Metals Technical Guide

Engineered for Performance

19994-B
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MATERIAL CONSIDERATIONS

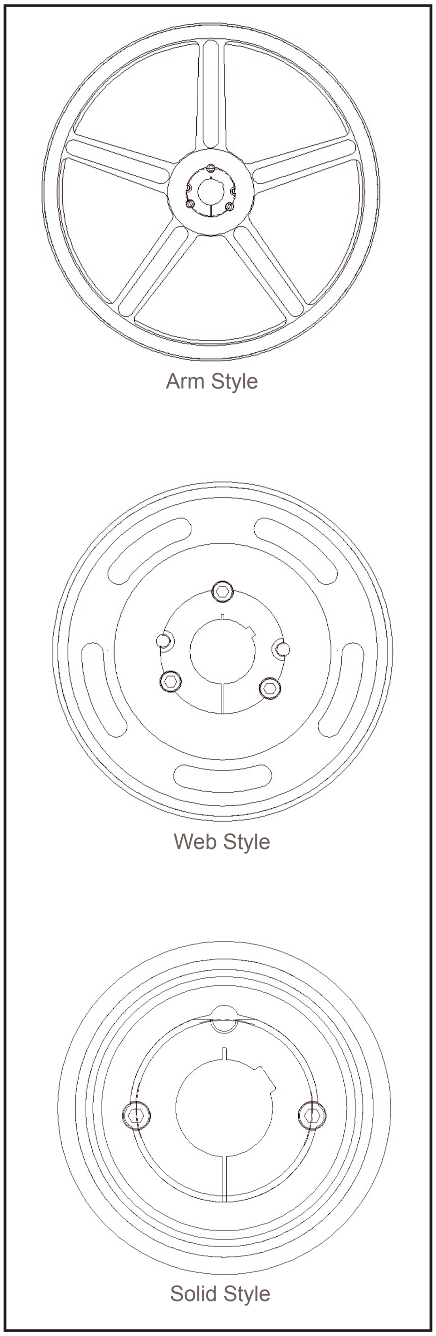


Figure 1 - Common Styles of Sprockets and Sheaves

Selecting the right material for a belt drive application involves many factors, including the cost effectiveness of the number of parts needed and the material performance required. Gates offers industrial sheaves, sprockets, bushings and related components in a variety of materials to meet the needs of each application. Most Gates stock products are made out of gray and ductile iron or sintered steel and are offered in a variety of different body styles, such as arm, web, or solid (See Figure 1).

Gray Iron

The most popular casting material used today, gray iron, contains a large amount of carbon in the form of gray graphite flakes. Properties of common varieties of gray iron are described in Table 1. For any application requiring rim speeds above 6,500 feet per minute (fpm), Gates recommends that sprockets or sheaves are specially ordered with appropriate materials and are dynamically balanced to ensure safe drive operation.

Gray iron's widespread use is due to the following characteristics:

- Machinability
- Wear resistance
- Dampening capacity
- Heat dissipation
- Low elasticity modulus
- Malleability

Common products that use gray iron castings include:

- Automotive components
- Agricultural equipment
- Construction equipment
- Machine tools
- Lawn and garden equipment
- Heavy equipment

Table 1- Gray Iron Material Properties

Available Grades and Maximum Allowable Rim Speeds		
Gray Iron	Yield Tensile Strength (psi)	Max. Allowable Rim Speed (fpm)
Class 30B, ASTM A-48	30,000	6,500
Class 40B, ASTM A-48	40,000	7,500

Table 2- Ductile Iron Material Properties

Available Grades and Maximum Allowable Rim Speeds		
Ductile Iron	Yield Tensile Strength (psi)	Max. Allowable Rim Speed (fpm)
65-45-12, ASTM A-536	45,000	8,000
80-55-06, ASTM A-536	55,000	9,000

Table 3- Steel Material Properties

Available Grades and Maximum Allowable Rim Speeds		
Steel	Yield Tensile Strength (psi)	Max. Allowable Rim Speed (fpm)
1018 Steel	53,700	9,000
1144 Steel	89,900	12,000
304L Stainless Steel	30,500	7,000
416 Stainless Steel	84,800	11,000

Ductile Iron

Ductile iron is the second most popular material used for castings. Ductile iron contains graphite modules, which improve strength and ductility over gray iron of comparable composition. Ductile iron is sometimes referred to as nodular iron because the graphite is in the shape of spheres or nodules. Properties of common varieties of ductile iron are listed in Table 2.

Ductile iron has the following desirable characteristics:

- High tensile strength and toughness
- Good machinability (equal to gray iron of the same hardness)
- High modulus of elasticity (good shock resistance)
- Wear resistance
- Excellent ductility
- Diversity of casting options

Ductile iron castings are used in:

- Automotive components
- Agricultural equipment
- Construction equipment
- Lawn and garden equipment
- Heavy equipment
- Railroad equipment

Steel

Steels are alloys of iron and carbon, with the exception of stainless steels, which are alloys of iron, chromium and nickel. Steel is classified by its composition. The American Iron and Steel Institute (AISI) and the Society of Automotive Engineers (SAE) assign alloy designations. Most "general use" steels fall into three categories:

1. Carbon steels
2. Alloy steels
3. Stainless steels

Carbon steel contains small but specific amounts of manganese and silicon and is generally classified based on carbon content. Three broad classifications are referred to as low, medium and high carbon steels. Free cutting steels are carbon steels with sulfur, lead or phosphorous added.

Alloy steels are carbon steels with other elements added to increase hardness. These elements make alloy steels easier to heat treat for greater strength. The most commonly added alloys are nickel, chromium and molybdenum. Steels with certain amounts of manganese are also considered alloys.

Table 4 -
Sintered Steel Material Properties

Available Grades and Maximum Allowable Rim Speeds		
Sintered Steel	Yield Tensile Strength (psi)	Max. Allowable Rim Speed (fpm)
FC-0208-50	55,000	9,000
F-0008-30	35,000	7,000

Material characteristics and mechanical properties of different types of steels vary widely and are listed in Table 3. All common steel types may be used to produce component parts to custom specifications or specialized part requirements.

Sintered Steel

Sintered steel can be used effectively in applications that have traditionally used other fabrication methods such as steel stampings, cast (gray or ductile) iron, die casting and screw machining. A wide variety of materials lend themselves to the sintering process. Sintering may be selected for the following reasons:

- Reduced secondary operations/scrap
- Ability to maintain close tolerances
- Good surface finish
- Complex shapes
- Low cost for moderate to high production quantities
- Wide range of mechanical properties
- Recyclable parts

Sintered parts are used in:

- Power tools
- Appliances
- Firearm components
- Automotive components
- Office equipment
- Computers
- Lawn and garden equipment

Generally, the higher the sintered steel tensile strength grades, the higher the cost. Although there are many material options to choose from, two common grades are generally suitable for most powdered metal power transmission components. Material properties for sintered steel are listed in Table 4.

Aluminum

Aluminum offers many advantages over other materials. Some of these include:

- Light weight (~1/3 the weight of steel)
- Machinable
- High strength-to-weight ratio
- Non-oxidizing when exposed to air
- Heat dissipating
- High electrical conductivity
- Can be cast by all common casting methods
- Heat treatable for higher strength and hardness

Table 5- Aluminum Properties

Available Grades and Maximum Allowable Rim Speeds		
Aluminum	Yield Tensile Strength (psi)	Max. Allowable Rim Speed (fpm)
2024-T3	50,000	12,000
6061-T6	40,000	11,000
7075-T6	73,000	15,000

Many power transmission components made of various aluminum alloys and finishes provide excellent service. Aluminum components are used in:

- Office equipment
- Household appliances
- Home and commercial laundry equipment
- Computer hardware
- Power hand tools
- Lawn and garden equipment
- Light-duty machine tools
- Die-cast motorcycle rear wheel sprockets
- Performance motor sports

When selecting aluminum materials for sheaves, pulleys and sprockets, it is important to consider the service life of the drive along with the desired performance characteristics of the application. Heavily loaded drives and drives running in abrasive or contaminated environments often require long industrial service life. Plain aluminum sheaves or sprockets will not likely meet the performance expectations of drives operating in long life or under severe conditions. Heat-treated, hard anodized, and plated aluminum parts may perform satisfactorily but should be evaluated for suitability and tested on the actual application if possible.

Aluminum is often selected because it is a light weight material. If applications are lightly loaded or see limited or seasonal use, aluminum may be ideally suited for power transmission components.

Many different grades and types of aluminum are available for power transmission components. Properties of common varieties of aluminum are listed in Table 5.

Plastic

Plastic materials are very versatile and offer many advantages when used for pulleys and sprockets. Some of these are:

- Light weight
- Non-corrosive (will not rust)
- Electrically conductive (if required)
- Affordable (particularly in high volumes)
- Wide variety of filled and non-filled materials
- Malleable around metal inserts

It is possible to manufacture plastic power transmission components by conventional machining methods, but injection molding is preferred, especially for high volumes. This is because most parts are ready for use after molding. Plastic part cost is typically much lower in high volumes than that of a comparable machined part.

Plastic components are commonly used in a variety of applications such as:

- Office equipment
- Appliances
- Lawn and garden equipment
- Power tools
- Computer peripherals

Plastic components have a wide range of properties. These properties vary depending on the material selected. Reinforcements such as fiberglass can be added as well.

Common materials for plastic power transmission components are:

- Polycarbonate (Lexan®), fiberglass reinforcement optional
- Acetal (Delrin®), fiberglass reinforcement optional
- Nylon
- Nylatron®

Like aluminum parts, plastic parts may not be suitable for heavily loaded drives, drives that run in abrasive or contaminated environments, or drives that require long industrial service life. The service life of the drive needs to be carefully evaluated with the performance characteristics such as heat dissipation of the application before plastic parts are chosen.

MANUFACTURING AND PROCESS CAPABILITY

Manufacturing Processes

Metals can be manufactured through a number of different processes. Two common processes, casting and powdered metal manufacturing, are explained in detail below. For further information, contact your Gates sales representative or the Made-to-Order Metal Team.

Casting

The casting process permits functional part designs with a wide degree of variation in shape. Curved surfaces, thin walls, arms or spokes, raised hubs or projections, and even complex interior shapes are possible without major restrictions. Major advantages of castings include:

- Low pattern costs
- Reduced machining costs and part weight
- Short production lead times
- Adaptability to quantity variation from prototype to high production
- Efficient production process

Powdered Metal Manufacturing

The powdered metal processes involve unidirectionally compacting metal powder in rigid dies into desired shapes. The resulting compact is then sintered (heated in an atmospheric oven) at temperatures exceeding 2,000 degrees Farenheit to develop strength. After sintering, the parts may then be sized or coined for very close tolerance requirements. Sizing, or repressing, improves a part's dimensional precision by slightly deforming the material.

This process has a wide range of applications. Because special press tooling is used to make the parts, large volumes can be made without machining each part.

Part manufacturing capability is measured by the force or tonnage required to press the powder into the required shape and achieve the desired properties.

Design Considerations

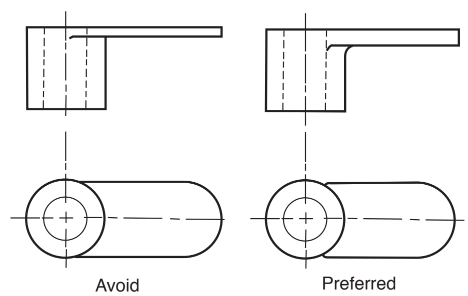
Here are some guidelines to follow when designing parts for powdered metal manufacturing:

Designs with thin walls or sharp corners can inhibit powder flow in the mold and can produce non-homogenous properties.

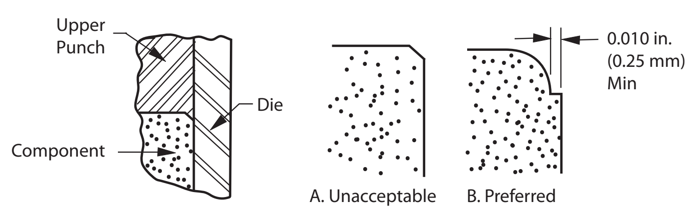
Parts with thin flanges or sharp edges are succeptible to breaking while handling before sintering.

Avoid part designs that create thin walls or sharp edges in tooling, which can break under compacting pressure.

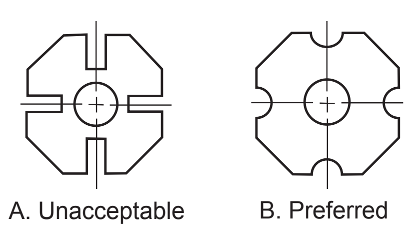
Large-diameter parts that have arms or holes may require the same processing for a smaller diameter, solid part.



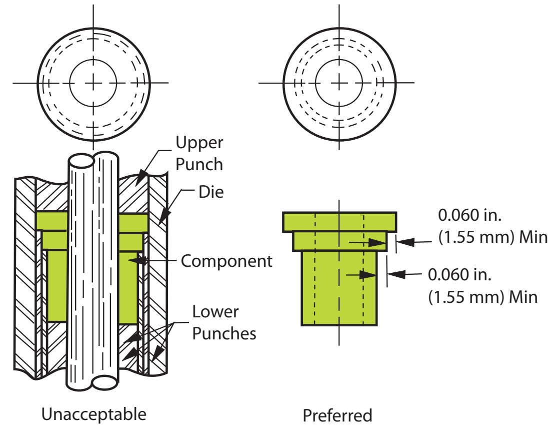
Large, thin protrusions should be as thick as permissable and be joined to more massive features with generous radii.



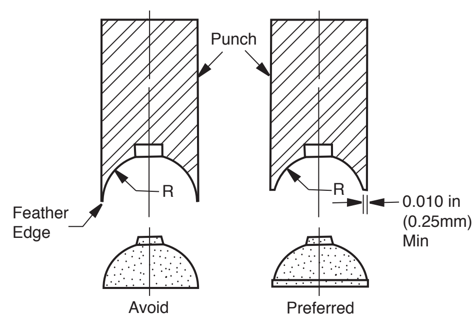
The radius of the corner in example (A) cannot be pressed because it would require a feather edge on the punch. The edge may be relieved with a flat edge as seen in example (B).



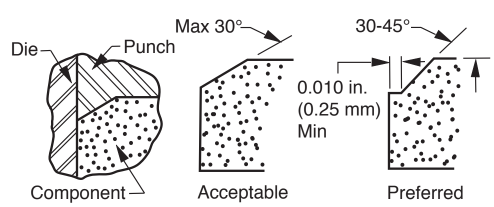
The design of (A) requires long, thin tool membranes, and the sharp corners cause problems in powder fill. Design (B) avoids both problems.



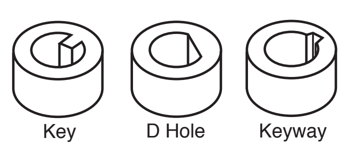
Multiple steps require a minimum 0.060 in. (1.5mm) axial difference to allow adequate strength in the punches.



A flat on the diameter of the sphere allows the punch to terminate a flat rather than a feather edge.



A chamber is preferred to a radius at the intersection of tool members. Angles 30° or less from radial provide sufficient tool strength. Angles 30-45° should terminate in a flat. Angles greater than 45° should be avoided.

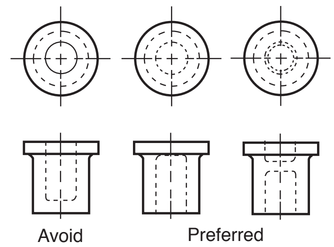


Keys, D holes, and keyways can be formed in hubs in the compaction operation.

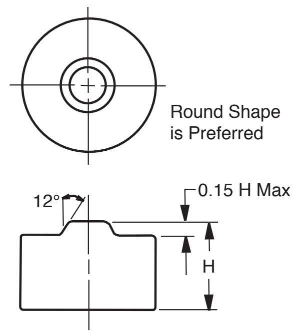
Table 6: Machine Shop Capabilities

Process	OD Maximum
Welded Fabricated Assembly	*
Turning	108”
Hobbing	76”
Shaping	*
Boring	*

*Machining capability varies with diameter and face width. It may be possible that some small bores cannot be made to full face widths. For small bores with unusual length proportions, capability should be checked with your Gates representative.



Avoid blind holes with the blind end opposite a flange.



A boss can be formed in the punch face at either end of the component provided that the guidelines for the draft and height are observed.

General Machine Shop

General machine shops typically offer the following processes:

- Drilling/Boring
- Milling
- Welding
- Hobbing
- Shaping
- Broaching
- Balancing
- Sawing
- Turning
- Grinding

See Table 6 for more information about these capabilities.

Surface Treatments and Coatings

Surface treatments and coatings can help protect a part from excessive wear, rust, and/or corrosion. A variety of standard and special treatments are available.

Coatings

Clear, Rust-Preventative Dip

- Water based
- Used on most sintered steel, cast iron and ferrous parts less than 19” in diameter
- Non-flammable
- Outdoor protection in excess of one year
- Humid indoor atmosphere protection for up to five years
- Passes 5 percent salt spray test
- Excellent replacement for solvent or oil-based products

Paint

- Meets USDA regulations
- Good chemical and rust resistance

Steam Treating (sintered steel parts only)

- Provides a dark-blue, rust-resistant coating
- Sintered steel parts must be impregnated prior to painting and planting

Platings

Platings provide corrosion and abrasion resistance. It is important to note that platings may slightly affect tooth profiles on synchronous sprockets because of the extra thickness.

Dense, Hard, Chrome Plating

- Good corrosion/chemical resistance that performs equal to or better than 440C stainless
- Surface hardness of 70-72 Rockwell C that provides superior abrasion resistance
- Precision uniform surface
- Conforms to FDA and USDA requirements
- Plating temperature range exceeds belt temperature range

Electroless Nickel Plating

- Good corrosion/chemical resistance, including many alkalis and weak acids, in plating thickness over .001”
- Unaffected by petroleum products
- A 49 Rockwell C hardness rating provides good wear resistance
- Can conform to FDA and USDA standards
- Plating temperature range exceeds belt temperature range

Zinc Plating

- Does not meet FDA or USDA requirements
- Indoor and atmospheric corrosion resistance
- Good chemical resistance
- Temperature range exceeds belt temperature range

Made-to-Order/Prototype Capabilities

The following manufacturing capabilities can help reduce lead times for prototypes or low volume (under 50 piece) production runs. Although cost per individual piece is higher, upfront costs are lower. Special tooling requirements such as spline broach may require longer lead times. Special bore sizes can sometimes use a reborable or special bushing.

Bar Stock

Cast iron bar is stocked in diameters 10" and smaller. No pattern is required. This is an advantage when prototypes are needed quickly. Ductile iron or steel material is also available.

Floor Molding

Iron casting molds can be made by using a wide variety of stock rims combined with arms and hubs to form three-piece patterns. This capability allows low-volume sheave and synchronous sprocket castings to be made with minimal or no pattern costs.

Stock Castings

Stock castings can sometimes be used to manufacture made-to-order QD® and Taper-Lock® sheaves and synchronous sprockets. Because the need for a new pattern is eliminated, delivery time is reduced and a lower cost is provided.
Note: Each application must be reviewed so that bushing torque limits are not exceeded.

Sintered Steel Blanks

Sintered steel blanks are used to manufacture V-belt sheaves and synchronous sprockets. These blanks can also be used to manufacture OEM specials when their design fits or can be modified to fit the design. This eliminates most tooling cost, improves delivery, and provides a low product cost.

Pulley Stock

Pulley stock is available for quick prototype work in all pitches.

QD AND TAPER-LOCK BUSHING CAPABILITY

› Reborable Bushings

Along with a standard line of QD® and Taper-Lock® bushings, Gates also stocks reborable bushings. These bushings allow for quick turn-around time when usual bore and key requirements are needed. These can be furnished "as is" for the user to rebore or can be finished in the factory. Tables 7-8 include the available sizes and materials.

Table 7: Maximum Standard Bore Capacity for Taper-Lock Bushings (in inches)

	Sintered Steel		Steel		Stainless Steel		Cast Iron		Ductile Iron	
Bushing	Stock Bore	Maximum Bore	Stock Bore	Maximum Bore	Stock Bore	Maximum Bore	Stock Bore	Maximum Bore	Stock Bore	Maximum Bore
1008	1/2	1	1/2	1	1/2	1				
1108	1/2	1-1/8	1/2	1-1/8	1/2	1-1/8				
1210	1/2	1-1/4	1/2	1-1/4	1/2	1-1/4				
1215	1/2	1-1/4	1/2	1-1/4	1/2	1-1/4				
1310	1/2	1-3/8	1/2	1-7/16	1/2	1-3/8				
1610	1/2	1-5/8	1/2	1-11/16	1/2	1-5/8				
1615	1/2	1-5/8	1/2	1-11/16	1/2	1-5/8				
2012	1/2	2	1/2	2-1/8	1/2	2				
2517	1/2	2-1/2	1	2-11/16	1/2	2-1/2				
2525			1-7/16	2-11/16						
3020			1-7/16	3-1/4	7/8	3				
3030			1-7/16	3-1/4			15/16	3	1-7/16	3-15/16
3535							1-3/16	3-1/2	1-15/16	4-7/16
4040							1-7/16	4	2-7/16	4-15/16
4545							1-5/16	4-1/2	2-15/16	5-15/16
5050							2-7/16	5	3-7/16	6
6050							3-7/16	6	3-15/16	7
7060							3-15/16	7	4-7/16	8
8065							4-7/16	8		
10085							7	10		
120100							8	12		

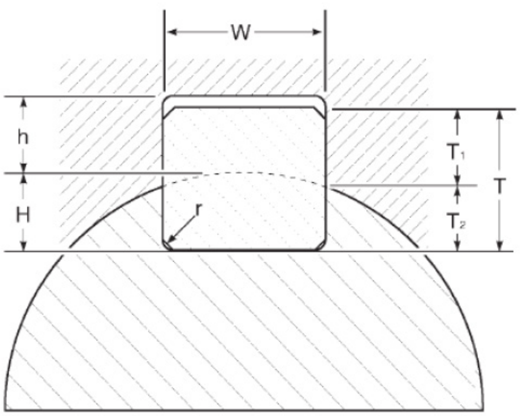


Figure 2: Keyway and Key Size Dimension Reference

English	Metric
Keyway: W x T_1	Keyway: W x h
Key: W x T	Key: W x T

Table 8: Maximum Standard Bore Capacity for QD® Bushings (in inches)

	Sintered Steel		Cast Iron		Ductile Iron	
Bushing	Stock Bore	Maximum Bore	Stock Bore	Maximum Bore	Stock Bore	Maximum Bore
JA	1/2	1-1/16				
SH	1/2	1-1/4			1/2	1-11/16
SDS	1/2	1-5/8			1-7/16	2
SDS	1/2	1-9/16			1-9/16	2
SK	1/2	2-1/6			2	2-5/8
SF	1/2	2-3/8			2-5/16	2-15/16
E			7/8	3	7/8	3-1/2
F			1	3-7/16	1	4
JA			1-1/2	3-7/8	1-1/2	4-1/2
M			2	5	2	5-1/2
N			2-7/16	5-1/4	2-7/16	6
P			3-7/16	7	3-7/16	7
W			4	8		

Specifying English and Metric Keyways

The process of dimensioning and specifying keys and keyways varies significantly from the English to the Metric system. In the English system, it is the standard practice to dimension the keyway, (the machined profile in the hub of the bushing), while in the Metric system it is common practice to specify the key size (the machined metal piece that fits in between the shaft and the hub).

In the English system, the keyway in the hub is dimensioned by the width and depth at the side. In the Metric system the keyway is dimensioned by the width and depth measured from the radius of the shaft to the center of the keyway. Refer to Figure 2. Note that T_1 and T_2 are not necessarily equal.

Order Metric bored bushings with either of the following:

1. Specify “standard keyway”
2. Specify key size (in mm for Metric or inches for English)

A list of the standard keyway and corresponding key sizes for both English and Metric shafts are listed in tables 9-11.

Table 9: English Standard Keyway and Key Sizes

Shaft Diameter (in.)		Keyway (in.)		Key (in.)	
From	To	Width (W)	Depth (T_1)	Width (W)	Depth (T)
5/16	7/16	3/32	3/64	3/32	3/32
1/2	9/16	1/8	1/16	1/8	1/8
5/8	7/8	3/16	3/32	3/16	3/16
15/16	1 1/4	1/4	1/8	1/4	1/4
1 5/16	1 3/8	5/16	5/32	5/16	5/16
1 7/16	1 3/4	3/8	3/16	3/8	3/8
1 13/16	2 1/4	1/2	1/4	1/2	1/2
2 5/16	2 3/4	5/8	5/16	5/8	5/8
2 13/16	3 1/4	3/4	3/8	3/4	3/4
3 5/16	3 3/4	7/8	7/16	7/8	7/8
3 13/16	4 1/2	1	1/2	1	1
4 9/16	5 1/2	1 1/4	5/8	1 1/4	1 1/4
5 9/16	6 1/2	1 1/2	3/4	1 1/2	1 1/2
6 9/16	7 1/2	1 3/4	3/4	1 3/4	1 1/2
7 9/16	9	2	3/4	2	1 1/2

Table 10: Metric Standard Parallel Keyway and Key Sizes

Shaft Diameter (mm)		Keyway (mm)		Key (mm)	
From	To	Width (W)	Depth (h)	Width (W)	Depth (T)
6	8	2	1.0	2	2
9	10	3	1.4	3	3
11	12	4	1.8	4	4
13	17	5	2.3	5	5
18	22	6	2.8	6	6
23	30	8	3.3	7	7
31	38	10	3.3	8	8
39	44	12	3.3	12	8
45	50	14	3.8	14	9
51	58	16	4.3	16	10
59	65	18	4.4	18	11
66	75	20	4.9	20	12
76	86	22	5.4	22	14
86	96	25	5.4	25	14
96	110	28	6.4	28	16
111	130	32	7.4	32	18
131	150	36	8.4	36	20
151	170	40	9.4	40	22
171	200	45	10.4	45	25
201	230	50	11.4	50	28
231	260	56	12.4	56	32
261	290	63	12.4	63	32
291	330	70	14.4	70	36
331	380	80	15.4	80	40
381	440	90	17.4	90	45
441	500	100	19.4	100v	50

The maximum rebore capacity changed if a keyway is required. Table 11 shows the maximum metric bore capacity for Taper-Lock® bushings based on keyway.

Table 11: Metric Bore Capacity for Taper-Lock® Bushings (in mm)

TL Bush Size	Sintered Steel			Cast Iron			Ductile Iron			Steel		
	Full Keyway	Shallow Keyway	No Keyway	Full Keyway	Shallow Keyway	No Keyway	Full Keyway	Shallow Keyway	No Keyway	Full Keyway	Shallow Keyway	No Keyway
1008	22	25	25							22	22	26
1108	25	25	29							25	28	29
1210	32	32	32							32	32	32
1215	32	32	32							32	32	32
1310	35	35	35							35	35	36
1610	40	40	40							42	42	44
1615	40	40	40							42	42	44
2012	50	50	51							50	50	55
2517	60	60	64							65	65	68
2525				60	60	64				65	65	68
3020	75	75	76							80	80	82
3030				75	75	76				80	80	82
3525				90	90	90	95	100	100			
3535				90	90	90	95	95	100			
4030				100	100	102	110	115	115			
4040				100	100	102	105	105	113			
4535				110	110	114	125	125	125			
4545				110	110	114	115	115	125			
5040				125	125	127	127	127	134			
5050				125	125	127	127	127	134			
6050				152	152	152	152	152	152			
7060				177	177	180	180	180	180			
8065				203	203	203	203	203	203			
10085				254	254	254	254	254	254			
120100				304	304	304	304	304	304			

NOTES: ISO standard method for measuring keyseat depth
MM Bore and Keyway dimensions conform to ISO standard recommendation R773 for "Free" fit
Verify torque capability. Contact Application Engineer for assistance
REFERENCE: 1 inch=25.4mm

V-BELT SHEAVE SPECIFICATIONS

General Information

Availability and Delivery

Before you select a sheave, check the supply of the Gates V-belt distributor who serves your area. Distributors are listed at gates.com/distributor or in the Yellow Pages of your phone book under "Belting."

Delivery times for made-to-order sheaves vary depending upon how special the construction. Estimated delivery times can be furnished by your Gates V-belt distributor.

How to Order Sheaves and Bushings

When ordering special, made-to-order sheaves, complete page 33 of this document and e-mail to makemymetal@gates.com or specify:

- Diameter*
- Number and size of grooves (3V, 5V, 8V, A, B, C, and D)
- Type of hub (Bored to size, QD, etc.)
- Hub length and location
- Bore and keyway dimensions
- Split or solid rim and hub (or WR^2 if extra flywheel effect is required)

*Outside diameter for 3V, 5V, 8V or Datum Diameter for A, B, C, and D

Hi-Power II and Tri-Power Classical Sheave Groove Specifications

Dimensions listed in Tables 12 and 13 below to be used in conjunction with Figure 3.

The variation in datum diameter between the grooves in any one sheave must be within the following limits:

- Up through 19.9" outside diameter and up through 6 grooves; 0.010" (add 0.0005" for each additional groove)
- 20.0" and over on outside diameter and up through 10 grooves; 0.015" (add 0.0005" for each additional groove)

This variation can be obtained easily by measuring the distance across two measuring balls or rods placed diametrically opposite each other in a groove. Comparing this "diameter over balls or rods" measurement between grooves will give the variation in datum diameter. Deep groove sheaves are intended for drives with belt offset such as quarter-turn or vertical shaft drives. Joined belts will not operate in deep groove sheaves.

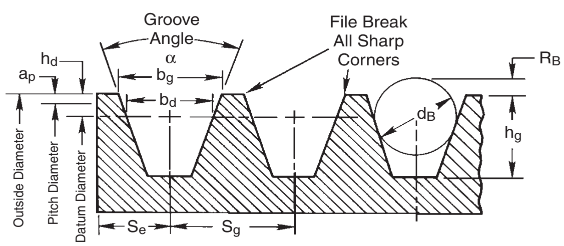


Figure 3 - Groove Dimensions (for tables 12 and 13)

Table 12: Gates Standard Sheave Groove Dimensions

Standard Groove Dimensions (in)											Design Factors	
Cross Section	Datum Diameter Range	α Groove Angle ±0.33°	b_d Ref.	b_g	h_g Min.	$2h_d$ Ref.	R_B Min.	d_B ±0.0005	S_g ±0.025	S_e	Minimun Recommended Datum Diameter	$2a_p$
A, AX	Up through 5.4 Over 5.4	34 38	0.418	0.494 0.504 ±0.005	0.460	0.250	0.148 0.149	0.4375 (7⁄16)	0.625	0.375 +0.090 -0.062	A 3.0 AX 2.2	0
B, BX	Up through 7.0 Over 7.0	34 38	0.530	0.637 0.650 ±0.006	0.550	0.350	0.189 0.190	0.5625 (9⁄16)	0.750	0.500 +0.120 -0.065	B 5.4 BX 4.0	0
A-B Combination: A, AX Belt	Up through 7.4 (1) Over 7.4	34 38	(2) 0.508	0.612 ±0.006 0.625	0.612	0.634 (3) 0.602	0.230 0.226	0.5625 (9⁄16)	0.750	0.500 +0.120 -0.065	A 3.6(1) AX 2.8	0.39 0.35
A-B Combination: B, BX Belt	Up through 7.4 (1) Over 7.4	34 38		0.612 ±0.006 0.625		0.268 (3) 0.276	0.230 0.226				B 5.7(1) BX 4.3	-0.08 -0.07
C, CX	Up through 7.99 Over 7.99 to and including 12.0 Over 12.0	34 36 38	0.757	0.879 0.887 ±0.007 0.895	0.750	0.400	0.274 0.276 0.277	0.7812 (25⁄32)	1.000	0.688 +0.160 -0.070	C 9.0 CX 6.8	0
D	Up through 12.99 Over 12.99 to and including 17.0 Over 17.0	34 36 38	1.076	1.259 1.271 ±0.008 1.283	1.020	0.600	0.410 0.410 0.411	1.1250 (1⅛)	1.438	0.875 +0.220 -0.080	13.0	0

Table 13: Gates Deep Sheave Groove Dimensions

Deep Groove Dimensions (in)											Design Factors	
Cross Section	Datum(4) Diameter Range	α Groove Angle ±0.33°	b_d Ref.	b_g	h_g Min.	$2h_d$ Ref.	R_B Min.	d_B ±0.0005	S_g ±0.025	S_e	Minimun Recommended Datum Diameter	$2a_p$
B, BX	Up through 7.0 Over 7.0	34 38	0.530	0.747 0.774 ±0.006	0.730	0.710	0.007 0.008	0.5625 (9⁄16)	0.875	0.562 +0.120 -0.065	B 5.4 BX 4.0	0.36
C, CX	Up through 7.99 Over 7.99 to and including 12.0 Over 12.0	34 36 38	0.757	1.066 1.085 ±0.007 1.105	1.055	1.010	-0.035 -0.032 -0.031	0.7812 (25⁄32)	1.250	0.812 +0.160 -0.070	C 9.0 CX 6.8	0.61
D	Up through 12.99 Over 12.99 to and including 17.0 Over 17.0	34 36 38	0.076	1.513 1.541 ±0.008 1.569	1.435	1.430	-0.010 -0.009 0.008	1.1250 (1⅛)	1.750	1.062 +0.220 -0.080	13.0	0.83

Notes for Tables 12 and 13:

- Diameters shown for combination grooves are outside diameters. A specific datum diameter does not exist for either A or B belts in combination grooves
- Summation of the deviations from “Sg” for all grooves in any one sheave shall not exceed +0.031”
- The b_d value shown for combination grooves is the “constant width” point but does not represent a datum width for either A or B belts ($2h_d$=0.340 for reference)
- $2h_d$ values for combination grooves are calculated based on b_d for A and B grooves
- The A/AX, B/BX combination groove should be used when deep grooves are required for A or AX belts
- Face width of standard and deep groove sheaves:

  Face Width = Sg (Ng-1) + $2s_e$

  Where: Ng = Number of Grooves
- Maximum surface roughness height (Arithmetic Average) for sheave groove sidewalls is 125 microinches.

Super HC Narrow Sheave Groove Specifications

The variation in datum diameter between the grooves in any one sheave must be within the following limits:

- Up through 19.9” outside diameter and up through 6 grooves; 0.010” (add 0.0005” for each additional groove)
- 20.0” and over on outside diameter and up through 10 grooves; 0.015” (add 0.0005” for each additional groove)
- Face width of standard and deep groove sheaves:

  Face Width = Sg (Ng-1) + $2s_e$

  Where Ng = Number of Grooves

This variation can be obtained easily by measuring the distance across two measuring balls or rods placed diametrically opposite each other in a groove. Comparing this “diameter over balls or rods” measurement between grooves will give the variation in pitch diameter.

Deep groove sheaves are intended for drives with belt offset such as quarter-turn or vertical shaft drives. Joined belts will not operate in deep groove sheaves.

Dimensions are listed in Tables 14 and 15 to be used in conjunction with Figures 4 and 5.

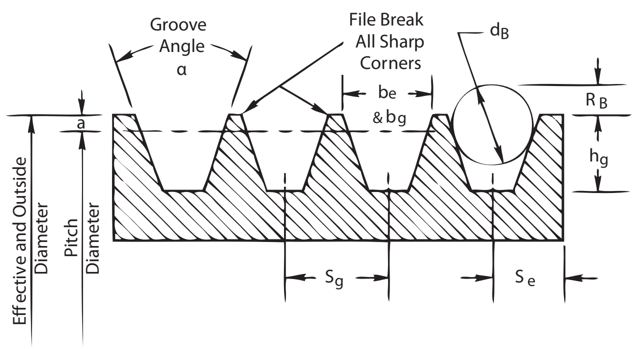


Figure 4 - Sheave Groove Dimensions

Table 14: Gates Super HC Standard Groove Sheave Dimensions

Cross Section	Outside Diameter (in)	Groove Angle ±0.25°	Standard Groove Dimensions (in) b_g ±0.005	b_e Ref	h_g Min.	R_B Min.	d_B ±0.0005	S_g ±0.015	S_e	Design Factors Minimum Recommended Outside Diameter	2a
3V, 3VX	Up through 3.49	36	0.350	0.350	0.340	0.181	0.3438	0.406	0.344 +0.094 -0.031	3V 2.65 3VX 2.20	0.050
	Over 3.49 to and including 6.00	38				0.183					
	Over 6.00 to and including 12.00	40				0.186					
	Over 12.00	42				0.188					
5V, 5VX	Up through 9.99	38	0.600	0.600	0.590	0.329	0.5938	0.688	0.500 +0.125 -0.047	5V 7.10 5VX 4.40	0.100
	Over 9.99 to and including 16.00	40				0.332					
	Over 16.00	42				0.336					
8V	Up through 15.99	38	1.000	1.000	0.990	0.575	1.0000	1.125	0.750 +0.250 -0.062	12.50	0.200
	Over 15.99 to and including 22.40	40				0.580					
	Over 22.40	42				0.585					

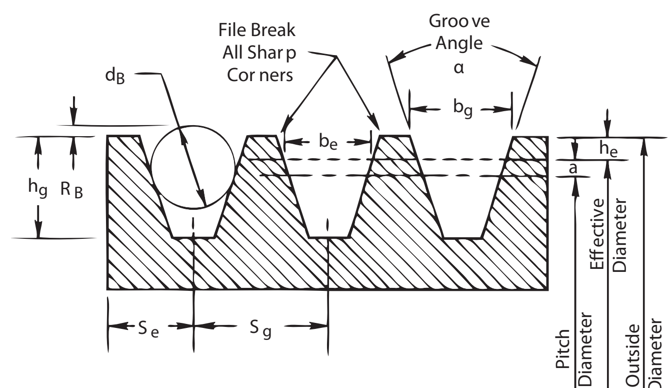


Figure 5 - Deep Groove Dimensions

Table 15: Gates Super HC Deep Groove Sheave Dimensions

Cross Section	Outside Diameter (in)	Groove Angle ±0.25°	Deep Groove Dimensions (in) b_g ±0.005	b_e Ref	h_g Min.	R_B Min.	d_B ±0.0005	S_g ±0.015	S_e	Design Factors Minimum Recommended Outside Diameter	2a	2he
3V, 3VX	Up through 3.71	36	0.421	0.350	0.449	0.070	0.3438	0.500	0.375 +0.094 -0.031	3V 2.87 3VX 2.42	0.050	0.218
	Over 3.71 to and including 6.22	38	0.425			0.073						
	Over 6.22 to and including 12.22	40	0.429			0.076						
	Over 12.22	42	0.434			0.078						
5V, 5VX	Up through 10.31	38	0.710	0.600	0.750	0.168	0.5938	0.812	0.562 +0.125 -0.047	5V 7.42 5VX 4.72	0.100	0.320
	Over 10.31 to and including 16.32	40	0.716			0.172						
	Over 16.32	42	0.723			0.175						
8V	Up through 16.51	38	1.180	1.000	1.252	0.312	1.0000	1.312	0.844 +0.250 -0.062	13.02	0.200	0.524
	Over 16.51 to and including 22.92	40	1.191			0.316						
	Over 22.92	42	1.201			0.321						

Notes for Tables 14 and 15

- Summation of the deviations from “Sg” for all grooves in any one sheave shall not exceed +0.031”
- Maximum surface roughness height (Arithmetic Average) for V-pulley groove sidewalls is 125 microinches.

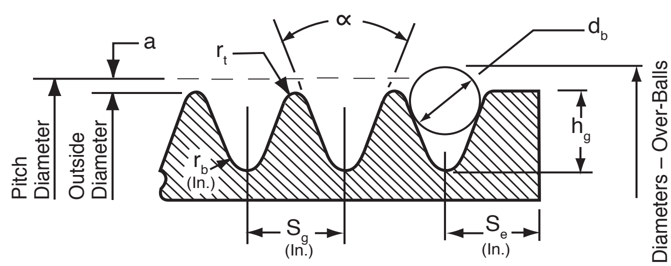
Micro-V Sheave Groove Specifications

The variation in pitch diameter between the grooves in any one sheave must be within the following limits:

- Up through 2.9" outside diameter and up through 6 grooves; 0.002" (add 0.0001" for each additional groove)
- Over 2.9" to and including 19.9" and up through 10 grooves; 0.005" (add 0.0002" for each additional groove)
- Over 19.9 "and up through 10 grooves; 0.010" (add 0.0005" for each additional groove)

This variation can be obtained easily by measuring the distance across two measuring balls or rods placed diametrically opposite each other in a groove. Comparing this "diameter over balls or rods" measurement between grooves will give the variation in pitch diameter.

Dimensions are listed in Table 16 to be used in conjunction with Figure 6.



Where: Face Width = S_g (Ng - 1) + $2S_e$
Ng = Number of grooves

Figure 6 - Micro-V Sheave Groove Dimensions

Table 16: Micro-V Sheave Groove Dimensions

Cross Section	Minimum Recommended Outside Diameter (in)	Groove Angle	S_g (in)	r_t +0.005 -0.000 (in)	2a (in)	r_b (in)	h_g Min. (in)	d_B +0.0005 (in)	S_e (in)
J	0.80	40	0.092 +0.001	0.008	0.030	0.015 +0.000 -0.005	0.071	0.0625	0.125 +0.030 -0.015
K	1.5	40	0.140 +0.002	0.010	0.038	0.020 +0.000 -0.005	0.122	0.1093	0.375 +0.075 -0.030
L	3.00	40	0.185 +0.002	0.015	0.058	0.015 +0.000 -0.005	0.183	0.1406	0.375 +0.075 -0.030
M	7.00	40	0.370 +0.003	0.030	0.116	0.030 +0.000 -0.010	0.377	0.2812	0.500 +0.100 -0.040

NOTE: Summation of the deviations from "Sg" for all grooves in any on sheave shall not exceed +0.010"

Metric Power Sheave Groove Specifications

The maximum differences between the datum diameters of any two grooves of the same pulley are:

- •0.3mm for Y groove profiles
- •0.4mm for Z, A, B, SPZ, SPA, and SPB groove profiles
- •0.6mm for C, D, E, and SPC groove profiles

Dimensions are listed in Table 17 to be used with Figure 7.

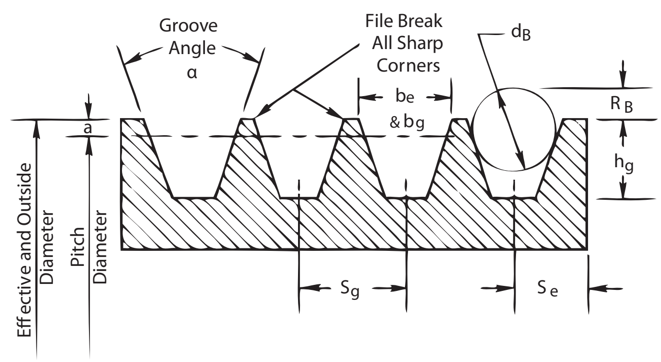


Figure 7 - Metric Sheave Groove Dimensions

Table 17: Groove Dimensions and Tolerances

Belt section	Datum Width bd	Datum Diameter	Groove Angle	bg	d	e	f*	b
	mm	mm	a	mm	mm	mm	mm	mm
Z** XPZ	8.5	63 to 80 >80	34°± 1° 38° ± 1°	9.72 9.88	11 (+0.25/-0)	12±0.30	8±0.6	2
SPA*** XPA	11	90 to 118 >118	34°± 1° 38° ± 1°	12.68 12.89	13.75 (+0.25/-0)	15±0.30	10±0.6	2.75
SPB*** SPB-PB XPB	14	140 to 190 >190	34°± 1° 38° ± 1°	16.14 16.41	17.5 (+0.25/-0)	19±0.40	12.5±0.8	3.5
SPC*** SPC-PB XPC	19	224 to 315 >315	34°± 1/2° 38° ± 1/2°	21.94 22.31	24 (+0.25/0)	25.5±0.50	17±1.0	4.8

Tolerances on datum diameters can be calculated by applying the tolerance (+1.6/-0%) to the nominal value of the datum diameter in mm.

*These tolerances have to be taken into account when aligning the pulleys

**According to DIN 2217

***According to DIN 2211 and ISO 4183

Polyflex® Sheave Groove Specifications

The sides of the groove shall not exceed 125 microinches (RMS) roughness.

The summations of deviations from S for all grooves in any one sheave shall not exceed ±0.015”.

The variation in diameter over ball (Outside Diameter + 2K) shall not vary from groove to groove in any one sheave more than:

- 0.002” for 5M
- 0.003” for 7M
- 0.004” for 11M

The tolerance on outside diameter shall be:

- ±0.005” for sheaves 1.04” through 5.00” outside diameter
- ±0.015” for sheaves 5.01” through 10.0” outside diameter
- ±0.030” for sheaves 10.01” through 20.0” outside diameter
- ±0.050 for sheaves 20.01” and more.

Dimensions are listed in Table 18 to be used with Figure 8

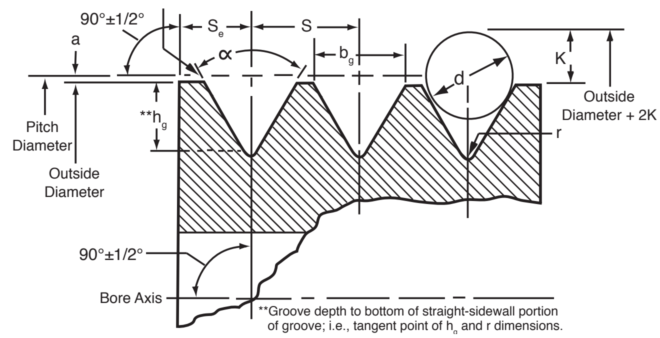


Figure 8 - Polyflex Sheave Groove Dimensions

Table 18: Polyflex Sheave Groove Dimensions

Groove Designation	Minimum Recommended Outside Diameter	2a PD to OD Value (in)	(b_g) Groove Top Width (in) ±0.002”	(S) Groove Spacing (in) +0.005 -0.002	(S_e) Edge Spacing (in) Minimum	(r) Bottom Radius (in) Maximum	Groove Angle		(hg) Groove Depth (in)	(2K) Two Times Ball Extension (in) ±0.005	(d) Ball or Rod Diameter (in) ±0.0005
							Outside Diameter Range (in)	(a) Groove Angle (degrees) ±1/4°			
5M	1.04	0.05	0.177	0.209	0.136	0.016	1.04-1.26	60	0.129	0.209	0.1719
							1.27-3.80	62	0.124	0.211	
							Over 3.80	64	0.120	0.213	
7M	1.67	0.09	0.280	0.335	0.222	0.023	1.67-3.00	60	0.208	0.359	0.2813
							Over 3.00	62	0.200	0.361	
11M	2.64	0.14	0.441	0.520	0.339	0.031	2.64-4.60	60	0.335	0.595	0.4531
							Over 4.60	62	0.323	0.599	

Tolerances

Regardless of the material used for V-belt sheaves, specific tolerances must be met to assure proper performance. The following specifications and tolerances should be used when designing parts.

Eccentricity

Allowable amount of radial runout from the pulleys to the outside diameter (O.D.)

O.D.	Total Eccentricity Radial TIR
Up to 8”	.004”
More than 8’	.005” per inch of diameter

Note: May not exceed the tolerance of outside diameter

Axial Runout

The total amount by which the pulley plane, normal to the axis of rotation, deviates (also known as pulley wobble)

For narrow and classical profile sheaves

- Axial runout is 0.010” up through 5.0” outside diameter
- For each additional inch of outside diameter, add 0.005”

For Micro-V sheaves

- 0.001” per inch of outside diameter

For Polyflex sheaves

- Axial runout 0.001” up through 20.0” outside diameter
- For each additional inch of outside diameter, add 0.0005”

Radial Runout

The total amount the pulley O.D. deviates from the axis of rotation

For narrow and classical profile sheaves

- Radial runout is 0.010” up through 10.0” outside diameter
- For each additional inch of outside diameter, add 0.005”

For Micro-V sheaves

- Radial runout is 0.005” up through 2.9” outside diameter
- Runout is 0.010” over 2.9” to and including 10.0”
- For each additional inch of outside diameter, add 0.0005”

For Polyflex sheaves

- Radial runout is 0.005” up through 10.0” of outside diameter
- For each additional inch of outside diameter, add 0.0005”

Balance and Sheave Rim Speeds

Gates stock sheaves and bushings are given a static balance that is satisfactory for rim speeds up to 6,500 feet per minute for stock V-belts. If sheaves are subjected to speeds above these limits, the actual calculated speeds should be detailed on the sheave order so that the sheave supplier can furnish the required balancing and the proper material.

If you are in doubt as to the requirements of a “problem” drive, call your local Gates Industrial V-Belt distributor for his expertise, backed by factory-trained engineers.

SPROCKET SPECIFICATIONS

General Information

Availability and Delivery

Before you select a sprocket, check stock from a Gates industrial belt distributor who serves your area. Distributors are listed at gates.com/distributor or in the Yellow Pages of your phone book under "Belting."

Delivery times for made-to-order sprockets vary depending upon how special the construction is. Estimated delivery times can be furnished by your Gates distributor.

How to Order Sprockets

When ordering special, made-to-order sprockets, complete page 33 of this document and e-mail to makemymetal@gates.com.

Sprocket Tolerance Specifications

Standard sprocket tolerances are shown in tables 19, 20 and 21. Because certain modifications such as reboring may result in unsatisfactory drive performance, strict adherence to the standard tolerances is highly recommended.

Table 19: Sprocket O.D. Tolerances (in inches)

Sprocket O.D.	O.D. Tolerance
1 - 1,000	+.002 - .000
1,001 - 2,000	+.003 - .000
2,001 - 4,000	+.004 - .000
4,001 - 7,000	+.005 - .000
7,001 - 12,000	+.006 - .000
12,001 - 20,000	+.007 - .000
20,001 and up	+.008 - .000

Balancing

Stock sprockets are statically balanced per MPTA (Mechanical Power Transmission Association) Standard Practice for Pulley Balancing SPB-86 using the weight based on the following criteria:

Balance limit (ounces) = Sprocket Weight (lb) x 0.016 (ounces)
or 0.176 ounces (5 grams)
Use whichever value is greater.

Poly Chain® GT® Sprocket Tooth Profile

The Poly Chain GT sprocket tooth profile was designed and developed exclusively by Gates Corporation to operate with the Gates Poly Chain GT Carbon belt. The tooth surface should be free of any surface defects and should be 80 microinches finish or better.

Sprocket Blanks

Sprocket blanks can be grooved by Gates for specially designed, made-to-order sprockets. If those sprockets are supplied in blank form, Gates can perform the “grooving” operation. The blank diameter must be 0.050” larger than the finished sprocket O.D. Contact your local Gates representative for additional details.

Axial Runout

- For each inch of outside diameter up through 10.0 inches, add 0.001 inches
- For each additional inch of outside diameter over 10.0 inches, add 0.0005 inches

Tables 20 and 21 can be used with Figure 9 when considering sprocket design.

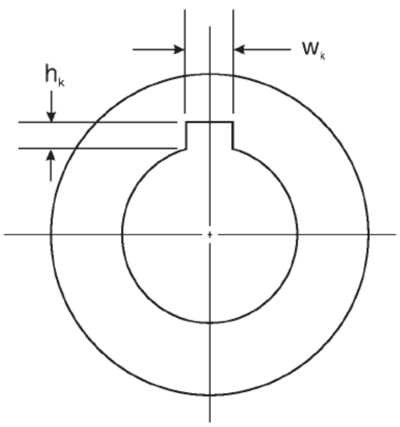


Figure 9- Sprocket Profile

Table 20: Sprocket Runout (Radial Runout*)

Outside Diameter	Outside Diameter	Total Eccentricity Total Indicator Reading	
(in)	(mm)	(in)	(mm)
Over 2 to 4	50 100	0.003	0.08
Over 4 to 8	100 200	0.004	0.10
Over 8	200	0.0005 per inch O.D. over 8”	0.0005 per mm O.D. over 200 mm
		(may not exceed face diameter tolerance)	

*Total Indicator Reading

Table 21: Sprocket Outside Diameter and Pitch

		Pitch to Pitch Tolerance (in.)	
Outside Diameter Range (in.)	Outside Diameter Tolerance (in.)	Adjacent Grooves	Accumulative Over 90 Degrees
Over 2,000 to and including 4,000	+0.004 -0.000	+0.001	+0.0045
Over 4,000 to and including 7,000	+0.005 -0.000	+0.001	+0.005
Over 7,000 to and including 12,000	+0.006 -0.000	+0.001	+0.006
Over 12,000 to and including 20,000	+0.007 -0.000	+0.001	+0.0065
Over 20,000	+0.008 -0.000	+0.001	+0.0075

Guide Flanges

Guide flanges are needed in order to keep the belt on the sprocket. Due to tracking characteristics, even on the best aligned drives, belts can ride towards the edge of the sprockets. Flanges will prevent the belt from riding completely over the edge.

On all drives using stock or made-to-order sprockets, the following conditions should be considered when selecting flanged sprockets:

- On all two-sprocket drives, the minimum flanging requirements are two flanges on one sprocket or one flange on each sprocket on opposite sides.
- On drives where the center distance is more than eight times the diameter of the small sprocket, both sprockets should be flanged on both sides.
- On vertical shaft drives, one sprocket should be flanged on both sides, and all the other sprockets in the system should be flanged on the bottom side only.
- On drives with more than two sprockets, the minimum flanging requirements are two flanges on every other sprocket or one flange on every sprocket—on alternating sides around the system.
- Some drives may require sprockets with different widths. In this case, the narrower of the two sprockets should be flanged on both sides.

On made-to-order sprockets, flanges must be securely fastened, such as using mechanical fasteners, welding, shrink-fit, or other equivalent methods.

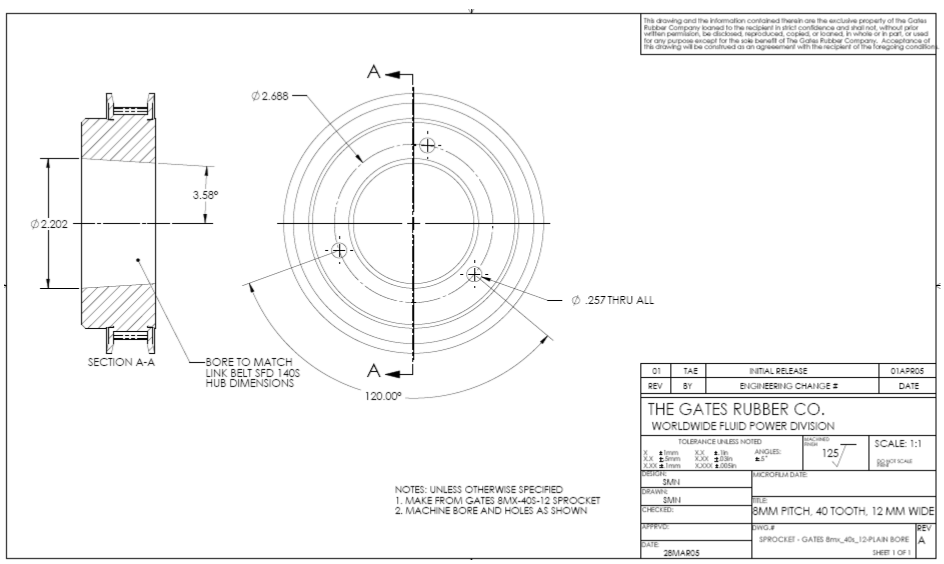
Although guide flanges for any non-stock diameter pulley can be specially produced, it may be possible to use flanges that fit other belt tooth profile parts. A flange from a different profile pulley or sprocket may fit some non-stock hardware. Gates will check and select the proper stock guide flange for special diameter pulleys and sprockets.

SHEAVE AND SPROCKET DESIGN GUIDE

Approval Drawings

Gates may require approval of drawings prior to production on some OEM and/or special products. Gates reserves the right to review drawings to assure that final products are designed to recommended guidelines by Gates Product Application Engineers.

Below is an example of an approved drawing:



Notes and Information for Sprocket Style Guide and Data Sheet

The following design assistance is useful to design or modify stock hardware. Numbered style guide drawings on page 32 are listed in order of popularity, and can be used to either aid in design or validate a custom design drawing. If using a style guide in your design, indicate the style number when filling out the Sprocket/Sheave Data Sheet on page 33.

A blank space for custom designed drawings is also included on the data sheet. Please read the Notes and Information page before completing the design drawing so that your Gates representative can better assist you with your drive design.

Notes:

- All blanks should be filled.
  - “N/A” can be used for “Not Applicable”
  - Zero (“0”) for “None”
  - “I/S” can be used for “Industry Standard”
- Unless specific tolerances entered, accepted industrial tolerances will be used by the vendor.
- If a standard bushing is specified, taper diameters, bolt holes, and other related dimensions need not be entered.
- Spoke or arm type sprockets are not covered by the illustrations.

Information:

Tooth Pitch: Distance between the centers of two adjacent sprocket grooves.

Tooth Profile: Shape of the groove—Poly Chain® GT®, Trapezoidal, HTD®, etc.

V-Belt Cross Section: Such as A, B, C, D. See pages 16-23.

Outside Diameter (OD): Diameter as measured over the groove surface.

Bore Diameter (BD): On untapered bores, this is the diameter exclusive of any keyways.

Outside Diameter Of Flanges: Unless there is a maximum diameter limitation, vendor selection is advised.

Keysize: If the keysize is not yet determined by the mating shaft, see standard keysize data on pages 14 and 15.

Setscrew Quantity: If not specified, two at (90°) will be used.

Setscrew Size: If not specified, the setscrew diameter will be the same as the key width.

Bushing Type: Such as QD, VT, TL (Taper-Lock).

Bushing Size: Such as (TL) 3020 or (QD) SD.

Bushing Material: Such as cast iron, steel, or sintered steel. See page 11.

Part Material: Such as steel, plastic, or iron. See pages 1-5.

Plating: Such as Electroless or Zinc. See pages 10-11.

Style Guide Number: This number indicates the illustration being used from the style guide (page 32).

Face Width (FW): Distance across the grooved portion of the sprocket plus flange seat. If standard belt width is being used, refer to the appropriate catalog for normal face width.

Overall Width (OW): Width at the extremes, including the hub projection (the distance the hub extends past the face width).

Hub Diameter (HD): Minimum diameter is bore diameter plus twice the keyseat depth plus twice the setscrew diameter.

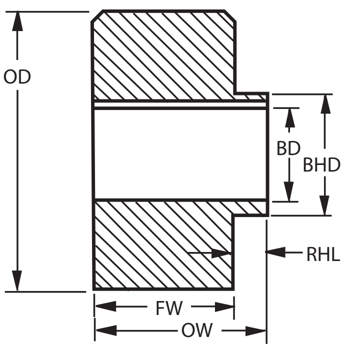
Hub Length (HL): Distance between the hub edge and the web. Minimum hub length is twice the screw diameter for a straight bore.

Counter Bore/Indent (C-Bore): Distance between the edge of the rim and the web.

Dynamic Balance: Contact the Made-to-Order metals team or Product Application Engineers to see if dynamic balancing is recommended for your application.

Sprocket Style Guide

CODE 1



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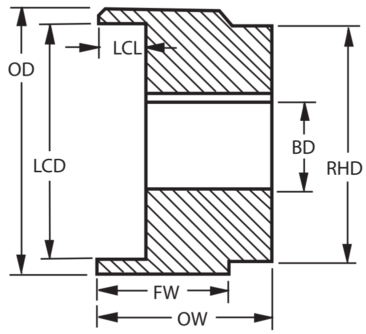

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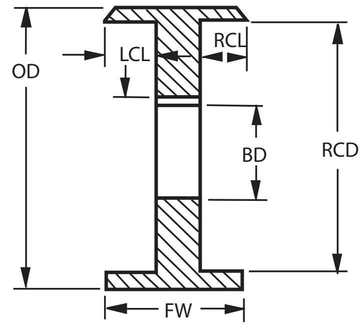

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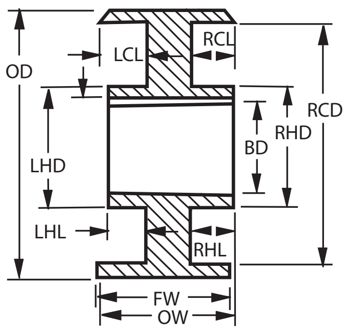

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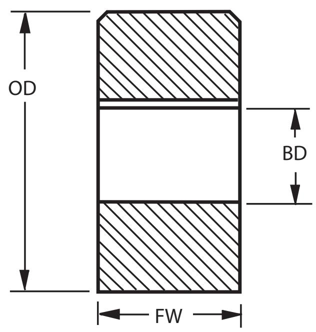

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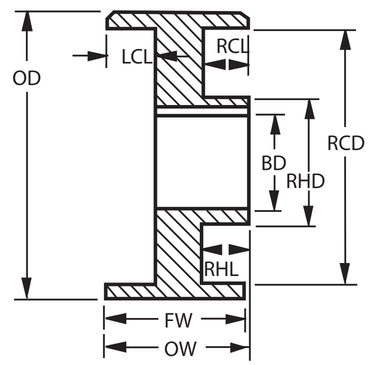

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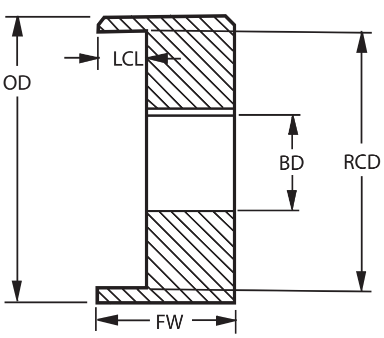

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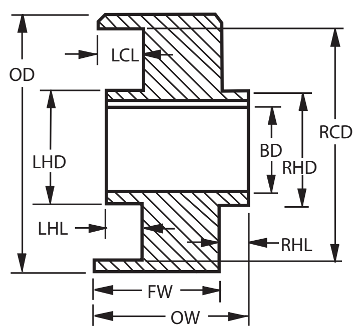

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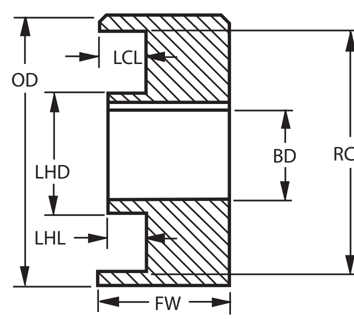

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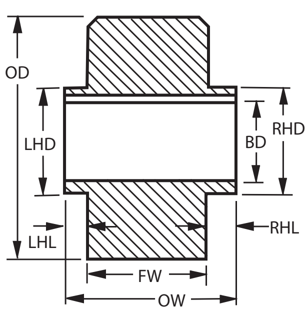

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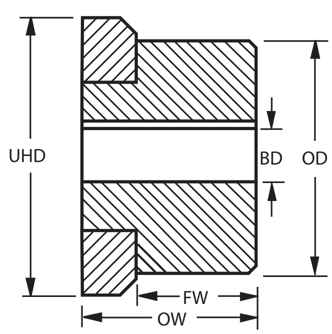


Sprocket/Sheave Data Sheet

Company		Date	
Address			

City		State		Zip	
Phone		Fax		Email	

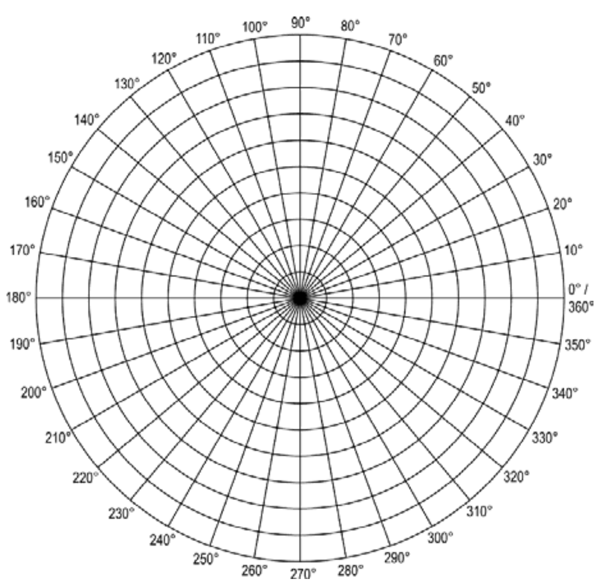
Please fill in those fields which are applicable to your design.
(if not specified, nominal values will be used where applicable)

Sprockets		**Sheaves**	
Tooth Profile/Pitch		Belt Cross Section	
# of Teeth		# of bands/ribs	
Belt Width		Outside Dia. (OD)	
Flanged Y/N			

Construction

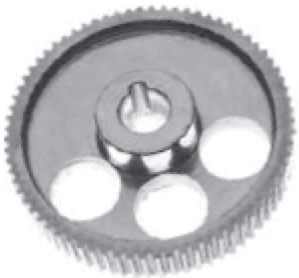
Bore Dia. (BD)		Keyway Y/N		Size	
Setscrews Y/N		Qty		Size	
Bushing Y/N		Model #		Reverse Mounting Y/N	
Bushing Mat'l					
Part Material					
Plating Y/N		Type			
Style Guide #		Style (Solid, Web or Arm)			
Face Width (FW)					
Overall Width (OW)					
Left Hub Y/N		Dia. (LHD)		Length (LHL)	
Right Hub Y/N		Dia. (RHD)		Length (RHL)	
Left C-Bore Y/N		Dia. (LCD)		Length (LCL)	
Right C-Bore Y/N		Dia. (RCD)		Length (RCL)	
Dynamic Bal. Y/N		@ RPM			
Add'l Comments					

Polar Grid for Illustration	**Rectangular Grid for Illustration**



makemymetal@gates.com **800-709-6001 phone** **303-744-4080 fax**

Made-to-Order Metals



When standard products won't work, call the Gates Made-to-Order Metals Team. Our dedicated made-to-order metal staff specializes in providing prototype and production pulleys, sheaves and sprockets to meet your design expectations. No order is too large or too small.

- Pulleys, Sheaves and Sprockets – All Gates Synchronous Profiles and Pitches, Micro-V® and V-belt, Plain or Profiled Idlers
- Bores – Plain, Straight, Tapered, Splined or any special bore. Manufactured to accept Taper-Lock®, Ringfeder®, QD, Torque Tamer, Trantorque® or other special bushings
- Styles – Bar Stock, Idlers, Custom Configurations, Special Hubs and more
- Material – Aluminum, Steel, Ductile, Cast iron, Phenolic, Stainless Steel or Plastics
- Finishes – Hard Coat, Food Grade, Zinc, Clear Anodize, Nickel Plating, Painted, Custom Plating or any Special Coatings
- Other Services – Sub-Assemblies, Press Bearings, Sprocket/ Bushing Balance and Index Marking
- Processes – Hob Cutting, Shaper Cutting, Die Casting and Molding

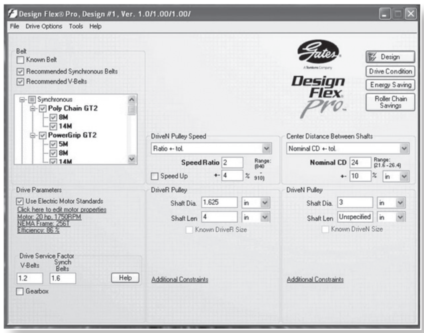
For more information call 800-709-6001,
visit www.gates.com/mtometals or
send an email to makemymetal@gates.com.

Online Drive Design and Engineering Tools

At www.gates.com/drivedesign

Fast and easy resources for selecting and maintaining Gates belt drive systems

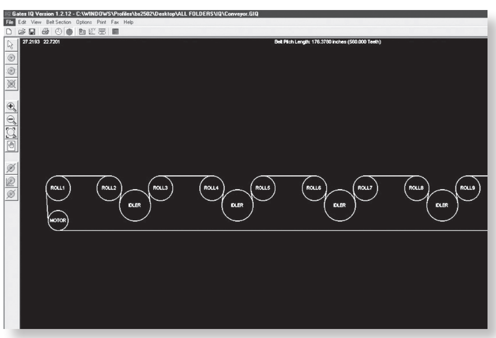
- Quickly find the product information you need
- Get answers, solve problems, and develop solutions
- Create drive designs in minutes



Design Flex® Pro™

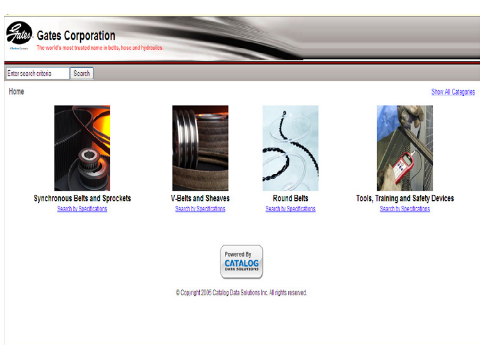
If you currently design 2-point drives using manuals, then you know how long it can take and that you only get one solution. With Gates Design Flex Pro program, you can design a drive in minutes and get every possible drive solution that fits your design parameters. Plus, you can print, email, and create a PDF of the design specifications. Use Design Flex Pro to:

- Convert roller chain drives to Poly Chain® GT® Carbon™ belt drive systems
- Design 2-point drives quickly and correctly
- Get multiple design solutions
- See both V-belt and synchronous options
- Design using different languages for customers outside the US
- Save time and money



Design IQ™

This program provides a blank slate for designing multi-point and complex serpentine belt drives. Utilizing a specific Gates product that you have identified, as well as your drive specifications, the software will calculate belt tension, shaft load, belt length, and more.



PartView™

PartView™ is Gates new web-based interactive product catalog of industrial belts and pulleys that lets you pick the right parts via a high-speed, easy-to-use search engine and obtain solid CAD models, specification sheets and additional product information.

Quality Statement

Gates is committed to providing its customers the highest quality products and services. Gates operates a quality management system which is certified to TS16949 standards. Gates committment extends to ensuring that all external suppliers comply with the requirements of ISO9001.

Decimal and Millimeter Equivalents of Fractions

Inches		
Fractions	Decimals	Millimeters
1/64	.015625	.397
1/32	.03125	.794
3/64	.046875	1.191
1/16	.0625	1.588
5/64	.078125	1.984
3/32	.09375	2.381
7/64	.109375	2.778
1/8	.125	3.175
9/64	.140625	3.572
5/32	.15625	3.969
11/64	.171875	4.366
3/16	.1875	4.763
13/64	.203125	5.159
7/32	.21875	5.556
15/64	.234375	5.953
1/4	.250	6.350
17/64	.265625	6.747
9/32	.28125	7.144
19/64	.296875	7.541
5/16	.3125	7.938
21/64	.328125	8.334
11/32	.34375	8.731
23/64	.359375	9.128
3/8	.375	9.525
25/64	.390625	9.922
13/32	.40625	10.319
27/64	.421875	10.716
7/16	.4375	11.113
29/64	.453125	11.509
15/32	.46875	11.906
31/64	.484375	12.303
1/2	.500	12.700
33/64	.515625	13.097
17/32	.53125	13.494
35/64	.546875	13.891
9/16	.5625	14.288
37/64	.578125	14.684
19/32	.59375	15.081
39/64	.609375	15.478
5/8	.625	15.875
41/64	.640625	16.272
21/32	.65625	16.669
43/64	.671875	17.066
11/16	.6875	17.463
45/64	.703125	17.859
23/32	.71875	18.256
47/64	.734375	18.653
3/4	.750	19.050
49/64	.765625	19.447
25/32	.78125	19.844
51/64	.796875	20.241
13/16	.8125	20.638
53/64	.828125	21.034
27/32	.84375	21.431
55/64	.859375	21.828
7/8	.875	22.225
57/64	.890625	22.622
29/32	.90625	23.019
59/64	.921875	23.416
15/16	.9375	23.813
61/64	.953125	24.209
31/32	.96875	24.606
63/64	.984375	25.003
1	1.000	25.400

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QD® is a registered trademark of Emerson Electric
Lexan® is a registered trademark of General Electric Company Corporation
Delrin® is a registered trademark of Du Pont de Nemours and Company Corporation
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