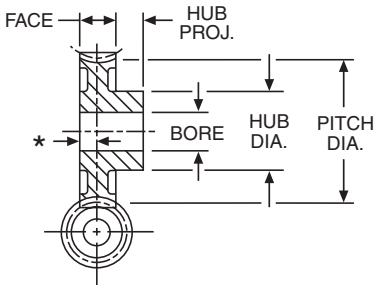
12 DIAMETRAL PITCH
BRONZE AND CAST IRON WORM GEARS
STEEL WORMS – UNHARDENED AND HARDENED

PRESSURE ANGLE – 14½°

RATIO = Gear Teeth ÷ Worm Threads
RH = RIGHT HAND — LH = LEFT HAND
All others stocked RIGHT HAND ONLY.

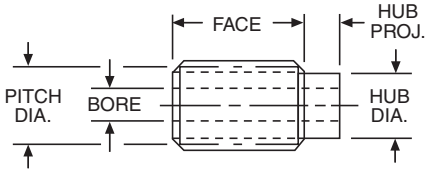


STANDARD TOLERANCES

DIMENSION		TOLERANCE
BORE	All	±.0005

WORM LEAD and LEAD ANGLE

	SINGLE	DOUBLE	QUAD
LEAD	.2618"	.5236"	1.0472"
LEAD ANGLE	4°46´	9°28´	18°26´



REFERENCE PAGES

Alterations — 149
Horsepower Ratings — 85, 86
Lubrication — 149
Materials — 150
Selection Procedure — 84

ALL DIMENSIONS IN INCHES
ORDER BY CATALOG NUMBER OR ITEM CODE

12 DIAMETRAL PITCH — WORM GEARS — FACE = .500" *CENTER LINE WORM TO FLUSH END = .250"

No. of Teeth	Pitch Dia.	Bore	Hub Dia.	Hub Proj.	Style See Page 150	SINGLE Thread Catalog Number	SINGLE Thread Item Code	DOUBLE Thread Catalog Number	DOUBLE Thread Item Code	QUAD Thread Catalog Number	QUAD Thread Item Code
BRONZE											
12	1.000	.5625	1.00	.62	A	–	–	–	–	QB1212†	13762
16	1.333	.6875	1.25	.62	A	–	–	–	–	QB1216†	13764
20	1.667	.500	1.25	.50	A	GB1050A	13626	DB1400	13714	DB1600	13766
30	2.500	.500	1.19	.62	B	GB1051	13628	–	–	–	–
		.750		.62	B	–	–	DB1401A	13716	DB1601A	13768
40	3.333	.625	1.44	.62	B	GB1052A	13630	–	–	–	–
		.750		.62	B	–	–	DB1402A	13718	DB1602A	13770
50	4.167	.625	1.44	.62	B	GB1053A	13632	–	–	–	–
		.750		.62	B	–	–	DB1403A	13720	DB1603A	13772
60	5.000	.625	1.69	.62	B	GB1260A	13634	–	–	–	–
		.750		.62	B	–	–	DB1260A	13722	QB1260A	13774
80	6.667	.625	1.94	.75	C	GB1054	13636	–	–	–	–
100	8.333	.750	1.94	.75	C	GB1055	13638	–	–	–	–
CAST IRON											
20	1.667	.500	1.25	.50	A	G1050ARH G1050ALH	13110 13112	D1400RH D1400LH	13260 13262	D1600	13352
30	2.500	.500	1.19	.62	B	G1051RH G1051LH	13114 13116	–	–	–	–
		.750		.62	B	–	–	D1401ARH D1401ALH	13264 13266	D1601A	13354
40	3.333	.625	1.44	.62	B	G1052ARH G1052ALH	13118 13120	–	–	–	–
		.750		.62	B	–	–	D1402ARH D1402ALH	13268 13270	D1602A	13356
50	4.167	.625	1.44	.62	B	G1053ARH G1053ALH	13122 13124	–	–	–	–
		.750		.62	B	–	–	D1403ARH D1403ALH	13272 13274	D1603A	13358
60	5.000	.625	1.69	.75	B	G1260RH G1260LH	13126 13128	–	–	–	–
		.750			B	–	–	D1260A	13276	Q1260A	13360
80	6.667	.625	1.94	.75	B	G1054	13130	–	–	–	–
		.750			B	–	–	D1404	13278	–	–
100	8.333	.750	1.94	.75	C	G1055	13134	–	–	–	–

12 DIAMETRAL PITCH — WORMS FOR ABOVE GEARS

Pitch Dia.	Face	Bore	Hub Dia.	Hub Proj.	SINGLE Thread Catalog Number	SINGLE Thread Item Code	DOUBLE Thread Catalog Number	DOUBLE Thread Item Code	QUAD Thread Catalog Number	QUAD Thread Item Code
UNHARDENED – STEEL										
1.000	1.125	.625	–	–	–	–	D1407KRH‡ D1407KLH‡	12806 12808	D1607KRH‡ D1607KLH‡	12822 12824
	1.625	.625	–	–	–	–	L1407‡	12912	–	–
		.500	–	–	L1056‡	12900	–	–	–	–
	1.125	.500	.75	.38	GH1056RH GH1056LH	12884 12886	DH1407RH DH1407LH	12838 12840	DH1607 –	12854 –
HARDENED – STEEL										
1.000	1.125	.625	–	–	–	–	H1407RH‡ H1407LH‡	12980 12982	H1607‡	12996 –
	1.625	.625	–	–	–	–	HL1407‡	13018	–	–
		.500	–	–	HL1056‡	13006	–	–	–	–
	1.125	.500	–	–	H1056RH‡ H1056LH‡	12962 12960	– –	– –	– –	– –

†.750" Face, Center Line Worm to Flush End = .375"
‡Furnished with .125" Keyway.
Hardened Worms have ground and polished threads.

GENERAL

MATERIALS

Boston Gear stock steel gears are made from a .20 carbon steel with no subsequent treatment. For those applications requiring increased wearability. Case-hardening produces a wear resistant, durable surface and a higher strength core. Carburizing and hardening is the most common process used. Several proprietary nitriding processes are available for producing an essentially distortion-free part with a relatively shallow but wear-resistant case. Boston stock worms are made of either a .20 or .45 carbon steel. Selection of material is based on size and whether furnished as hardened or untreated.

Stock cast iron gears are manufactured from ASTM-CLASS 30 cast iron to Boston Gear specifications. This provides a fine-grained material with good wear-resistant properties.

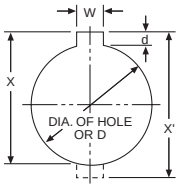
Bronze worm and helical gears are produced from several alloys selected for bearing and strength properties. Phosphor bronze is used for helicals and some worm gears (12P and coarser). Finer pitch worm gears are made from several different grades of bronze, dependent on size.

Non-metallic spur Gears listed in this Catalog are made from cotton reinforced phenolic normally referred to as Grade “C.”

Plastic Gears listed are molded from either Delrin®, Acetal or Minlon®.

STANDARD KEYWAYS AND SETSCREWS

Diameter of Hole	Standard		Recommended Setscrew
	W	d	
5/16 to 7/16”	3/32”	3/64”	10-32
1/2 to 9/16	1/8	1/16	1/4-20
5/8 to 7/8	3/16	3/32	5/16-18
15/16 to 1-1/4	1/4	1/8	3/8-16
1-5/16 to 1-3/8	5/16	5/32	7/16-14
1-7/16 to 1-3/4	3/8	3/16	1/2-13
1-13/16 to 2-1/4	1/2	1/4	9/16-12
2-5/16 to 2-3/4	5/8	5/16	5/8-11
2-13/16 to 3-1/4	3/4	3/8	3/4-10
3-5/16 to 3-3/4	7/8	7/16	7/8-9
3-13/16 to 4-1/2	1	1/2	1-8
4-9/16 to 5-1/2	1-1/4	7/16	1-1/8-7
5-9/16 to 6-1/2	1-1/2	1/2	1-1/4-6



FORMULA:

$$X = \sqrt{(D/2)^2 - (W/2)^2} + d + D/2$$

X’ = 2X – D

EXAMPLE:

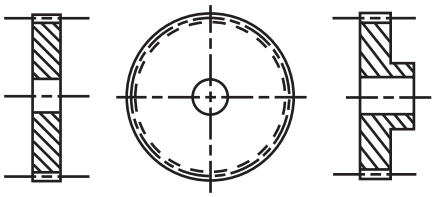
Hole 1”; Keyway 1/4” wide by 1/8” deep.

$$X = \sqrt{(1/2)^2 - (1/8)^2} + 1/8 + 1/2 = 1.109\text{”}$$

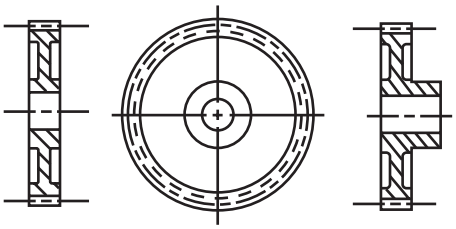
X’ = 2.218 – 1.000 = **1.218”**

STYLES

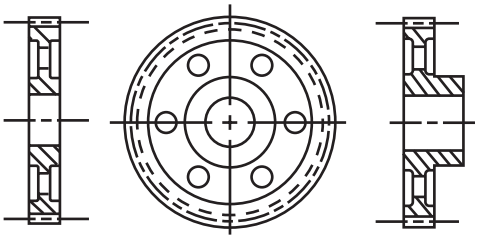
Boston Spur, Helical, and Worm Gears are carried in Plain, Web, or Spoke styles, as illustrated.



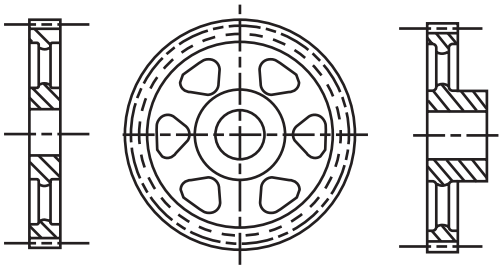
PLAIN – A



WEB – B



WEB WITH
LIGHTNING HOLES – C



SPOKE – D

ENGINEERING INFORMATION

HOW TO FIGURE HORSEPOWER AND TORQUE

TO OBTAIN	HAVING	FORMULA
Velocity (V) Feet Per Minute	Pitch Diameter (D) of Gear or Sprocket – Inches & Rev. Per Min. (RPM)	V = .2618 x D x RPM
Rev. Per Min. (RPM)	Velocity (V) Ft. Per Min. & Pitch Diameter (D) of Gear or Sprocket—Inches	$RPM = \frac{V}{.2618 \times D}$
Pitch Diameter (D) of Gear or Sprocket — Inches	Velocity (V) Ft. Per Min. & Rev. Per Min. (RPM)	$D = \frac{V}{.2618 \times RPM}$
Torque (T) In. Lbs.	Force (W) Lbs. & Radius (R) Inches	T = W x R
Horsepower (HP)	Force (W) Lbs. & Velocity (V) Ft. Per Min.	$HP = \frac{W \times V}{33000}$
Horsepower (HP)	Torque (T) In. Lbs. & Rev. Per Min. (RPM)	$HP = \frac{T \times RPM}{63025}$
Torque (T) In. Lbs.	Horsepower (HP) & Rev. Per Min. (RPM)	$T = \frac{63025 \times HP}{RPM}$
Force (W) Lbs.	Horsepower (HP) & Velocity (V) Ft. Per Min.	$W = \frac{33000 \times HP}{V}$
Rev. Per Min. (RPM)	Horsepower (HP) & Torque (T) In. Lbs.	$RPM = \frac{63025 \times HP}{T}$

POWER is the rate of doing work.

WORK is the exerting of a FORCE through a DISTANCE. ONE FOOT POUND is a unit of WORK. It is the WORK done in exerting a FORCE OF ONE POUND through a DISTANCE of ONE FOOT.

THE AMOUNT OF WORK done (Foot Pounds) is the FORCE (Pounds) exerted multiplied by the DISTANCE (Feet) through which the FORCE acts.

THE AMOUNT OF POWER used (Foot Pounds per Minute) is the WORK (Foot Pounds) done divided by the TIME (Minutes) required.

$$\text{POWER (Foot Pounds per Minute)} = \frac{\text{WORK (Ft. Lbs.)}}{\text{TIME (Minutes)}}$$

POWER is usually expressed in terms of HORSEPOWER.

HORSEPOWER is POWER (Foot Pounds per Minute) divided by 33000.

$$\text{HORSEPOWER (HP)} = \frac{\text{POWER (Ft. Lbs. per Minute)}}{33000}$$

$$= \frac{\text{WORK (Ft. Pounds)}}{33000 \times \text{TIME (Min.)}}$$

$$= \frac{\text{FORCE (Lbs.)} \times \text{DISTANCE (Feet)}}{33000 \times \text{TIME (Min.)}}$$

$$= \frac{\text{FORCE (Lbs.)} \times \text{DISTANCE (Feet)}}{33000 \times \text{TIME (Min.)}}$$

Cut on Dotted Lines
and Keep for Quick Reference

APPLICATION FORMULAS

1 hp = 36 lb-in. @ 1750 rpm
1 hp = 3 lb-ft. @ 1750 rpm

$$hp = \frac{\text{Torque (lb.-in.)} \times \text{rpm}}{63{,}025}$$

$$hp = \frac{\text{Force (lb)} \times \text{Velocity (ft/min.)}}{33{,}000}$$

Velocity (ft/min.) = 0.262 x Dia. (in.) x rpm
Torque (lb.-in) = Force (lb) x Radius (in.)

$$\text{Torque (lb.-in.)} = \frac{\text{hp} \times 63{,}025}{\text{rpm}}$$

$$\text{Mechanical Efficiency} = \frac{\text{Output hp}}{\text{Input hp}} \times 100\%$$

$$\text{Output hp} = \frac{\text{OT (lb-in.)} \times \text{Output rpm}}{63{,}025}$$

OT = Input Torque x Ratio x Efficiency
OT = Output Torque

$$\text{Output rpm} = \frac{\text{Input rpm}}{\text{Ratio}}$$

$$OHL = \frac{2\,TK}{D}$$

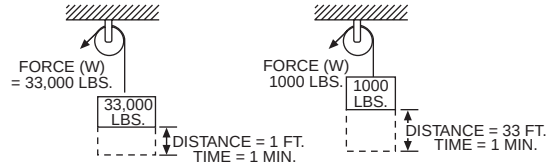
OHL = Overhung Load (lb)
T = Shaft Torque (lb-in.)
D = PD of Sprocket, Pinion or Pulley (in.)
K = Overhung Load Factor

Overhung Load Factors:

Sprocket or Timing Belt	1.00
Pinion & Gear Drive	1.25
Pulley & V-Belt Drive	1.50
Pulley & Flat Belt Drive	2.50
Variable Pitch Pulley	3.50

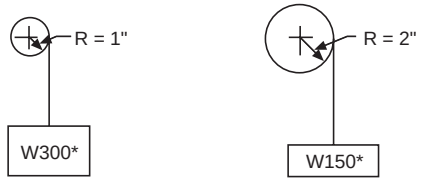
kW = hp x 0.7457
in. = mm/25.4
Temp. °C = (°F - 32) x 0.556
Temp. °F = (°C x 1.8) + 32
Torque (lb-in.) = 86.6 x kg•m
Torque (lb-in.) = 8.85 x N•m
Torque (lb-in.) = 88.5 x daN•m

ILLUSTRATION OF HORSEPOWER



$$HP = \frac{33{,}000 \times 1}{33{,}000 \times 1} = 1\ HP \qquad HP = \frac{1000 \times 33}{33{,}000 \times 1} = 1\ HP$$

TORQUE (T) is the product of a FORCE (W) in pounds, times a RADIUS (R) in inches from the center of shaft (Lever Arm) and is expressed in Inch Pounds.



T=WR=300 x 1=300 In. Lbs. T=WR=150 x 2=300 In. Lbs.

If the shaft is revolved, the FORCE (W) is moved through a distance, and WORK is done.

$$\text{WORK (Ft. Pounds)} = W \times \frac{2\pi R}{12} \times \text{No. of Rev. of Shaft.}$$

When this WORK is done in a specified TIME, POWER is used.

$$\text{POWER (Ft. Pounds per Min.)} = W \times \frac{2\pi R}{12} \times RPM$$

Since (1) HORSEPOWER = 33,000 Foot Pounds per Minute

$$\text{HORSEPOWER (HP)} = W \times \frac{2\pi R}{12} \times \frac{RPM}{33{,}000} = \frac{WxRxRPM}{63{,}025}$$

but TORQUE (Inch Pounds) = FORCE (W) X RADIUS (R)

$$\text{Therefore HORSEPOWER (HP)} = \frac{\text{TORQUE (T)} \times RPM}{63{,}025}$$