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	$RMP = \frac{V}{.268 \times D}$
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)	$HP = \frac{T \times TPM}{63025}$
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 (TP) In. Lbs.	$RPM = \frac{63025 \times H^{P}}{T}$

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 33,000.

$$\text{HORSEPOWER (HP)} = \frac{\text{POWER (Ft. Lbs. per Minute)}}{33{,}000}$$

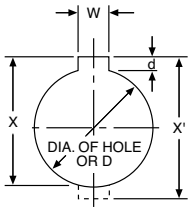
$$= \frac{\text{WORK (Ft. Pounds)}}{33{,}000 \times \text{TIME (Min.)}}$$

$$= \frac{\text{FORCE (Lbs.)} \times \text{DISTANCE (Feet)}}{33{,}000 \times \text{TIME (Min.)}}$$

$$\text{HORSEPOWER (HP)} = \frac{\text{FORCE (Lbs.)} \times \text{DISTANCE (Feet)}}{33{,}000 \times \text{TIME (Min.)}}$$

STANDARD KEYWAYS & SETSCREW

Diam. of Hole	Standard Keyway W	Standard Keyway D	Recommended Setscrew
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 to2-1/4	1/2	1/4	9/16–12
2-5/16 to 20-3/4	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:

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

$$X^1 = 2X - D$$

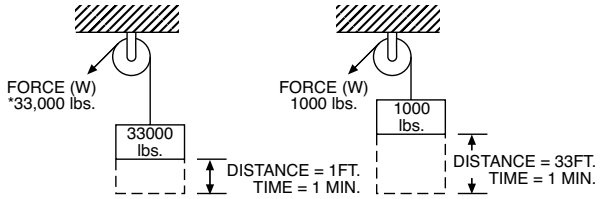
EXAMPLE:

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

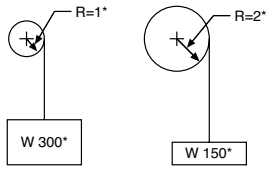
$$X = \sqrt{(1/2)^2 - (1/8)^2} + 1/8 + 1/2 = 1.109"$$

$$X^1 = 2.218 - 1.000 = \mathbf{1.218"}$$

ILLUSTRATION OF HORSEPOWER



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

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

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

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

I

General

Mounting

SPUR & HELICAL

For proper functioning gears, gears must be accurately aligned and supported by a shaft and bearing system which maintains alignment under load. Deflection should not exceed .001 inch at the tooth mesh for general applications. The tolerance on Center Distance normally should be positive to avoid possibility of gear teeth binding. Tolerance value is dependent on acceptable system backlash. As a guide for average application, this tolerance might vary from .002 for Boston Gear's fine pitch gears to .005 for the coarsest pitch.

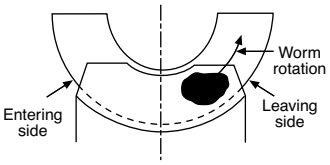
WORMS AND WORM GEAR

It is important that the mounting assures the central plane of the Worm gear passes essentially through the axis of the Worm. This can be accomplished by adjusting the Worm Gear axially. Boston Worm Gears are cut to close toleranc-ing of the Center Line of the Gear tooth to the flush side of the Gear. When properly mounted Worm Gears will become more efficient after initial break-in period.

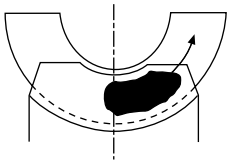
HOW WORM GEARS "ADJUST" THEMSELVES

The gear in a worm gear reducer is made of a soft bronze material. Therefore, it can cold-work and wear-in to accommodate slight errors in misalignment.

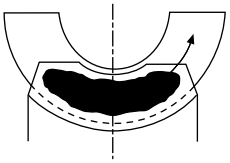
Evolution of Contact in a Worm Gear



Initially, contact is concentrated on the leaving side of the worm.



After several hours or running under load, gear has cold-worked to spread area of contact.



After many hours of operation, contact has spread to cover the entire working area of the tooth.

Alterations

Boston Gear Service Centers are equipped to alter catalog sprockets (rebore, keyway, setscrew, etc.). For customers, choosing to make their own alterations, the guidelines listed below should be beneficial. Alterations to hardened gears should not be made without consultation with factory.

In setting up for reboring the most important consideration is to preserve the accuracy of concentricity and lateral runout provided in the original product. There are several methods for accomplishing this. One procedure is: mount the part on an arbor, machine hub diameter to provide a true running surface, remove from arbor and chuck on the hub diameter, check face and bore runout prior to reboring. As a basic rule of thumb, the maximum bore should not exceed 60% of the Hub Diameter and depending on Key size should be checked for minimum wall thickness. A minimum of one setscrew diameter over a keyway is considered adequate.

Boston Gear offers a service for hardening stock sprockets. This added treatment can provide increased horsepower capacity with resultant longer life and/or reduction in size and weight.

Customers wishing to do the hardening operation should refer to "Materials" below for information.

Lubrication

The use of a straight mineral oil is recommended for most worm gear applications. This type of oil is applicable to gears of all materials, including non-metallic materials.

Mild E.P. (Extreme Pressure) lubricants may be used with Iron and Steel Gears. E.P. lubricants normally should be selected of the same viscosity as straight mineral oil, E.P. lubricants are not recommended for use with brass or bronze gears.

SAE80 or 90 gear oil should be satisfactory for splash lubricated gears. Where extremely high or low speed conditions are encountered, consult a lubricant manufac-turer. Oil temperature of 150°F should not be exceeded for continuous duty applications. Temperatures up to 200°F can be safely tolerated for short periods of time.

Many specialty lubricants have been recently developed to meet the application demands of today's markets, includ-ing synthetics and both high and low temperature oils and greases. In those instances where Bath or Drip Feed is not practical, a moly-Disulphide grease may be used successfully, for low speed applications.

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.

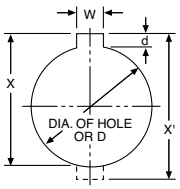
Bronze worm and helical gears are produced from several alloys selected for bearing and strength properties. Phosphor bronze is used for helicals and some worm gears (12P and coarser). Finer pitch worm gears are made from several different grades of bronze, dependent on size.

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:

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

$X^1 = 2X - D$

Example:

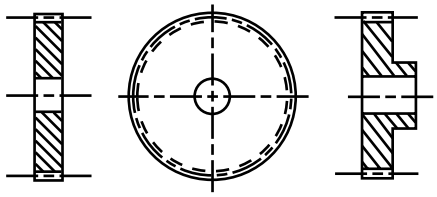
Hole 1"; Keyway 1/4" wide by 1/8" deep.

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

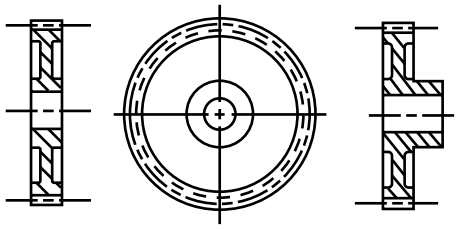
$X^1 = 2.218 - 1.000 =$ **1.218"**

Styles

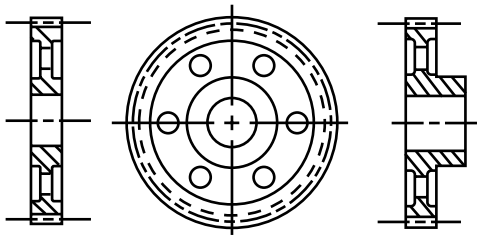
Boston Spur, Helical, and Worm Gears are carried in Plain, Web, or Spoke styles, as illustrated.



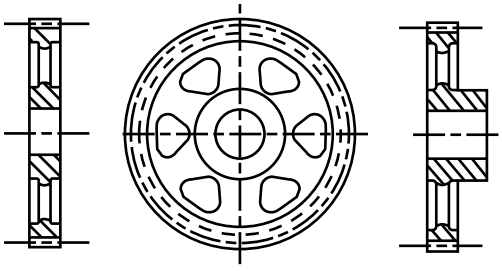
PLAIN – A



WEB – B



WEB WITH LIGHTNING HOLES – C



SPOKE – D

I

Sprockets

Alterations

Boston Gear Service Centers are equipped to alter catalog sprockets (rebore, keyway, setscrew, etc.). For customers, choosing to make their own alterations, the guidelines listed below should be beneficial. Alterations to hardened gears should not be made without consultation with factory.

In setting up for reboring the most important consideration is to preserve the accuracy of concentricity and lateral runout provided in the original product. There are several methods for accomplishing this. One procedure is: mount the part on an arbor, machine hub diameter to provide a true running surface, remove from arbor and chuck on the hub diameter, check face and bore runout prior to reboring. As a basic rule of thumb, the maximum bore should not exceed 60% of the Hub Diameter and depending on Key size should be checked for minimum wall thickness. A minimum of one setscrew diameter over a keyway is considered adequate.

Boston Gear offers a service for hardening stock sprockets. This added treatment can provide increased horsepower capacity with resultant longer life and/or reduction in size and weight.

Customers wishing to do the hardening operation should refer to “Materials” below for information.

Materials

Plastic

Plastic sprockets listed are molded from Nylatron GS.

Steel

Type B one-piece sprockets are furnished in a free-machining, low carbon steel.

Plate sprockets (Type A) and two-piece construction (Type B) are made of low carbon steel (basically AISI 1020).

1/4” pitch (Type B) up to 20 teeth is furnished from sintered metal powder conforming to ASTM-B-426-70 Grade 1, Type III with hardness of RB60 MIN.

Stainless Steel

1/4, 3/8 and 1/2” Pitches stock bore, single strand are furnished from 303 free-machining Stainless Steel.

Cast Iron

Block Chain Sprockets are furnished in Cast Iron for 9 through 12 teeth, which conforms to ASTM-A48-Class 30 Cast Iron, providing a fine-grained material with good wear resistant properties.

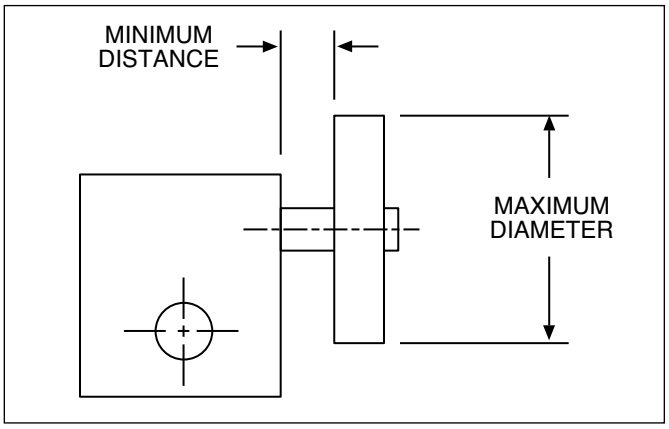
STANDARD KEYWAYS AND SETSCREWS

Diameter of Hole	Standard Keyway		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

Overhung Load

Overhung load is introduced on a shaft by the sprocket, gear, or belt from which the shaft is driven. A shaft driven by a properly installed flexible coupling would not have an overhung load.

The magnitude of the overhung load is determined by the load at the driving or driven member and the distance this member is from the nearest shaft support bearing. Overhung load will reduce the safe power transmission capacity of any shaft, therefore, every effort must be made to reduce this load. There are two ways to reduce this load (1) reduce the support distance or (2) increase the diameter of the driving and driven member. In most cases, increasing the size of a drive is not possible and therefore, all effort should be made to reduce the support distance.



FORMULA:

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

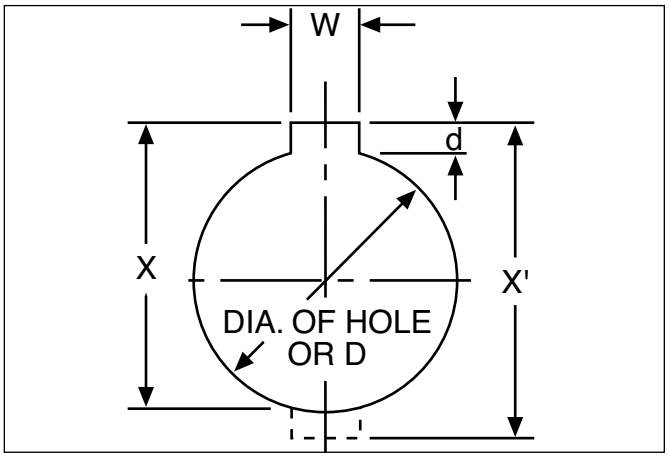
$X' = 2X - D$

EXAMPLE:

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

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

$X' = 2.218 - 1.000 = \mathbf{1.218"}$



Sprocket Diameters for ANSI Standard Series

Number of Teeth	1/4" Pitch–No. 25 .130" Roller Diameter			3/8" Pitch–No. 35 .200" Roller Diameter			1/2" Pitch–No. 40 .312" Roller Diameter			1/2" Pitch–No. 41 .306" Roller Diameter		
	Pitch Diameter	Outside Diameter	Bottom Diameter	Pitch Diameter	Outside Diameter	Bottom Diameter	Pitch Diameter	Outside Diameter	Bottom Diameter	Pitch Diameter	Outside Diameter	Bottom Diameter
9	0.731	0.83	0.601	1.096	1.26	0.896	1.462	1.67	1.149	1.462	1.67	1.156
10	0.809	0.91	0.679	1.214	1.38	1.014	1.618	1.84	1.305	1.618	1.84	1.312
11	0.887	1.00	0.757	1.331	1.50	1.131	1.775	2.00	1.462	1.775	2.00	1.469
12	0.966	1.08	0.836	1.449	1.63	1.249	1.932	2.17	1.619	1.932	2.17	1.626
13	1.045	1.16	0.915	1.567	1.75	1.367	2.089	2.33	1.776	2.089	2.33	1.783
14	1.124	1.24	0.994	1.685	1.87	1.485	2.247	2.49	1.934	2.247	2.49	1.941
15	1.203	1.32	1.073	1.804	1.99	1.604	2.405	2.65	2.092	2.405	2.65	2.099
16	1.282	1.40	1.152	1.922	2.11	1.722	2.563	2.81	2.250	2.563	2.81	2.257
17	1.361	1.48	1.231	2.041	2.23	1.841	2.721	2.98	2.408	2.721	2.98	2.415
18	1.440	1.56	1.310	2.160	2.35	1.960	2.879	3.14	2.566	2.879	3.14	2.573
19	1.519	1.64	1.389	2.278	2.47	2.078	3.038	3.30	2.725	3.038	3.30	2.732
20	1.598	1.72	1.468	2.397	2.59	2.197	3.196	3.46	2.883	3.196	3.46	2.890
21	1.678	1.80	1.548	2.516	2.71	2.316	3.355	3.62	3.042	3.355	3.62	3.049
22	1.757	1.88	1.627	2.635	2.83	2.435	3.513	3.78	3.200	3.513	3.78	3.207
23	1.836	1.96	1.706	2.754	2.95	2.554	3.672	3.94	3.359	3.672	3.94	3.366
24	1.915	2.04	1.785	2.873	3.07	2.673	3.831	4.10	3.518	3.831	4.10	3.525
25	1.995	2.12	1.865	2.992	3.19	2.792	3.989	4.26	3.676	3.989	4.26	3.683
26	2.074	2.20	1.944	3.111	3.31	2.911	4.148	4.42	3.835	4.148	4.42	3.842
27	2.154	2.28	2.024	3.230	3.43	3.030	4.307	4.58	3.994	4.307	4.58	4.001
28	2.233	2.36	2.103	3.349	3.55	3.149	4.466	4.74	4.153	4.466	4.74	4.159
30	2.392	2.52	2.262	3.588	3.79	3.388	4.783	5.06	4.470	4.783	5.06	4.477
31	2.471	2.60	2.341	3.707	3.91	3.507	4.942	5.22	4.629	4.942	5.22	4.636
32	2.551	2.68	2.421	3.826	4.03	3.626	5.101	5.38	4.789	5.101	5.38	4.794
33	2.630	2.76	2.500	3.945	4.15	3.745	5.260	5.54	4.947	5.260	5.54	4.954
34	2.710	2.84	2.580	4.064	4.27	3.864	5.419	5.70	5.106	5.419	5.70	5.113
35	2.789	2.92	2.659	4.183	4.39	3.983	5.578	5.86	5.265	5.578	5.86	5.272
36	2.869	3.00	2.739	4.303	4.51	4.103	5.737	6.02	5.424	5.737	6.02	5.431
38	3.028	3.16	2.898	4.541	4.75	4.341	6.055	6.33	5.742	6.055	6.33	5.749
39	3.107	3.24	2.977	4.660	4.87	4.460	6.214	6.49	5.901	6.214	6.49	5.908
40	3.187	3.32	3.693	5.734	5.95	5.534	7.645	7.93	7.332	7.645	7.93	7.339
41	3.266	3.40	3.136	4.899	5.11	4.699	6.532	6.81	6.219	6.532	6.81	6.226
42	3.346	3.48	3.216	5.018	5.23	4.818	6.691	6.97	6.378	6.691	6.97	6.385
44	3.505	3.64	3.375	5.257	5.47	5.057	7.009	7.29	6.696	7.009	7.29	6.703
45	3.584	3.72	3.454	5.736	5.59	5.176	7.168	7.45	6.855	7.168	7.45	6.862
48	3.823	3.96	3.693	5.734	5.95	5.534	7.645	7.93	7.332	7.645	7.93	7.339
52	4.141	4.28	4.011	6.211	6.43	6.011	8.281	8.57	7.968	8.281	8.57	7.975
54	4.300	4.44	4.170	6.449	6.66	6.249	8.599	8.89	8.286	8.599	8.89	8.294
56	4.459	4.60	4.329	6.688	6.90	6.488	8.917	9.20	8.605	8.917	9.20	8.611
60	4.777	4.92	4.647	7.165	7.38	6.965	9.554	9.84	9.241	9.554	9.84	9.246
64	5.095	5.23	4.965	7.643	7.86	7.443	10.190	10.48	9.877	10.190	10.48	9.883
65	5.175	5.31	5.045	7.762	7.98	7.562	10.349	10.64	10.036	10.349	10.64	10.044
66	5.254	5.39	5.124	7.881	8.10	7.681	10.508	10.80	10.195	10.508	10.80	10.202
70	5.572	5.71	5.442	8.358	8.58	8.158	11.145	11.43	10.832	11.145	11.43	10.840
72	5.732	5.87	5.602	8.597	8.81	8.397	11.463	11.75	11.150	11.463	11.75	11.156
80	6.368	6.51	6.238	9.552	9.77	9.352	12.736	13.03	12.423	12.736	13.03	12.430
84	6.686	6.83	6.556	10.029	10.25	9.829	13.372	13.66	13.059	13.372	13.66	13.067
96	7.641	7.78	7.511	11.461	11.68	11.261	15.281	15.57	14.969	15.281	15.57	14.976

Sprocket Diameters for ANSI Standard Series Hubs

No. of Teeth	5/8" Pitch–No. 50 .400" Roller Diameter			3/4" Pitch–No. 60 .468" Roller Diameter			1" Pitch–No. 80 .625" Roller Diameter		
	Pitch Diameter	Outside Diameter	Bottom Diameter	Pitch Diameter	Outside Diameter	Bottom Diameter	Pitch Diameter	Outside Diameter	Bottom Diameter
9	1.87	2.09	1.427	2.193	2.51	1.724	2.924	3.35	2.299
10	2.023	2.30	1.623	2.427	2.76	1.958	3.236	3.68	2.611
11	2.218	2.50	1.818	2.662	3.00	2.193	2.549	4.01	2.924
12	2.415	2.71	2.015	2.898	3.25	2.429	3.864	4.33	3.239
13	2.612	2.91	2.212	3.134	3.49	2.665	4.179	4.66	3.554
14	2.809	3.11	2.409	3.371	3.74	2.902	4.494	4.98	3.869
15	3.006	3.32	2.606	3.607	3.98	3.138	4.180	5.31	4.185
16	3.204	3.52	2.804	3.844	4.22	3.375	5.126	5.63	4.501
17	3.401	3.72	3.001	4.082	4.46	3.613	5.442	5.95	4.817
18	3.599	3.92	3.199	4.319	4.70	3.850	5.759	6.27	5.134
19	3.797	4.12	3.397	4.557	4.95	4.088	6.076	6.59	5.451
20	3.995	4.32	3.595	4.794	5.19	4.325	6.393	6.91	5.768
21	4.193	4.52	3.793	5.032	5.43	4.563	6.710	7.24	6.085
22	4.392	4.72	3.992	5.270	5.67	4.801	7.027	7.56	6.402
23	4.590	4.92	4.190	5.508	5.91	5.039	7.344	7.88	6.719
24	4.788	5.12	4.388	5.746	6.15	5.277	7.661	8.20	7.036
25	4.987	5.32	4.587	5.984	6.39	5.515	7.979	8.52	7.354
26	5.185	5.52	4.785	6.222	6.63	5.753	8.296	8.84	7.671
28	5.582	5.92	5.182	6.699	7.11	6.230	8.931	9.48	8.306
30	5.979	6.32	5.579	7.175	7.59	6.706	9.567	10.11	8.942
32	6.376	6.72	5.976	7.652	8.07	7.183	10.202	10.75	9.577
34	6.774	7.12	6.374	8.128	8.54	7.659	10.838	11.39	10.213
35	6.972	7.32	6.572	8.367	8.78	7.898	11.156	11.71	10.531
36	7.171	7.52	6.771	8.605	9.02	8.136	11.474	12.03	10.849
37	7.370	7.72	6.970	8.844	9.26	8.375	11.792	12.35	11.167
38	7.569	7.92	7.169	9.082	9.50	8.613	12.110	12.67	11.485
40	7.966	8.32	7.566	9.559	9.98	9.090	12.746	13.31	12.121
42	8.363	8.72	7.963	10.036	10.46	9.567	13.382	13.94	12.757
44	8.761	9.11	8.361	10.513	10.94	10.044	14.018	14.58	13.393
45	8.960	9.31	8.560	10.752	11.18	10.283	14.336	14.90	13.711
48	9.556	9.91	9.156	11.467	11.89	10.998	15.290	15.86	14.665
49	9.755	10.11	9.355	11.706	12.13	11.237	15.608	16.18	14.983
50	9.954	10.31	9.554	11.945	12.37	11.476	15.926	16.50	15.301
52	10.351	10.71	9.951	12.422	12.85	11.953	16.562	17.13	15.937
54	10.749	11.11	10349	12.899	13.33	12.430	17.198	17.77	16.573
56	11.147	11.50	10.747	13.376	13.81	12.907	17.835	18.41	17.210
60	11.942	12.30	11.542	13.330	14.76	13.861	19.107	19.68	18.482
64	12.738	13.10	12.338	15.285	15.72	14.816	20.380	20.96	19.755
70	13.931	14.29	13.531	16.717	17.15	16.248	22.289	22.87	21.664
72	14.329	14.69	13.929	17.194	17.63	16.725	22.926	23.50	22.301
76	15.124	15.49	14.724	18.149	18.58	17.680	24.199	24.78	23.574
80	15.920	16.28	15.520	19.103	19.54	18.634	25.471	26.05	24.846
84	16.715	17.08	16.315	20.058	20.49	19.589	26.744	27.33	26.119
90	17.909	18.27	17.509	21.490	21.93	21.021	28.654	29.24	28.029
96	19.102	19.47	18.702	22.922	23.36	22.453	30.563	31.15	29.938

Horsepower & Torque Capacity of Shafting

Diameter	Shaft Horsepower Based on Pure Torsion at 10,000 PSI Maximum Shear Stress							Torque Capacity (Lb. Ins.) Based on 10,000 PSI Shear Stress
	30	50	100	175	690	1150	1750	
3/8	0.049	0.082	0.164	0.287	1.13	1.88	2.87	103
7/16	0.078	0.130	0.261	0.456	1.79	2.99	4.56	164
1/2	0.117	0.194	0.389	0.681	2.68	4.47	6.80	245
9/16	0.166	0.277	0.554	0.969	3.82	6.36	9.69	349
5/8	0.228	0.380	0.760	1.32	5.24	8.73	13.2	479
11/16	0.303	0.506	1.01	1.76	6.97	11.6	17.6	637
3/4	0.394	0.656	1.31	2.29	9.05	15.0	22.9	827
13/16	0.501	0.834	1.66	2.92	11.5	19.1	29.2	1052
7/8	0.625	1.04	2.08	3.64	14.3	23.9	36.4	1314
15/16	0.769	1.28	2.56	4.48	17.6	29.4	44.3	1616
1	0.933	1.55	3.11	5.44	21.4	35.7	54.4	1961
1-1/16	1.12	1.86	3.73	6.53	25.7	42.9	65.3	2352
1-1/8	1.32	2.21	4.43	7.75	30.5	50.9	77.5	2792
1-3/16	1.56	2.60	5.21	9.11	35.9	59.9	91.1	3283
1-1/4	1.82	3.03	6.07	10.6	41.9	69.8	106	3830
1-5/16	2.11	3.51	7.03	12.3	48.5	80	123	4433
1-3/8	2.42	4.04	8.08	11.1	55.8	93	141	5097
1-7/16	2.77	4.62	9.24	16.1	63.7	106	161	5824
1-1/2	3.15	5.25	10.5	18.3	72.4	120	183	6618
1-9/16	3.56	5.93	11.8	20.7	81.8	136	207	7480
1-5/8	4.00	6.67	13.3	23.3	92.1	153	233	8414
1-11/16	4.48	7.47	14.9	26.1	103.1	171	261	9422
1-3/4	5.00	8.33	16.6	29.1	115.0	191	291	10509
1-13/16	5.55	9.26	18.5	32.4	127.8	213	324	11675
1-7/8	6.15	10.2	20.5	35.8	141.5	235	358	12925
1-15/16	6.78	11.3	22.6	39.6	156.1	260	396	14261
2	7.46	12.4	24.8	43.5	171.7	286	435	15686
2-1/16	8.18	13.6	27.2	47.7	188.3	313	477	17203
2-1/8	8.95	14.9	29.8	52.2	206.0	343	522	18815
2-3/16	9.77	16.2	32.5	56.9	224.7	374	569	20525
2-1/4	10.6	17.7	35.4	62.0	244.5	407	620	22335
2-5/16	11.5	19.2	38.4	67.3	265.4	442	673	24248
2-3/8	12.5	20.8	41.6	72.9	287.6	479	729	26268
2-7/16	13.5	22.5	45.0	78.8	310.9	518	788	29396
2-1/2	14.5	24.3	48.6	85.0	335.1	559	850	30637
2-9/16	15.7	26.1	52.3	91.6	361.2	602	916	32993
2-5/8	16.8	28.1	56.2	98.4	388.3	647	984	35466

The above table is computed based on a torsional stress of 10,000 PSI. For applications involving bending moments (gears, sprockets, etc.) the horsepower capacity must be reduced accordingly.

The stress level of 10,000 PSI is representative of medium carbon steel shafting. For other materials, a correction must be made accordingly.

Temperature Conversion Table

Degrees Celcius "C"; Degrees Fahrenheit "F"

Degree C.	Degree F.	Degree C.	Degree F.	Degree C.	Degree F.	Degree C.	Degree F.	Degree C.	Degree F.
–40	–40.0	8	46.4	56	132.8	104	219.2	152	305.6
–39	–38.2	9	48.2	57	134.6	105	221.0	153	307.4
–38	–36.4	10	50.0	58	136.4	106	222.8	154	309.2
–37	–34.6	11	51.8	59	138.2	107	224.6	155	311.0
–36	–32.8	12	53.6	60	140.0	108	226.4	156	312.8
–35	–31.0	13	55.4	61	141.8	109	228.2	157	314.6
–34	–29.2	14	57.2	62	143.6	110	230.0	158	316.4
–33	–27.4	15	59.0	63	145.4	111	231.8	159	318.2
–32	–25.6	16	60.8	64	147.2	112	233.6	160	320.0
–31	–23.8	17	62.6	65	149.0	113	235.4	161	321.8
–30	–22.0	18	64.4	66	150.8	114	237.2	162	323.6
–29	–20.2	19	66.2	67	152.6	115	239.0	163	325.4
–28	–18.4	20	68.0	68	154.4	116	240.8	164	327.2
–27	–16.6	21	69.8	69	156.2	117	242.6	165	329.0
–26	–14.8	22	71.6	70	158.0	118	244.4	166	330.8
–25	–13.0	23	73.4	71	159.8	119	246.2	167	332.6
–24	–11.2	24	75.2	72	161.6	120	248.0	168	334.4
–23	– 9.4	25	77.0	73	163.4	121	249.8	169	336.2
–22	– 7.6	26	78.8	74	165.2	122	251.6	170	338.0
–21	– 5.8	27	80.6	75	167.0	123	253.4	171	339.8
–20	– 4.0	28	82.4	76	168.8	124	255.2	172	341.6
–19	– 2.2	29	84.2	77	170.6	125	257.0	173	343.4
–18	– 0.4	30	86.0	78	172.4	126	258.8	174	345.2
–17	+ 1.4	31	87.8	79	174.2	127	260.6	175	347.0
–16	3.2	32	89.6	80	176.0	128	262.4	176	348.8
–15	5.0	33	91.4	81	177.8	129	264.2	177	350.6
–14	6.8	34	93.2	82	179.6	130	266.0	178	352.4
–13	8.6	35	95.0	83	181.4	131	267.8	179	354.2
–12	10.4	36	96.8	84	183.2	132	269.6	180	356.0
–11	12.2	37	98.6	85	185.0	133	271.4	181	357.8
–10	14.0	38	100.4	86	186.8	134	273.2	182	359.6
– 9	15.8	39	102.2	87	188.6	135	275.0	183	361.4
– 8	17.6	40	104.0	88	190.4	136	276.8	184	363.2
– 7	19.4	41	105.8	89	192.2	137	278.6	185	365.0
– 6	21.2	42	107.6	90	194.0	138	280.4	186	366.8
– 5	23.0	43	109.4	91	195.8	139	282.2	187	368.6
– 4	24.8	44	111.2	92	197.6	140	284.0	188	370.4
– 3	26.6	45	113.0	93	199.4	141	285.8	189	372.2
– 2	28.4	46	114.8	94	201.2	142	287.6	190	374.0
– 1	30.2	47	116.6	95	203.0	143	289.4	191	375.8
0	32.0	48	118.4	96	204.8	144	291.2	192	377.6
+ 1	33.8	49	120.2	97	206.6	145	293.0	193	379.4
2	35.6	50	122.0	98	208.4	146	294.8	194	381.2
3	37.4	51	123.8	99	210.2	147	296.6	195	383.0
4	39.2	52	125.6	100	212.0	148	298.4	196	384.8
5	41.0	53	127.4	101	213.8	149	300.2	197	386.6
6	42.8	54	129.2	102	215.6	150	302.0	198	388.4
7	44.5	55	131.0	103	217.4	151	303.8	199	390.2

Equivalent Table

FRACTION — DECIMAL — MILLIMETER

Fraction Inches	Inch Decimal Equivalent	Millimeter Equivalent	Fraction Inches	Inch Decimal Equivalent	Millimeter Equivalent
1/64	.0156	.397	33/64	.5156	13.097
1/32	.0312	.794	17/32	.5312	13.494
3/64	.0469	1.191	35/64	.5469	13.891
1/16	.0625	1.588	9/16	.5625	14.288
5/64	.0781	1.984	37/64	.5781	14.684
3/32	.0937	2.381	19/32	.5937	15.081
7/64	.1094	2.778	39/64	.6094	15.478
1/8	.1250	3.175	5/8	.6250	15.875
9/64	.1406	3.572	41/64	.6406	16.272
5/32	.1562	3.969	21/32	.6562	16.669
11/64	.1719	4.366	43/64	.6719	17.066
3/16	.1875	4.763	11/16	.6875	17.463
13/64	.2031	5.159	45/64	.7031	17.859
7/32	.2187	5.556	23/32	.7187	18.256
15/64	.2344	5.953	47/64	.7344	18.653
1/4	.2500	6.350	3/4	.7500	19.050
17/64	.2656	6.747	49/64	.7656	19.447
9/32	.2812	7.144	25/32	.7812	19.844
19/64	.2969	7.541	51/64	.7969	20.241
5/16	.3125	7.938	13/16	.8125	20.638
21/64	.3281	8.334	53/64	.8281	21.034
11/32	.3437	8.731	27/32	.8437	21.431
23/64	.3594	9.128	55/64	.8594	21.828
3/8	.3750	9.525	7/8	.8750	22.225
25/64	.3906	9.922	57/64	.8906	22.622
13/32	.4062	10.319	29/32	.9062	23.019
27/64	.4219	10.716	59/64	.9219	23.416
7/16	.4375	11.113	15/16	.9375	23.813
29/64	.4531	11.509	61/64	.9531	24.209
15/32	.4687	11.906	31/32	.9687	24.606
31/64	.4844	12.303	63/64	.9844	25.003
1/2	.5000	12.700	1	1.0000	25.400

MILLIMETER — INCHES

Millimeters	Inches
1	.0394
2	.0787
3	.1181
4	.1575
5	.1968
6	.2362
7	.2756
8	.3150
9	.3543
10	.3937
11	.4331
12	.4724
13	.5118
14	.5512
15	.5905
16	.6299
17	.6693
18	.7087
19	.7480
20	.7874
21	.8268
22	.8661
23	.9055
24	.9449
25	.9842
26	1.0236
27	1.0630
28	1.1024
29	1.1417
30	1.1811

Engineering Information

Metric Conversion Chart

Area

Multiply	By	To Obtain
Millimeters^2	.00155	inches^2
Centimeters^2	.155	inches^2
Meters^2	10.76	feet^2
Inches^2	645.16	millimeters^2
Inches^2	6.452	centimeters^2
Feet^2	929.03	centimeters^2
Feet^2	.0929	meters^2

Density

Multiply	By	To Obtain
lg/cm^3	.03613	lb/in^3
lg/cm^3	62.43	lb/in^3
lb/in^3	27.68	gr/cm^3
lb/ft^3	.016	g/cm^3
lb/ft^3	16.02	Kg/m^3

Power

Multiply	By	To Obtain
Joule/sec	.001341	Horsepower
Kilocalorie/hour	3.967	BTW/hour
Horsepower	.33000	ft-lb/min
Horsepower	746	watts
BTU/hour	.2521	kilocalorie/hour

Length

Multiply	By	To Obtain
Millimeter	.03937	inch
Centimeter	.3937	inch
Meter	39.37	inch
Inch	2.54	centimeter
Feet	30.48	centimeter
Feet	.3048	meter

Volume

Multiply	By	To Obtain
Centimeter^3	.0610	inches^3
Centimeter^3	.034	fluid ounce
Liter	61.02	inches^3
Liter	.0353	feet^3
Liter	.264	U.S. gallon
Inch^3	16.39	centimeter^3
Feet^3	28.32	liter
Gallon	3.785	liter

Weight

Multiply	By	To Obtain
Gram	.03527	ounce
Kilogram	35.27	ounce
Kilogram	2.205	pounds
Ounce	28.35	gram
Pound	453.6	grams

Torque

Multiply	By	To Obtain
Newton-meter	8.84	in-lb
in-lb	.113	Newton-meter

Velocity

Multiply	By	To Obtain
Centimeter/second	.3937	inches/second
Centimeter/second	1.969	feet/minute
Meter/second	3.281	feet/second
Meter/second	196.9	feet/minute
Meter/second	2.237	miles per hour
Inch/second	25.4	millimeters/second
Inch/second	2.54	centimeters/second
Foot/second	.3048	meters/second
Foot/minute	.00508	meters/second

BOSTON GEAR REGISTERED TRADEMARKS

BOSTON GEAR®

BOSTON®

BOStonE®

BOST-BRONZ®

BEAR-N-BRONZ®

Application Classification for Various Loads

Type of Machine To Be Driven	Chart I For All Drives – Service Factor Loading: Not More Than 15 Mins. in 2 Hrs.	Not More Than 10 Hrs. per Day	More Than 10 Hrs. Per Day
AGITATORS			
Pure Liquid	0.80	1.00	1.25
Semi-Liquids, Variable Density	1.00	1.25	1.50
BLOWERS			
Centrifugal and Vane	0.80	1.00	1.25
Lobe	1.00	1.25	1.50
BREWING AND DISTILLING			
Bottling Machinery	0.80	1.00	1.25
Brew Kettles–Continuous Duty	—	—	1.25
Cookers – Continuous Duty	—	—	1.25
Mash Tubs – Continuous Duty	—	—	1.25
Scale Hopper – Frequent Starts	—	1.25	1.50
CAN FILLING MACHINES	—	1.00	—
CANE KNIVES	—	1.50	—
CAR DUMPERS	—	1.75	—
CAR PULLERS	—	1.25	—
CLARIFIERS	—	1.00	1.25
CLASSIFIERS	—	1.25	1.50
CLAY WORKING MACHINERY			
Brick Press & Briquette Machine	—	1.75	2.00
Extruders and Mixers	1.00	1.25	1.50
COMPRESSORS			
Centrifugal	—	1.00	1.25
Lobe – Reciprocating, Multi-Cycle	—	1.25	1.50
Reciprocating – Single Cycle	—	1.75	2.00
CONVEYORS— UNIFORMLY LOADED & FED			
Apron	—	1.00	1.25
Assembly-Belt – Bucket or Pan	—	1.00	1.25
Chain – Flight	—	1.00	1.25
Oven – Live Roll – Screw	—	1.25	1.50
CONVEYORS—HEAVY DUTY NOT UNIFORMLY FED			
Apron	—	1.25	1.50
Assembly-Belt – Bucket or Pan	—	1.25	1.50
Chain – Flight	—	1.25	1.50
Live Roll	—	—	—
Oven – Screw	—	1.25	1.50
Reciprocating – Shaker	—	1.75	2.00
CRANES AND HOISTS			
Main Hoists			
Bridge and Trolley Drive	*	1.00	1.25
CRUSHER			
Ore, Stone	—	1.75	2.00
Sugar	—	1.50	1.50

Type of Machine To Be Driven	Chart I For All Drives – Service Factor Loading: Not More Than 15 Mins. in 2 Hrs.	Not More Than 10 Hrs. per Day	More Than 10 Hrs. Per Day
ELEVATORS			
Bucket – Uniform Load	—	1.00	1.25
Bucket – Heavy Load	—	1.25	1.50
Centrifugal Discharge	—	1.25	1.50
Freight	—	1.25	1.50
Gravity Discharge	—	1.00	1.25
FANS			
Centrifugal – Light (Small Diam.)	—	1.00	1.25
Large Industrial	—	1.25	1.50
FEEDERS			
Apron – Belt – Screw	—	1.25	1.50
Disc	—	1.00	1.25
Reciprocating	—	1.75	2.00
FOOD INDUSTRY			
Beet Slicer	—	1.25	1.50
Cereal Cooker	—	1.00	1.25
Dough Mixer – Meat Grinder	—	1.25	1.50
GENERATORS (NOT WELDING)	—	1.00	1.25
HAMMER MILLS	—	1.75	2.00
HOISTS			
Heavy Duty	—	1.75	2.00
Medium Duty and Skip Type	—	1.25	1.50
LAUNDRY TUMBLERS	—	1.25	1.50
LINE SHAFTS			
Uniform Load	—	1.00	1.25
Heavy Load	—	1.25	1.50
MACHINE TOOLS			
Auxiliary Drive	—	1.00	1.25
Main Drive – Uniform Load	—	1.25	1.50
Main Drive – Heavy Duty	—	1.75	2.00
METAL MILLS			
Draw Bench Carriers & Main Drive	—	1.25	1.50
SLITTERS	—	1.25	1.50
TABLE CONVEYORS — NON REVERSING			
Group Drives	—	1.25	1.50
Individual Drives	—	1.75	2.00
Wiring Drawing, Flattening or Winding	—	1.25	1.50
MILLS ROTARY TYPE BALL AND ROD			
Spur Ring Gear and Direct Connected	—	—	2.00
Cement Kilns, Pebble	—	—	1.50
Dryers and Coolers	—	—	1.50
Plain and Wedge Bar	—	—	1.50
Tumbling Barrels	—	—	2.00

Application Classification for Various Loads (Continued)

Type of Machine To Be Driven	Chart I For All Drives – Service Factor Loading: Not More Than 15 Mins. in 2 Hrs.	Not More Than 10 Hrs. per Day	More Than 10 Hrs. Per Day
MIXERS			
Concrete – Continuous	—	1.25	1.50
Concrete – Intermittent	—	1.25	1.50
Constant Density	—	1.00	1.25
Semi-Liquid	—	1.25	1.50
OIL INDUSTRY			
Oil Well Pumping	—	—	*
Chillers, Paraffin Filter Press	—	1.25	1.50
Rotary Kilns	—	1.25	1.50
PAPER MILLS			
Agitator (Mixer)	—	1.25	1.50
Agitator – Pure Liquids	—	1.00	1.25
Barking Drums – Mechanical			
Barkers	—	1.75	2.00
Bleacher	—	1.00	1.25
Beater	—	1.25	1.50
Calender Heavy Duty	—	—	2.00
Calender Anti-Friction Brgs.	—	1.00	1.25
Cylinders	—	1.25	1.50
Chipper	—	—	2.00
Chip Feeder	—	1.25	1.50
Coating Rolls – Couch Rolls	—	1.00	1.25
Conveyors – Chips – Bark – Chemical	—	1.00	1.25
Conveyors – Log and Slab	—	—	2.00
Cutter	—	—	2.00
Cylinder Molds, Dryers (Anti-Friction Brg.)	—	—	1.25
Felt Stretcher	—	1.25	1.50
Screens – Chip and Rotary	—	1.25	1.50
Thickener (AC)	—	1.25	1.50
Washer (AC)	—	1.25	1.50
Winder – Surface Type	—	—	1.25
PLASTICS INDUSTRY			
Intensive Internal Mixers			
Batch Type	—	—	1.75
Continuous Type	—	—	2.00
Batch Drop Mill – 2 Rolls	—	—	1.25
Compounding Mills	—	—	1.25
Calenders	—	—	1.50
Extruder – Variable Speed	—	—	1.50
Extruder – Fixed Speed	—	—	1.75
PULLERS			
Barge Haul	—	—	2.00

Type of Machine To Be Driven	Chart I For All Drives – Service Factor Loading: Not More Than 15 Mins. in 2 Hrs.	Not More Than 10 Hrs. per Day	More Than 10 Hrs. Per Day
PUMPS			
Centrifugal	—	—	1.25
Proportioning	—	—	1.50
Reciprocating			
Single Acting, 3 or more Cycles	—	1.25	1.50
Double Acting, 2 or more Cycles	—	1.25	1.50
Rotary – Gear or Lube	—	1.00	1.25
RUBBER INDUSTRY			
Batch Mixers	—	—	1.75
Continuous Mixers	—	—	1.50
Calenders	—	—	1.50
Extruders – Continuous	—	—	1.50
Extruders – Intermittent	—	—	1.75
Tire Building Machines	—	—	—
Tire & Tube Press Openers	—	—	—
SEWAGE DISPOSAL EQUIPMENT			
Bar Screens	—	1.00	1.25
Chemical Feeders	—	1.00	1.25
Collectors	—	1.00	1.25
Dewatering Screws	—	1.25	1.50
Scum Breakers	—	1.25	1.50
Slow or Rapid Mixers	—	1.25	1.50
Thickeners	—	1.25	1.50
Vacuum Filters	—	1.25	1.50
SCREENS			
Air Washing	—	1.00	1.25
Rotary – Stone or Gravel	—	1.25	1.50
Traveling Water Intake	—	1.00	1.25
SKIP HOISTS	—	—	—
SLAB PUSHERS	—	1.25	1.50
STOKERS	—	—	1.25
TEXTILE INDUSTRY			
Batchers or Calenders	—	1.25	1.50
Cards	—	1.25	1.50
Card Machines	—	1.75	2.00
Dry Cans and Dryers	—	1.25	1.50
Dyeing Machines	—	1.25	1.50
Looms	—	1.25	1.50
Mangles, Nappers and Pads	—	1.25	1.50
Soapers, Tenner Frames	—	1.25	1.50
Spinners, Washers, Winders	—	1.25	1.50
TUMBLING BARRELS	1.50	1.75	2.00
WINDLASS	—	1.25	1.50