter (mm)	[da]	69.400	-64.000
Effective tip diameter (mm)	[da.e/i]	69.400 /69.210	-64.000 /-64.190
Tip diameter allowances (mm)	[Ada.e/i]	0.000 /-0.190	0.000 /-0.190
Root diameter (mm)	[df]	63.100	-70.600
Effective root diameter (mm)	[df.e/i]	63.040 /63.008	-70.626 /-70.669
Root diameter allowances (mm)	[Adf.e/i]	-0.061 /-0.092	-0.026 /-0.069
Root form diameter (mm)	[dFf]	63.718	-70.193
Effective root form diameter (mm)	[dFf.e/i]	63.665 /63.637	
Effective root form diameter (mm)	[dFf.e/i]		-70.219 /-70.263
(dFf2 calculated on the basis of the constructed involute.)			
Root diameter allowances in accordance with DIN 5480 -1, Table 5:			
Root form diameter (mm)	[dFf]	63.920	-69.480
Effective root form diameter (mm)	[dFf.e/i]	63.920 /63.889	-69.480 /-69.524
Active tip diameter (mm)	[dNa.e/i]	69.400 /69.210	-64.000 /-64.190
Active root diameter (mm)	[dNf.e/i]	64.000 /64.190	-69.400 /-69.210

6 Measurements for tooth thickness

		---------- Shaft ------------------------ Hub ---------	
Tolerance class		6	7
Tooth thickness tolerance		DIN 5480 f	DIN 5480 H

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Tolerance values acc. to DIN 5480-1 (mm)	[TG]	0.0280	0.0400
(mm)	[Tact]	0.0180	0.0250
(mm)	[Teff]	0.0100	0.0150
Number of teeth spanned	[k]	4.0000	-4.0000
Base tangent length (no backlash) (mm)	[Wk]	31.9898	-31.9898
Diameter of measuring circle (mm)	[dMWk.m]	65.4880	-65.5039
Theoretical diameter of ball/pin (mm)	[dm]	5.8253	5.3305
Effective diameter of ball/pin (mm)	[DMeff]	6.0000	5.5000
Measurement over balls, no backlash (mm)	[MRe/Mri-ball]	76.1835	-58.2371
Diametral measurement over pins, no backlash (mm)	[MRe/Mri-pin]	76.1835	-58.2371

6.1 Measurements according to DIN 5480:2006 (Actual)

---------- Shaft ------------------------ Hub ---------

Tooth thickness (mm)	[Smax/Smin]	5.082 /5.064	
Space width (mm)	[Emax/Emin]		5.1566/5.1316
Tooth thickness tolerance, normal section (mm)	[Tol.Smax/min]	-0.0350/ -0.0530	
Tooth space tolerance, normal section (mm)	[Tol.Emax/min]		0.0400/0.0150
Base tangent length (mm)	[Wk.Smax/Smin]	31.9594/ 31.9439	
Base tangent length (mm)	[Wk.Smax/Smin]		-32.0244/-32.0027
Diametral measurement over two balls (mm)	[MRe/Mri-ball]	76.1313/ 76.1044	
Diametral measurement over two balls (mm)	[MRe/Mri-ball]		-58.3152/-58.2664
Diametral measurement over pins (mm)	[MRe/Mri-pin]	76.1313/ 76.1044	
Diametral measurement over pins (mm)	[MRe/Mri-pin]		-58.3152/-58.2664

6.2 Measurements according to DIN 5480:2006 (Effective)

---------- Shaft ------------------------ Hub ---------

Tooth thickness (mm)	[Svmax/min]	5.0916/5.0816	
Space width (mm)	[Evmax/min]		5.1316/5.1166
Tooth thickness tolerance, normal section (mm)	[Tol.Svmax/min]	-0.0250/ -0.0350	
Tooth space tolerance, normal section (mm)	[Tol.Evmax/min]		0.0150/0.0000
Base tangent length (mm)	[Wk.Svmax/min]	31.9681/ 31.9594	
Base tangent length (mm)	[Wk.Svmax/min]		-32.0027/-31.9898
Diametral measurement over two balls (mm)	[MRe/Mri-ball]	76.1462/ 76.1313	
Diametral measurement over two balls (mm)	[MRe/Mri-ball]		-58.2664/-58.2371
Diametral measurement over pins (mm)	[MRe/Mri-pin]	76.1462/ 76.1313	
Diametral measurement over pins (mm)	[MRe/Mri-pin]		-58.2664/-58.2371

6.3 Circumferential backlash

Circumferential backlash, transverse section:		
-Theoretical, without form errors (mm)	[jt.act]	0.0930/0.0500
-Effective, with form errors (mm)	[jt.eff]	0.0500/0.0250
Normal backlash:		
-Theoretical, without form errors (mm)	[jn.act]	0.0805/0.0433
-Effective, with form errors (mm)	[jn.eff]	0.0433/0.0217
Radial backlash:		
-Theoretical, without form errors (mm)	[jr.act]	0.0403/0.0217
-Effective, with form errors (mm)	[jr.eff]	0.0217/0.0108

Note: Take the values in "Actual dimensions" into account when checking splines with individual measurements (base tangent length/ measurement over pins).

7 Toothing tolerances

---------- Shaft ------------------------ Hub ---------

According to	DIN 5480:2006		
Tolerance class	[Q-DIN 5480]	6	7
Total profile deviation (µm)	[Fa]	10.0	13.0
Total helix deviation (µm)	[Fb]	10.0	12.0

Single pitch deviation (µm)	[fp]	8.0	11.0
Total cumulative pitch deviation (µm)	[Fp]	18.0	25.0
Runout (µm)	[Fr]	50.0	50.0

8 Supplementary data

8.1 Moment of inertia

--------- Shaft ----------------------- Hub ---------

Moment of inertia (System referenced to wheel 1):
 calculation without consideration of the exact tooth shape

Single gears((da+df)/2...di) (kg*m²)	[J]	0.00147	0.00206

8.2 Mounting

Remark regarding mounting with clamping using small helix angle on shaft
Jamming at the earliest at 0.33·b, and at the latest at 0.66·b

Helix angle difference (°)	[β.min/max]	0.0217/0.0868

9 Modifications and determination of the tooth form

9.1 Data for the tooth form calculation

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

10 Remarks

10.1 Conventions

- Specifications with **.e/i** mean: Maximum value **.e** and Minimum value **.i**, taking all tolerances into account.
- Specifications with **.m** mean: Mean value within tolerance.

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