MITER AND BEVEL BEARS
TOOTH STRENGTH (Straight Tooth)

The beam strength of Miter and Bevel gears (straight tooth) may be calculated using the Lewis Formula revised to compensate for the differences between Spur and Bevel gears. Several factors are often combined to make allowance for the tooth taper and the normal overhung mounting of Bevel gears.

$$W = \frac{SFY}{P}\left(\frac{600}{600 + V}\right).75$$

W = Tooth Load, Lbs. (along the Pitch Line)
S = Safe Material Stress (static) Lbs. per Sq. In. (Table 1)
F = Face Width, In.
Y = Tooth Form Factor (Table I)
P = Diametral Pitch
D = Pitch Diameter
V = Pitch Line Velocity, Ft. per Min. = .262 x D x RPM

TABLE I VALUES OF SAFE STATIC STRESS (s)

Material		(s) Lb. per Sq. In.
Plastic		5000
Bronze		10000
Cast Iron		12000
Steel	.20 Carbon (Untreated)	20000
Steel	.20 Carbon (Case-hardened)	25000
Steel	.40 Carbon (Untreated)	25000
Steel	.40 Carbon (Heat-treated)	30000
Steel	.40 C. Alloy (Heat-treated)	40000

TABLE II TOOTH FORM FACTOR (Y)

20°P.A.—LONG ADDENDUM PINIONS SHORT ADDENDUM GEARS

No. Teeth Pinion	Ratio 1	Ratio 1.5		Ratio 2		Ratio 3		Ratio 4		Ratio 6	
	Pin. Gear	Pin.	Gear	Pin.	Gear	Pin.	Gear	Pin.	Gear	Pin.	Gear
12	—	—	—	.345	.283	.355	.302	.358	.305	.361	.324
14	—	.349	.292	.367	.301	.377	.317	.380	.323	.405	.352
16	.333	.367	.311	.386	.320	.396	.333	.402	.339	.443	.377
18	.342	.383	.328	.402	.336	.415	.346	.427	.364	.474	.399
20	.352	.402	.339	.418	.349	.427	.355	.456	.386	.500	.421
24	.371	.424	.364	.443	.368	.471	.377	.506	.405	—	—
28	.386	.446	.383	.462	.386	.509	.396	.543	.421	—	—
32	.399	.462	.396	.487	.402	.540	.412	—	—	—	—
36	.408	.477	.408	.518	.415	.569	.424	—	—	—	—
40	.418	—	—	.543	.424	.594	.434	—	—	—	—

HORSEPOWER AND TORQUE

Max. allowable torque (T) that should be imposed on a gear will be the safe tooth load (W) multiplied by $\frac{D}{2}$ or $T = \frac{W \times D}{2}$

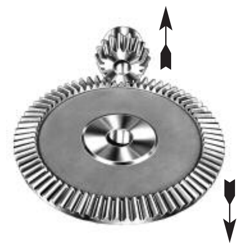
The safe horsepower capacity of the gear (at a given RPM) can be calculated from $HP = \frac{T \times RPM}{63{,}025}$ or directly from (W) and (V);

$$HP = \frac{WV}{33{,}000}$$

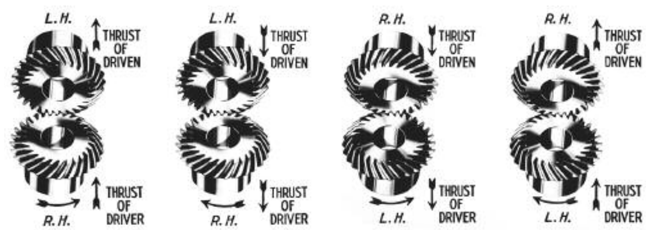
For a known HP, $T = \frac{63025 \times HP}{RPM}$

THRUST

The axial thrust loads developed by straight tooth miter and bevel gears always tend to separate the gears.



For Spiral Bevel and Miter Gears, the direction of axial thrust loads developed by the driven gears will depend upon the hand and direction of rotation. Stock Spiral Bevel pinions cut Left Hand only, Gears Right Hand only.



The magnitude of the thrust may be calculated from the formulae below, based on calculated HP, and an appropriate Thrust Bearing selected.

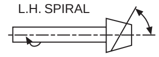
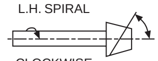
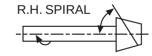
Straight Bevels and Miters

$$\text{Gear Thrust} = \frac{126{,}050 \times HP}{RPM \times \text{Pitch Diameter}} \times \tan\alpha \cos\beta$$

$$\text{Pinion Thrust} = \frac{126{,}050 \times HP}{RPM \times \text{Pitch Diameter}} \times \tan\alpha \sin\beta$$

Spiral Bevels and Miters

Thrust values for Pinions and Gears are given for four possible combinations.

R.H. SPIRAL  CLOCKWISE	$T_P = \frac{126{,}050 \times HP}{RPM \times D}\left(\frac{\tan\alpha \sin\beta}{\cos\gamma} - \tan\gamma \cos\beta\right)$
L.H. SPIRAL  C. CLOCKWISE	$T_G = \frac{126{,}050 \times HP}{RPM \times D}\left(\frac{\tan\alpha \cos\beta}{\cos\gamma} + \tan\gamma \sin\beta\right)$
L.H. SPIRAL  CLOCKWISE	$T_P = \frac{126{,}050 \times HP}{RPM \times D}\left(\frac{\tan\alpha \sin\beta}{\cos\gamma} + \tan\gamma \cos\beta\right)$
R.H. SPIRAL  C. CLOCKWISE	$T_G = \frac{126{,}050 \times HP}{RPM \times D}\left(\frac{\tan\alpha \cos\beta}{\cos\gamma} + \tan\gamma \sin\beta\right)$

α = Tooth Pressure Angle

β = 1/2 Pitch Angle

$$\text{Pitch Angle} = \tan^{-1}\left(\frac{N_P}{N_G}\right)$$

γ = Spiral Angle = 35°