KISSsoft evaluation

File

Name : BevelGear 6 (Straight, Fig.1)
Description: KISSsoft example
Changed by : Raman Gupta on: 12.08.2011 at: 13:15:52

BEVEL-GEAR-CALCULATION (BEVEL-GEAR-PAIR)

Drawing or article number:
Gear 1: 0.000.0
Gear 2: 0.000.0

Calculation method Bevel gear DIN 3991
Geometry calculation according ISO 23509:2006, method 0
Standard, fig 1 (Tip, Pitch and Root apex in one point)
Determination of face and tooth angle according to DIN3971-fig.1 (differs from ISO23509).
Manufacture process: lapped
No spiral tooting

Power (kW)                                  [P]                         10.00
Speed (1/min)                                [n]              1450.0               362.5
Torque (Nm)                                  [T]                65.9               263.4
Gear driving (+) / driven (-)                                 +                   -
Application factor [KA]                         1.25
Required service life [H]                      20000.00

1. TOOTH GEOMETRY AND MATERIAL

Offset (Center dist.) (mm) [a]                         0.000
Axis angle (°) [Sigma]                                90.000
Normal module (in middle) (mm) 2.0000
Pressure angle at normal section (°) [alfn]                     20.000
Helix angle in the middle (°) [betm]                      0.0000
Hand of gear Spur gear
Number of teeth [z]            13                  52
Facewidth (mm) [b]            20.00               20.00
Facing head tip diameter (mm) [rc0]                     50.00
Face hobbing
Number of cutter blade groups [z0]                       5.00
Material 18CrNiMo7-6 18CrNiMo7-6
Surface hardness HRC 61 HRC 61
Tooth root strength at NL (N/mm²) [sigFadm]             430.00              430.00
Fatigue strength. tooth root stress (N/mm²) [sigFlim]        430.00              430.00
Strength against Hertzian pressure at NL (N/mm²) [sigHadm]     1500.00             1500.00
Fatigue strength for Hertzian pressure (N/mm²) [sigHlim]       1500.00             1500.00
Lubrication type oil injection lubrication
Kinem. viscosity oil at 40 °C (mm²/s) [nu40]                 96.00
Oil temperature (°C) [Ts]                        70.000

Overall transmission ratio [itot]                     -4.000
Tooth thickness modification factor [xsmn]             0.0300              -0.0300
Profile shift coefficient [itot]                     0.4000              -0.4000
Tip diameter outside (mm) [dae]            37.297             124.094
Reference diameter Middle (mm) [dm]             26.000             104.000
Tip diameter Middle (mm) [dam]             31.433             104.582
Root diameter Middle (mm) [dfm]             22.702             102.399
Tip diameter Inside (mm) [dai]             25.569              85.071
Reference diameter Middle (mm) [Re]             63.600             428.802
Length of reference cone outside (mm) [Re]            63.600             428.802
Length of reference cone middle (mm) [Re]            53.600             43.600
Length of reference cone inside (mm) [Ri]             43.600              43.600
Reference cone angle (°) [delta]             14.036              75.964

****** Virtual spur gear toothing ******
Pressure angle at normal section (°) [alfnv]                 20.000
Virtual centre distance (mm) [av]                   227.801
Number of teeth [zv]                                  13.400             214.401
Gear ratio [uv]                                          16.000
Reference diameter (mm) [dv]                         26.800              428.802
Base diameter (mm) [dbv]                              25.184              402.942
Tip diameter (mm) \(d_{av}\) 32.400 431.202
Operating pitch diameter (mm) \(d_{wp}\) 26.800 428.802
Root diameter (mm) \(d_{fv}\) 23.400 422.202

Virtual cylindrical gear (ISO10300, Annex A):
Transverse contact ratio \(e_{psva}\) 1.532
Overlap ratio \(e_{psvb}\) 0.000
Total contact ratio \(e_{psvg}\) 1.532
(DIN 3991: \(e_{psva} = 1.532, e_{psvb} = 0.000, e_{psvg} = 1.532\))

2. FACTORS OF GENERAL INFLUENCE

Nominal circum. force at pitch circle (N) \(F_{mt}\) 5065.9 5065.9
Circumferential speed pitch d.. (m/sec) \(v\) 1.97 1.97
Meshing stiffness (N:mm*µm) \(c_{g}\) 20.00
Dynamic factor \(K_{V}\) 1.01
Bearing application factor \(K_{Hbbe}\) 1.25
Width factor – flank \(K_{Hb}\) 1.88
- Tooth root \(K_{Fb}\) 1.88
- Scuffing \(K_{Gb}\) 1.88
Transverse coefficient – flank \(K_{Ha}\) 1.00
- Tooth root \(K_{Fa}\) 1.00
- Scuffing \(K_{Ga}\) 1.00
Helix angle coefficient scuffing \(K_{Gb}\) 1.00

3. TOOTH ROOT STRENGTH

Calculation of Tooth form coefficients according method: C
Tooth form factor \(Y_{F}\) 2.38 2.32
Stress correction factor \(Y_{S}\) 1.80 1.76
Contact ratio factor \(Y_{eps}\) 0.74
Helix angle factor \(Y_{bet}\) 1.00
Bevel gear factor (root) \(Y_{K}\) 1.00
Tooth root stress (N/mm²) \(\sigma_{FG}\) 1118.42 1062.27
Support factor \(Y_{drel}\) 1.003 0.998
Surface factor \(Y_{RrelT}\) 0.957 0.957
Size coefficient (Tooth root) \(Y_{X}\) 1.000 1.000
Finite life factor \(Y_{NT}\) 1.000 1.000
Limit strength tooth root (N/mm²) \(\sigma_{FG}\) 825.46 821.33
Safety for Tooth root stress \(S_{F}=\sigma_{FG}/\sigma_{F}\) 0.74 0.77

4. SAFETY AGAINST PITTING (TOOTH FLANK)

--- GEAR 1 -------- GEAR 2 -------
Zone factor \(Z_{H}\) 2.49
Elasticity coefficient (N,5/mm) \(Z_{E}\) 189.81
Contact ratio factor \(Z_{eps}\) 0.907
Helix angle factor \(Z_{bet}\) 1.000
Bevel gear factor (flank) \(Z_{K}\) 0.850
Effective flank pressure (N/mm²) \(\sigma_{H}\) 1929.94
Lubrication factor \(Z_{L}\) 0.963 0.963
Speed factor \(Z_{V}\) 0.964 0.964
Roughness factor \(Z_{R}\) 0.984 0.984
Material mating factor \(Z_{W}\) 1.000 1.000
Finite life factor \(Z_{NT}\) 1.000 1.000
Limit strength pitting (N/mm²) \(\sigma_{HG}\) 1371.39 1371.39
Safety for surface pressure at operating pitch circle \(S_{H}\) 0.71 0.71
Flank pressure (N/mm²) \(\sigma_{HB/D}\) 1991.21 1929.94
Safety for surface pressure \(S_{H}=\sigma_{HG}/\sigma_{HB/D}\) 0.69 0.71

5. STRENGTH AGAINST SCUFFING

Calculation method according DIN3990
Applicable circumferential force/facewidth (N/mm) \(w_{Bt}\) 705.096

6. ALLOWANCES FOR TOOTH THICKNESS

Tooth thickness deviation \(A_{s.e/i}\) \(-0.054 / -0.084 -0.130 / -0.190\)
Tooth thickness allowance (normal section) (mm) Own Input Own Input
### 9. DETERMINATION OF TOOTHFORM

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<td>Normal backlash</td>
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<td>(mm)</td>
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