B.1 Gear Calculations

11-07-2006 Spur Gears Component Generator (Version 10.0.0)

--- Guide
External Gearing - ANSI
Calculation of geometry: Calculates the center distance according to the diametral pitch, number of teeth, correction and helix direction
Distribution of Correction: User
Load calculation: Calculates the torque according to the power and speed
Method of Strength Calculation: Strength check calculation

--- Basic Parameters
Desired Gear Ratio = 16.5
Pressure Angle alpha = 20°
Addendum a* = 1 (= 0.0139 in)
Clearance c* = 0.25 (= 0.0035 in)
Root Fillet = 0.38 (= 0.0053 in)
Addendum of Basic Rack = 1.25 (= 0.0174 in)
Helix Angle beta = 0°
Diametral Pitch P = 72 /in
Center Distance aw = 2.1875 in
Product Center Distance a = 2.1875 in
Total Unit Correction = 0
Operating Pressure Angle alphaw = 20°
Circular Pitch p = 0.0436 in
Base Circular Pitch ptb = 0.041 in
Contact Ratio = 1.6447 (1.6447 + 0)

Precision Specification 10
Limit Deviation of Helix Angle Fb = 0.00135 in
Limit Deviation of Axis Parallelity fx = 0.00135 in
Limit Deviation of Axis Parallelity fy = 0.0007 in

--- Gear 1
Number of Teeth = 18
Unit Correction = 0.26 (= 0.0036 in)
Pitch Diameter d = 0.25 in
Base Circle Diameter db = 0.2349 in
Outside Diameter do = 0.285 in
Root Diameter df = 0.2225 in
Work Pitch Diameter dw = 0.25 in
Tooth Thickness s = 0.0244 in
Outside Tooth Thickness = 0.568 (= 0.0079 in)

Facewidth = 0.1875 in
Face width Ratio = 0.5
Chordal Thickness T = 0.0216 in

Chordal Thickness Height ht = 0.0136 in
Dimension Over (Between) Wires M = 0.3068 in

Wire Diameter dw = 0.03 in
Limit Circumferential Run-out Fr = 0.002 in
Limit Deviation of Axial Pitch fpt = ±0.00105 in
Limit Deviation of Basic Pitch fpb = ±0.001 in

--- Gear 2
Number of Teeth = 297
Unit Correction = -0.26 (= -0.0036 in)
Pitch Diameter d = 4.125 in
Base Circle Diameter db = 3.8762 in
Outside Diameter do = 4.1456 in
Root Diameter df = 4.0831 in
Work Pitch Diameter dw = 4.125 in
Tooth Thickness s = 0.0192 in
Outside Tooth Thickness = 0.837 (= 0.0116 in)
Facewidth = 0.125 in
Face width Ratio = 0.0303
Chordal Thickness T = 0.0169 in

Chordal Thickness Height ht = 0.0072 in
Dimension Over (Between) Wires M = 4.1751 in

Wire Diameter dw = 0.03 in
Limit Circumferential Run-out Fr = 0.002 in
Limit Deviation of Axial Pitch fpt = ±0.00105 in
Limit Deviation of Basic Pitch fpb = ±0.001 in

--- Load (Gear 1; Gear 2)
Power P = 0.0003; 0.0003 HP
Efficiency = 0.97
Speed n = 120; 7.2727 rpm
Torque Mk = 0.0131; 0.2102 lb ft
Tangential Force Ft = 1.2605 lb
Radial Force Fr = 0.4588 lb
Axial Force Fa = 0 lb
Normal Force Fn = 1.3414 lb
Circumferential Speed v = 0.1309 ft/s
Resonance Speed nE1 = 203904.13 rpm

Strength Check According to ANSI

Durability Lh = 8 hour

--- Material Values
&Material designation: T300 sst; 6061-T6
Endurance Limit Sn = 34800; 18000 psi
Surface Fatigue Strength Sfe = 43500; 28000 psi
Modulus of Elasticity in Tension [10^3] = 28000; 10500 psi
Poisson's Ratio = 0.25; 0.33

--- Factors for Bending
Overload Factor Ko = 1
Dynamic Factor Kv = 1.2
Mounting Factor Km = 1.4; 1.4
Load Factor Cl = 1
Gradient Factor Cg = 1
Surface Factor Cs = 0.8; 0.8
Reliability Factor kr = 0.814
Temperature Factor kt = 1
Mean Stress Factor kms = 1.4; 1.4
Geometry Factor J = 0.28; 0.5

--- Factors for Contact
Overload Factor Ko = 1
Dynamic Factor Kv = 1.2
Mounting Factor Km = 1.4; 1.4
Life Factor Cli = 1.451; 1.887
Reliability Factor Cr = 1; 0.8
Elastic Factor Cp = 1640
Geometry Factor I = 0.1515

--- Calculation Results
Factor of Safety from Tooth Breakage kn = 8.901; 6.727
Factor of Safety from Pitting kf = 1.82; 1.219

Strength Check - True