ENGINEERING INFORMATION

WORMS AND WORM GEARS

WORM AND WORM GEAR FORMULAS

To Obtain	Having	Formula
Circular Pitch (p)	Diametral Pitch (P)	$p = \dfrac{3.1416}{P}$
Diametral Pitch (P)	Circular Pitch (p)	$P = \dfrac{3.1416}{p}$
Lead (of Worm) (L)	Number of Threads in Worm & Circular Pitch (p)	$L = p(\text{No. of Threads})$
Addendum (a)	Diametral Pitch (P)	$a = \dfrac{1}{P}$
Pitch Diameter (D) of Worm (D_W)	Outside Diameter (d_o) & Addendum (a)	$D_W = d_o - 2a$
Pitch Diameter of Worm Gear (D_G)	Circular Pitch (p) & Number of Teeth (N)	$D_G = \dfrac{N_G p}{3.1416}$
Center Distance Between Worm & Worm Gear (CD)	Pitch Diameter of Worm (d_w) & Worm Gear (D_G)	$CD = \dfrac{d_w + D_G}{2}$
Whole Depth of Teeth (h_T)	Circular Pitch (p)	$h_T = .6866\, p$
	Diametral Pitch (P)	$h_T = \dfrac{2.157}{P}$
Bottom Diameter of Worm (D_r)	Whole Depth (h_T) & Outside Diameter (d_w)	$d_r = d_o - 2h_T$
Throat Diameter of Worm Gear (D_T)	Pitch Diameter of Worm Gear (D) & Addendum (a)	$D_T = D_G + 2a$
Lead Angle of Worm (γ)	Pitch Diameter of Worm(D) & The Lead (L)	$\gamma = \tan^{-1}\left(\dfrac{L}{3.1416d}\right)$
Ratio	No. of Teeth on Gear (N_G) and Number of Threads on Worm	$\text{Ratio} = \dfrac{N_G}{\text{No. of Threads}}$
Gear O.D. (D_O)	Throat Dia. (D_T) and Addendum (a)	$D_O = D_T + .6a$

SELF-LOCKING ABILITY

There is often some confusion as to the self-locking ability of a worm and gear set. Boston worm gear sets, under no condition should be considered to hold a load when at rest. The statement is made to cover the broad spectrum of variables effecting self-locking characteristics of a particular gear set in a specific application. Theoretically, a worm gear will not back drive if the friction angle is greater than the worm lead angle. However, the actual surface finish and lubrication may reduce this significantly. More important, vibration may cause motion at the point of mesh with further reduction in the friction angle.

Generally speaking, if the worm lead angle is less than 5°, there is reasonable expectation of self-locking. Again, no guarantee should be made and customer should be advised. If safety is involved, a positive brake should be used.

WORM GEAR BACK-DRIVING

This is the converse of self-locking and refers to the ability of the worm gear to drive the worm. The same variables exist, making it difficult to predict. However, our experience indicates that for a hardened worm and bronze gear properly manufactured, mounted and lubricated, back-driving capability may be expected, if the lead angle is greater than 11°. Again, no guarantee is made and the customer should be so advised.

RATING

The high rate of sliding friction that takes place at the mesh of the Worm and Gear results in a more complex method of rating these Gears as opposed to the other Gear types. Material factors, friction factors and velocity factors must all be considered and applied to reflect a realistic durability rating.

BOSTON GEAR®