ARROW GEAR COMPANY

TANGENTIAL LOAD COEFFICIENTS FOR BEARING LOADS

The normal load on spiral bevel gear tooth surfaces may be resolved into three (3) components: (Wt) tangential; (Wx) axial and (Wr) radial.

The tangential and radial components act in a plane perpendicular to the gear axis and produce radial bearing loads. The axial component acts in a direction parallel to the axis producing thrust plus additional radial bearing loads.

The value of the axial and radial loads can be determined by multiplying the tangential load at mid face (Wtm) by the applicable coefficient (Kx) or (Kr) for the concave or convex load face of either the pinion (p) or the gear (g).

Fig. 24 is a table of coefficients (Kx) and (Kr) vs. gear ratios for 35° spiral bevel gears with 90° shaft angles and 20° pressure angle. Note the (+) values indicate forces tending to separate the two gears and the (-) values indicate forces drawing the gears into tighter mesh.

Fig. 24 - Tangential Load Coefficients for Bearing Loads

Coefficients for Spiral Bevel Gears:
Σ=90° Shaft Angle/ϕ=20° Pressure Angle/ψ=35° Spiral Angle

Load Face	Concave Pinion	Convex Gear	Convex Pinion	Concave Gear
Ratio Ng/np	Kxp=(Krg)	Kxg=(Krp)	Kxp=(Krg)	Kxg=(Krp)
1.0	.809	-.181	-.181	.809
1.1	.817	-.142	-.219	.800
1.2	.822	-.107	-.253	.790
1.3	.826	-.075	-.284	.779
1.4	.828	-.045	-.312	.769
1.5	.829	-.019	-.336	.758
1.6	.829	.006	-.358	.748
1.7	.829	.028	-.378	.738
1.8	.828	.048	-.396	.728
1.9	.827	.067	-.413	.719
2.0	.825	.084	-.428	.711
2.5	.815	.152	-.485	.673
3.0	.805	.200	-.524	.643
3.5	.795	.235	-.551	.620
4.0	.787	.261	-.572	.601
4.5	.780	.282	-.587	.586
5.0	.774	.298	-.599	.573
5.5	.768	.312	-.609	.562
6.0	.764	.323	-.618	.553
6.5	.760	.333	-.625	.546
7.0	.756	.341	-.630	.539
7.5	.753	.348	-.635	.533
8.0	.750	.354	-.640	.528
8.5	.747	.359	-.643	.523
9.0	.745	.364	-.647	.519
9.5	.743	.369	-.650	.515
10.0	.741	.372	-.653	.512

W_t = Tangential Load = $\frac{126050\ HP}{d\ RPMp}$

W_{tm} = Tangential Load at Mid-Face = $\frac{W_t}{\left[1-\frac{F}{d\sqrt{1+mg^2}}\right]}$

HP = Horsepower
d = Pinion Pitch Diameter
F = Face Width
mg = Ratio NG/NP
K_x = Axial Coefficient
K_r = Radial Coefficient
RPM_p = Pinion RPM
r_{mp} = pinion mean pitch radius
r_{mg} = gear mean pitch radius
$r_{mg} = r_{mp} \times mg$

W_x = Axial Load Component = $K_x W_{tm}$
W_r = Radial Load Component = $K_r W_{tm}$
$r_{mp} = \frac{d}{2} - \frac{F}{2\sqrt{2\,(1+mg)^2}}$

Fig. 25 - Normal Tooth Load Components

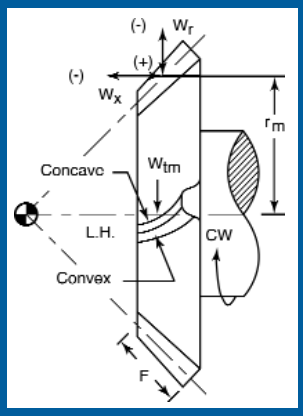

Fig. 26 - Normal Backlash at Tightest Point of Mesh

Diametral Pitch	Backlash
1	.020" to .030"
2	.012" to .016"
3	.008" to .011"
4	.006" to .008"
6	.004" to .006"
10	.002" to .004"
20 and Finer	.001" to .003"

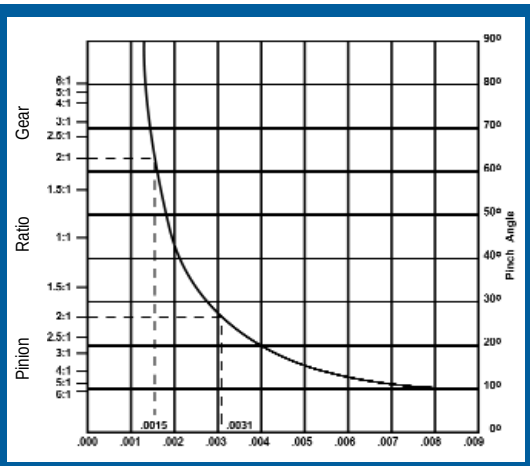

Fig. 27 - Axial Movement Per .001" Change in Backlash (Inches)