Table 25 Center Distance Tolerances

Belt Length		Center Distance Tolerance	
inches	mm	inches	mm
Up to 10	Up to 254	±.008	±.20
Over 10 To 15	Over 254 To 381	±.009	±.23
Over 15 To 20	Over 381 To 508	±.010	±.25
Over 20 To 30	Over 508 To 762	±.012	±.30
Over 30 To 40	Over 762 To 1016	±.013	±.33
Over 40 To 50	Over 1016 To 1270	±.015	±.38
Over 50 To 60	Over 1270 To 1524	±.016	±.41
Over 60 To 70	Over 1524 To 1778	±.017	±.43
Over 70 To 80	Over 1778 To 2032	±.018	±.46
Over 80 To 90	Over 2032 To 2286	±.019	±.48
Over 90 To 100	Over 2286 To 2540	±.020	±.51
Over 100 To 110	Over 2540 To 2794	±.021	±.53
Over 110 To 120	Over 2794 To 3048	±.022	±.56

Table 26 Overall Belt Thickness Dimensions

Belt Type	Belt Pitch	Overall Thickness (ref.)	
		inches	mm
MXL	.080"	.045	1.14
40 D.P.	.0816"	.045	1.14
XL	.200"	.090	2.29
3 mm HTD	3 mm	.095	2.41
5 mm HTD	5 mm	.150	3.81
2 mm GT	2 mm	.060	1.52
3 mm GT	3 mm	.095	2.41
5 mm GT	5 mm	.150	3.81
T2.5	2.5 mm	.051	1.3
T5	5 mm	.087	2.2
T10	10 mm	.177	4.5

Table 27 Overall Belt Thickness Tolerances

Standard	Class 2	Class 1
±0.015"	±0.010"	±0.005"
±0.38 mm	±0.25 mm	±0.13 mm

SECTION 17 STANDARDS APPLICABLE TO PULLEYS AND FLANGES

Pulleys are components manufactured to close tolerances in order to achieve best performance and long belt life. They are available in finished form or as bar stock which can be used for in-house manufacture of prototypes or smaller quantities.

For an uninitiated observer, a pulley may appear simply as a component with some trapezoidal or curvilinear grooves. In fact, the efficiency and integrity of a belt drive is closely attributed to the quality of pulleys involved. The pulleys, therefore, should be supplied by qualified and licensed suppliers. **In case of HTD and GT drives, the suppliers must be licensed by the Gates Rubber Company. Stock Drive Products is one of such licensed full line suppliers.**

To achieve the reproduction of the correct pulley profile, licensed hobs are used. The following inspection and design aids are used as well:

Master Profile: A scaled line drawing of the ideal groove profile with tolerance bands plotted on dimensionally stable translucent material. Suitable for groove inspection purposes on an optical comparator.

Dimensional Profile Drawing: A line drawing of the ideal groove profile with all arcs and radii defined. Suitable for mold design.

Digitized Points: A series of X and Y coordinates defining the ideal groove profile. Available in printed form or on a floppy disk. Suitable for mold design.

Tolerancing/Inspection Procedure: A typical pulley groove tolerance band is illustrated in **Figure 34**. Groove inspection must be made on an optical comparator at a specified magnification. The actual pulley groove profile must fit within the specified tolerance bands without any sharp transition or undercuts.

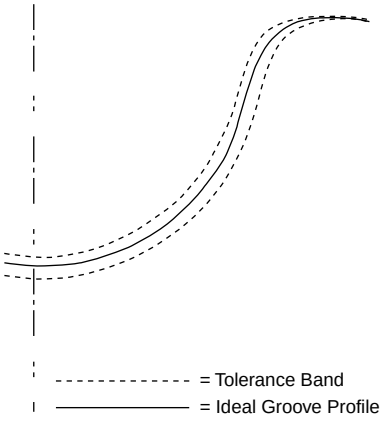


Fig. 34 Typical Pulley Groove Tolerance Band

17.1 Pulley Tolerances

Stock Drive Products has accepted, as a minimum requirement, the Engineering Standards recommended by the Mechanical Power Transmission Association. The Rubber Manufacturers Association, Inc. (RMA), the Rubber Association of Canada and the Gates Rubber Company standards are approved by the Technical Committee of the above associations. These standards are in substantial compliance with standards developed by the International Organization for Standardization (ISO).

Requirements of some belt manufacturers exceed those of RMA and ISO. Whenever practicable, Stock Drive Products adheres to those specifications which are more stringent.

The following tables contain the applicable tolerances:

Table 28 Pulley O.D. Tolerances

Pulley O.D.		Pulley O.D. Tollerances	
inches	mm	inches	mm
Up to 1	Up to 25.4	+.002 –.000	+.05 –.00
Over 1 To 2	Over 25.4 To 50.8	+.003 –.000	+.08 –.00
Over 2 To 4	Over 50.8 To 101.6	+.004 –.000	+.10 –.00
Over 4 To 7	Over 101.6 To 177.8	+.005 –.000	+.13 –.00
Over 7 To 12	Over 177.8 To 304.8	+.006 –.000	+.15 –.00
Over 12 To 20	Over 304.8 To 508.0	+.007 –.000	+.18 –.00
Over 20	Over 508.0	+.008 –.000	+.20 –.00

Table 29 Pulley Eccentricity

Outside Diameter		Total Eccentricity Total Indicator Reading	
inches	mm	inches	mm
Up to 2	Up to 50	0.0025	0.06
Over 2 To 4	Over 50 To 100	0.003	0.08
Over 4 To 8	Over 100 To 200	0.004	0.10
Over 8	Over 200	.0005"/inch O.D. > 8"	.013/mm O.D. O.D.> 200mm
		(may not exceed face diameter tolerance)	

The following definitions are being used when considering quality of pulleys:

Eccentricity: The allowable amount of radial run out from the pulley bore to the O.D. is shown in **Table 29**.

Helix Angle: Grooves should be parallel to the axis of the bore within 0.001" per inch (0.025 mm per 25.4 mm) of pulley groove face width.

Draft: The maximum permissible draft on the groove form is 0.001" per inch (0.025 mm per 25.4 mm) of face width and must not exceed the O.D. tolerance.

Parallelism: The bore of the pulley is to be perpendicular to the vertical faces of the pulley within 0.001" per inch (0.025 mm per 25.4 mm) of diameter with a maximum of 0.020" (0.51 mm) total indicator reading.

Pitch Accuracy: Adequate pitch to pitch accuracy is generally more difficult to achieve with molded pulleys than with machined pulleys. Recommended tolerances are listed in **Table 31**.

Balancing: Balancing is often not required on machined metal pulleys. All pulleys should be statically balanced to 1/8 oz (3.5 grams) in all sizes. Drives exceeding 6500 ft/min (33m/s) may require special materials, and should be dynamically balanced to 1/4 oz·in (1.78 N·mm).

Production pulleys should be made as closely to these tolerances as possible in order to maximize drive performance.

In addition to the **Tables 29**, **30** and **31** which define the tolerances related to pulleys manufactured by SDP/SI, **Tables 32** through **35** are given for reference only, as published by ISO (International Organization for Standardization) and RMA (Rubber Manufacturers Association).

Table 30 Bore Tolerance for Pulleys

Bore		Bore Tolerance	
in	**mm**	**in**	**mm**
To 1	To 2.54	+.0010 –.0000	+0.025 –0.000
1 to 2	25.4 to 50.8	+.0015 –.0000	+0.038 –0.000
2 to 3	50.8 to 76.2	+.0020 –.0000	+0.051 –0.000
3 up	76.2 up	+.0025 –.0000	+0.064 –0.000

Table 31 Pulley Pitch Accuracy

Bore				Pitch to Pitch		Accumulative*	
in		**mm**		**in**	**mm**	**in**	**mm**
Up to	1.0	Up to	25.4	±.001	±0.025	±.001	±0.025
Over To	1.0 2.0	Over To	25.4 50.8	±.001	±0.025	±.001	±0.025
Over To	2.0 4.0	Over To	50.8 101.6	±.001	±0.025	±.001	±0.025
Over To	4.0 7.0	Over To	101.6 177.8	±.001	±0.025	±.001	±0.025
Over To	7.0 12.0	Over To	177.8 304.8	±.001	±0.025	±.001	±0.025
Over To	12.0 20.0	Over To	304.8 508.0	±.001	±0.025	±.001	±0.025
Over	20.0	Over	508.0	±.001	±0.025	±.001	±0.025

***** Over 90°

Table 32 ISO Axial Pulley Runout

Outside Diameter Range		**Total Indicator Reading** (max.)	
in	**mm**	**in**	**mm**
≤ 4.000	≤ 101.60	.004	0.10
> 4.000 … ≤ 10.000	> 101.60 … ≤ 254.00	.001/in of O.D.	0.001/mm of O.D.
> 10.000	> 254.00	.010 + .0005/in of O.D. over 10.000"	0.25 + 0.0005/mm of O.D. over 254.00 mm

Table 33 ISO Radial Pulley Runout

Outside Diameter Range		**Total Indicator Reading** (max.)	
in	**mm**	**in**	**mm**
≤ 8.000	≤ 203.20	.005	0.13
> 8.000	> 203.20	.005 + .0005/in of O.D. over 8.000	0.13 + 0.0005/mm of O.D. over 203.20 mm

Table 34 ISO Pulley O.D. Tolerances

Outside Diameter		Tolerances	
in	**mm**	**in**	**mm**
≤ 1.000	≤ 25.40	+.002 /–.000	+0.05 / 0
> 1.000 ... ≤ 2.000	> 25.40 ... ≤ 50.80	+.003 /–.000	+0.08 / 0
> 2.000 ... ≤ 4.000	> 50.80 ... ≤ 101.60	+.004 /–.000	+0.10 / 0
> 4.000 ... ≤ 7.000	> 101.60 ... ≤ 177.80	+.005 /–.000	+0.13 / 0
> 7.000 ... ≤ 12.000	> 177.80 ... ≤ 304.80	+.006 /–.000	+0.15 / 0
> 12.000 ... ≤ 20.000	> 304.80 ... ≤ 508.00	+.007 /–.000	+0.18 / 0
> 20.000	> 508.00	+.008 /–.000	+0.20 / 0

Table 35 RMA Pulley Bore Tolerances

Length / Diameter of Bore	Up thru .75 (19)	Over .75 (19) to and including 1.00 (25.4)	Over 1.00 (25.4) to and including 1.25 (31.8)	Over 1.25 (31.8) to and including 1.50 (38.1)	Over 1.50 (38.1) to and including 2.00 (50.8)	Over 2.00 (50.8) to and including 2.50 (63.5)	Over 2.50 (63.5) to and including 3.00 (76.2)
	Tolerances						
Up thru 0.50 (12.7)	+.0015 +.0005 (+0.038 +0.013)	+.0015 +.0005 (+0.038 +0.013)	+.0015 +.0005 (+0.038 +0.013)	+.0015 +.0005 (+0.038 +0.013)	+.0015 +.0005 (+0.038 +0.013)		
Over 0.50 (12.7) to and including 1.00 (25.4)	+.0015 +.0005 (+0.038 +0.013)	+.0015 +.0005 (+0.038 +0.013)	+.0015 +.0005 (+0.038 +0.013)	+.0015 +.0005 (+0.038 +0.013)	+.0020 +.0005 (+0.051 +0.013)	+.0020 +.0005 (+0.051 +0.013)	+.0020 +.0005 (+0.051 +0.013)
Over 1.00 (25.4) to and including 1.50 (38.1)		+.0015 +.0005 (+0.038 +0.013)	+.0015 +.0005 (+0.038 +0.013)	+.0015 +.0005 (+0.038 +0.013)	+.0020 +.0010 (+0.051 +0.025)	+.0020 +.0010 (+0.051 +0.025)	+.0020 +.0010 (+0.051 +0.025)
Over 1.50 (38.1) to and including 2.00 (50.8)			+.0020 +.0005 (+0.051 +0.013)	+.0020 +.0005 (+0.051 +0.013)	+.0025 +.0010 (+0.064 +0.025)	+.0025 +.0010 (+0.064 +0.025)	+.0025 +.0010 (+0.064 +0.025)
Over 2.00 (50.8) to and including 2.50 (63.5)				+.0020 +.0005 (+0.051 +0.013)	+.0025 +.0010 (+0.064 +0.025)	+.0025 +.0010 (+0.064 +0.025)	+.0025 +.0010 (+0.064 +0.025)

NOTE: Dimensions in ( ) are in mm, all others are in inches

17.2 Pulley Materials

There is a wide variety of materials and manufacturing processes available for the production of synchronous belt pulleys. In selecting an appropriate material and production process, the designer should consider dimensional accuracy, material strength, durability and production quantity. Some broad guidelines and recommendations are as follows:

1. Machining

Excellent dimensional accuracy. Economical for low to moderate production quantities.

Typical materials:

Steel – Excellent Wear Resistance.

Aluminum – Good Wear Resistance; pulleys for power transmission drives should be hard anodized.

2. Powdered Metal and Die Casting

Good dimensional accuracy. Economical for moderate to high production quantities.

Typical materials:

Sintered Iron – Excellent Wear Resistance.

Sintered Aluminum – Good Wear Resistance; Light Weight and Corrosion Resistant.

Zinc Die Cast – Good Wear Resistance.

3. Plastic Molding

Good dimensional accuracy. Economical for high production quantities. Best suited for light to moderate torque loads. Fiber loading improves overall material strength and dimensional stability. However, increased belt wear can result from the presence of sharp abrasive fiber ends on the finished surface.

Assistance for total drive system design is available. Please contact our Application Engineering Department.

17.3 Flange Design And Face Width Guidelines

Figure 35 illustrates the expressions used in flange and pulley design. **Tables 36** and **37** pertain to flange dimensions and pulley face widths respectively.

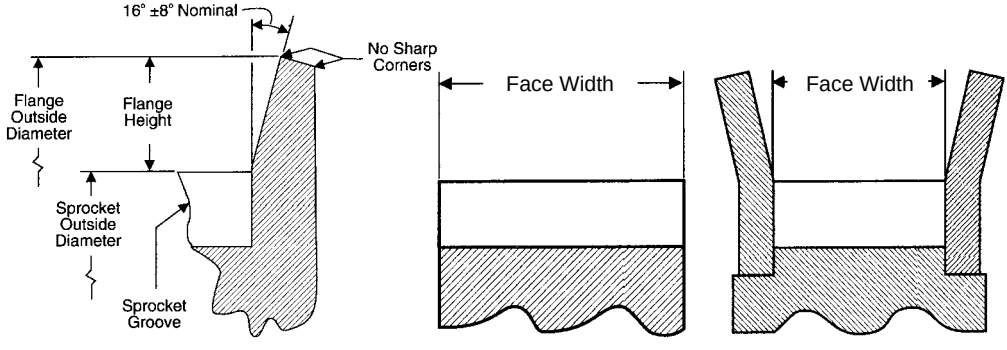


Fig. 35 Expressions Used in Flange and Pulley Design

Table 36 Nominal Flange Dimensions for Molding, Sintering, Casting, etc.

Belt Type	Minimum Flange Height		Nominal Flange Height	
	inches	mm	inches	mm
MXL	0.040	—	0.050	—
XL	0.060	—	0.080	—
2 mm GT2	0.043	1.10	0.059	1.50
3 mm GT2 & HTD	0.067	1.70	0.098	2.50
5 mm GT2 & HTD	0.091	2.20	0.150	3.80

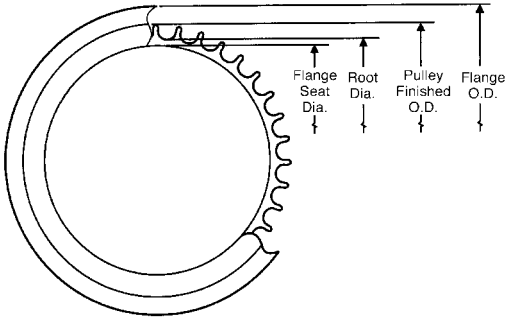
Table 37 Additional Amount of Face Width Recommended over Nominal Belt Width*

Belt Type	Nom. Face Width Unflanged		Nom. Face Width Flanged	
	inches	mm	inches	mm
MXL	+0.125	—	+0.040	—
XL	+0.190	—	+0.060	—
2 mm GT2	+0.118	+3.00	+0.039	+1.00
3 mm GT2 & HTD	+0.157	+4.00	+0.049	+1.25
5 mm GT2 & HTD	+0.197	+5.00	+0.059	+1.50

***** Add Table Values to Nominal Belt Width for Nominal Face Width

17.4 Guidelines For GT2 Flange Design

In some instances, special pulleys are used whch are made from pulley stock. The following guidelines are given to establish the design parameters for flanges which would fit these special pulleys. If possible, standard available flanges should be used to avoid tooling charges associated with production of special sized flanges.



Nominal GT2 Groove Depths

2 mm — .030" (0.76 mm)
3 mm — .045" (1.14 mm)
5 mm — .076" (1.93 mm)

GT2 Pitch Factors

2 mm — .016" (0.41 mm)
3 mm — .050" (1.27 mm)
5 mm — .070" (1.78 mm)

Figure 36 Terms Used for Timing Pulley Flange Design

Steps:

1. Determine pulley size and finished O.D. (See **Tables 12** through **14** on pages T-32 thru T-37).
2. Determine root diameter (Root Diameter = Finished O.D. – 2 x Nominal Groove Depth). See **Figure 19**, page T-15.
3. Determine maximum flange seat diameter.
   (Maximum Flange Seat Diameter = Root Diameter – Pitch Factor).
4. Select flange with inside diameter less than maximum flange seat diameter (see available flange sizes in the product section).
5. Determine flange seat diameter (Flange Seat Diameter = Flange I.D. +.000" –.003")
6. Determine flange seat width (Flange Seat Width = Flange Gauge + .020" ±.005"; see available flange sizes).
7. Flanges can be rolled, staked or punched on.