

Installation, Maintenance & Troubleshooting Guide

POWER TRANSMISSION

BELT DRIVES



GOODYEAR
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Installation, Maintenance & Troubleshooting Guide

POWER TRANSMISSION

BELT DRIVES

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Industry Standards

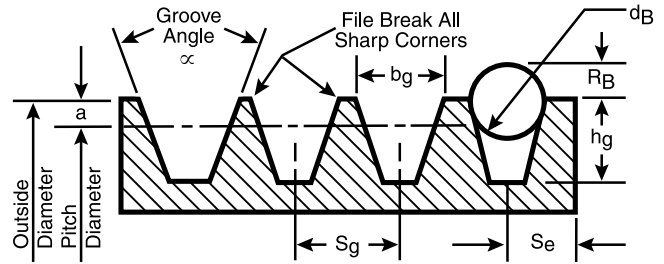
Sheaves should be checked for cleanliness, damage and wear each time belt maintenance is performed and whenever belts are changed. The inspection procedure is described on page 6 of this Guide.

The tables and tolerance data below are provided as a reference to determine if excessive sheave wear has occurred. They can also be used to aid in replacement belt cross section selection, if necessary.

The tables are based on industry standard dimensions for V-belt and Hy-T® belt sheaves. The original sheave specifications should always be checked, if possible. Variances from industry standards can occur to provide for special design or performance requirements.

NOTE: Industry standards for Poly-V® belts and positive drive belts are shown on pages 16 and 20 of this Guide.

Industry Standard Groove Dimensions for V-Belt Sheaves



Standard Groove Dimensions

Face Width of Standard and Deep Groove Sheaves
Face Width = $S_g(N_g - 1) + 2S_e$

Where:
 N_g = Number of Grooves

TABLE 1 GROOVE DIMENSIONS—INCHES

Cross Section	Standard Groove Dimensions								Drive Design Factors		
	Outside Diameter Range	Groove Angle α ± 0.33	b_g	h_g min.	R_B min.	d_b ± 0.0005	± 0.025	S_e	Pitch Diameter Range	Minimum Recommended Pitch Diameter	2a
A	Up Through 5.65 Over 5.65	34 38	0.494 ± 0.005 0.504	0.460	0.148 0.149	0.4375 (7/16)	0.625	0.375 -0.090 -0.062	Up Through 5.40 Over 5.40	3.0	0.250
B	Up Through 7.35 Over 7.35	34 38	0.637 ± 0.006 0.650	0.550	0.189 0.190	0.5625 (9/16)	0.750	0.500 -0.120 -0.065	Up Through 7.00 Over 7.00	5.4	0.350
A/B	Up Through 7.35 Over 7.35	34 38	0.612 ± 0.006 0.625	0.612	0.230 0.226	0.5625 (9/16)	0.750	0.500 -0.120		A = 3.0 B = 5.4	A = 0.620* B = 0.280
C	Up Through 8.39 Over 8.39 to & Incl. 12.40 Over 12.40	34 36 38	0.879 0.887 ± 0.276 0.895	0.750	0.274 0.276 0.277	0.7812 (25/32)	1.000	0.688 +0.160 -0.070	Up Through 7.99 Over 7.99 to & Incl. 12.00 Over 12.00	9.0	0.400
D	Up Through 13.59 Over 13.59 to & Incl. 17.60 Over 17.60	34 36 38	1.259 1.271 ± 0.008 1.283	1.020	0.410 0.410 0.411	1.1250 (1-1/8)	1.438	0.875 +0.220 -0.080	Up Through 12.99 Over 12.99 to & Incl. 17.00 Over 17.00	13.0	0.600
E	Up Through 24.80 Over 24.80	36 38	1.527 ± 0.010 1.542	1.270	0.476 0.477	1.3438 (1-11/32)	1.750	1.125 +0.280 -0.090	Up Through 24.00 Over 24.00	21.0	0.800
Deep Groove Dimensions											
Cross Section	Outside Diameter Range	Groove Angle α $\pm 0.33^\circ$	b_g	h_g min.	2a	S_g ± 0.025	S_e				
A	Up Through 5.96 Over 5.96	34 38	0.589 ± 0.005 0.611	0.615	0.560	0.750	0.438	+0.090 -0.062			
B	Up Through 7.71 Over 7.71	34 38	0.747 ± 0.006 0.774	0.730	0.710	0.875	0.562	+0.120 -0.065			
C	Up Through 9.00 Over 9.00 to & Incl. 13.01 Over 13.01	34 36 38	1.066 1.085 ± 0.007 1.105	1.055	1.010	1.250	0.812	+0.160 -0.070			
D	Up Through 14.42 Over 14.42 to & Incl. 18.43 Over 18.43	34 36 38	1.513 1.541 ± 0.008 1.569	1.435	1.430	1.750	1.062	+0.220 -0.080			
E	Up Through 25.69 Over 25.69	36 38	1.816 ± 0.010 1.849	0.715	1.690	2.062	1.312	+0.280 -0.090			

OTHER SHEAVE TOLERANCES

Outside Diameter
Up through 4.0 inches
outside diameter..... ± 0.020 inches
For each additional inch of outside
diameter add..... ± 0.005 inches

Radial Runout**
Up through 10.0 inches
outside diameter..... ± 0.010 inches
For each additional inch of outside
diameter add..... ± 0.0005 inches

Axial Runout**
Up through 5.0 inches
outside diameter..... ± 0.005 inches
For each additional inch of outside
diameter add..... ± 0.001 inches
**Total Indicator Reading

*The "a" values shown for the A/B combination sheaves are the geometrically derived values. These values may be different than those shown in manufacturer's catalogs.

Summation of the deviations from "Sg" for all grooves in any one sheave shall not exceed ± 0.050 inches.

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

Up through 19.9 inches outside diameter and up through 6 grooves:
0.010 inches (add 0.005 inches for each additional groove.)

20.0 inches and over on outside diameter and up through 10
grooves: 0.015 inches (add 0.0005 inches 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.

Deep groove sheaves are intended for drives with belt offset such as quarter-turn or vertical shaft drives. (See RMA Power Transmission Belt Technical Information Bulletin No. 10.)

Joined belts will not operate in deep groove sheaves.

Industry Standard Groove Dimensions for Hy-T Wedge® Belt Sheaves

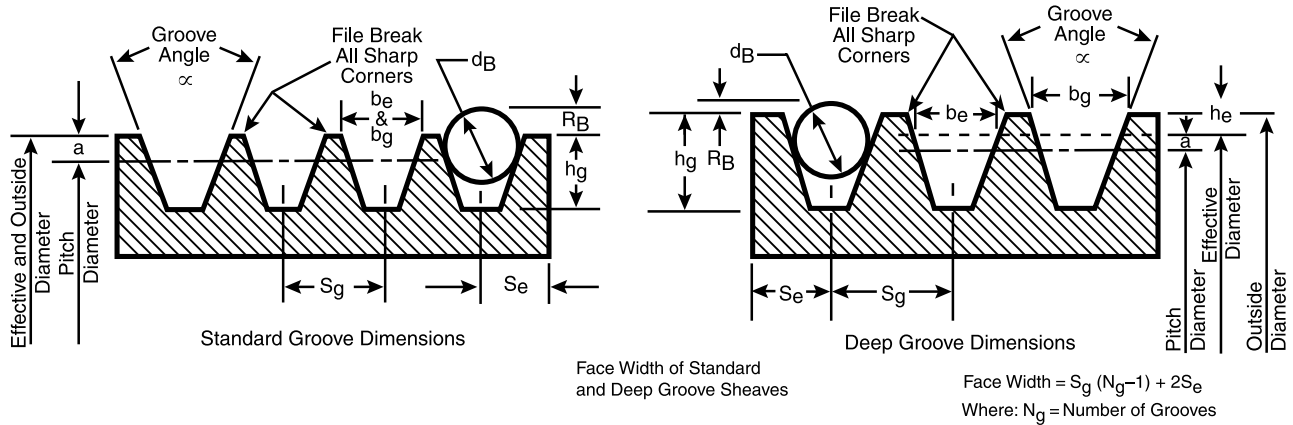


TABLE 2 GROOVE DIMENSIONS—INCHES

Cross Section	Standard Groove Outside Diameter	Standard Groove Dimensions								Design Factors		
		Groove Angle ± 0.25 Degrees	b_g ± 0.005	b_e Ref.	h_g Min.	R_B Min.	d_B ± 0.0005	S_g ± 0.015	S_e	Minimum Recommended Outside Diameter	2a	
3V	Up Through 3.49	36				0.181					2.65	0.050
	Over 3.49 To And Including 6.00	38	0.350	0.350	0.340	0.183	0.3438	0.406	0.344			
	Over 6.00 To And Including 12.00	40				0.186			+0.094			
	Over 12.00	42				0.188			-0.031			
5V	Up Through 9.99	38				0.329				7.10	0.100	
	Over 9.99 To And Including 16.00	40	0.600	0.600	0.590	0.332	0.5938	0.688	0.500			
	Over 16.00	42				0.336			+0.125 -0.047			
8V	Up Through 15.99	38				0.575				12.50	0.200	
	Over 15.99 To And Including 22.40	40	1.000	1.000	0.990	0.580	10.0000	1.125	0.750			
	Over 22.40	42				0.585			+0.250 -0.062			

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

Summation of the deviations from "Sg" for all grooves in any one sheave shall not exceed ± 0.031 inch. The variations in pitch diameter between the grooves in any one sheave must be within the following limits:

Up through 19.9 inches outside diameter and up through 6 grooves – 0.010 inches (Add 0.0005 inches for each additional groove.)

20.0 inches and over on outside diameter and up through 10 grooves – 0.015 inches (add 0.0005 inches for each additional groove.)

This variation can easily be obtained by measuring the distance across two measuring balls or rods placed in the grooves diametrically opposite each other. 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. (See Power Transmission Belt Technical Information Bulletin No.10.) They may also be necessary where oscillations in the center distance may occur. Joined belts will not operate in deep groove sheaves.

OTHER SHEAVE TOLERANCES

Outside Diameter

Up through 8.0 inches outside diameter..... ± 0.020 inches
For each additional inch of outside diameter add..... ± 0.0025 inches

Radial Runout**

Up through 10.0 inches outside diameter..... ± 0.010 inches
For each additional inch of outside diameter add..... ± 0.0005 inches

Axial Runout**

Up through 5.0 inches outside diameter..... ± 0.005 inches
For each additional inch of outside diameter add..... ± 0.001 inches

**Total Indicator Reading

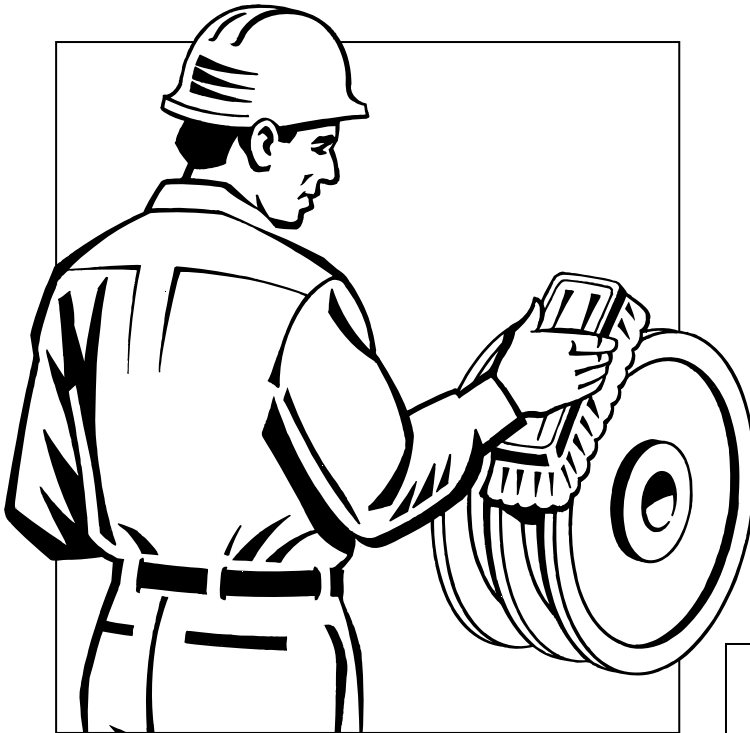
Installation

Torque-Flex,[®] Hy-T,[®] Hy-T Wedge,[®] Torque Team,[®] Hex, and FHP V-Belts

1. INSPECT SHEAVES

WARNING

Do not clean sheaves while the machine is running. Disconnect power supply to the machine before removing or installing sheaves. Take sheaves off machines to inspect, clean and repair them.

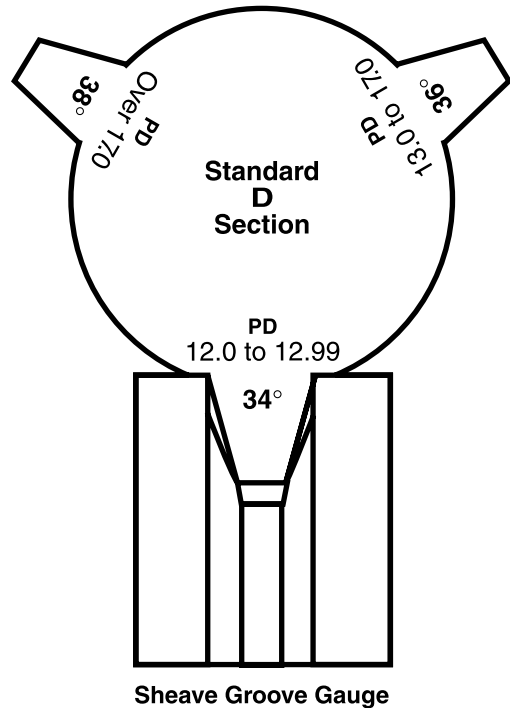


Damaged, worn or dirty sheaves will substantially reduce belt life. Nicks or gouges can cut the belt. Dirt in the grooves can abrade the belt and oil can attack the belt material. Worn grooves will allow the belt to bottom out, slip and become damaged.

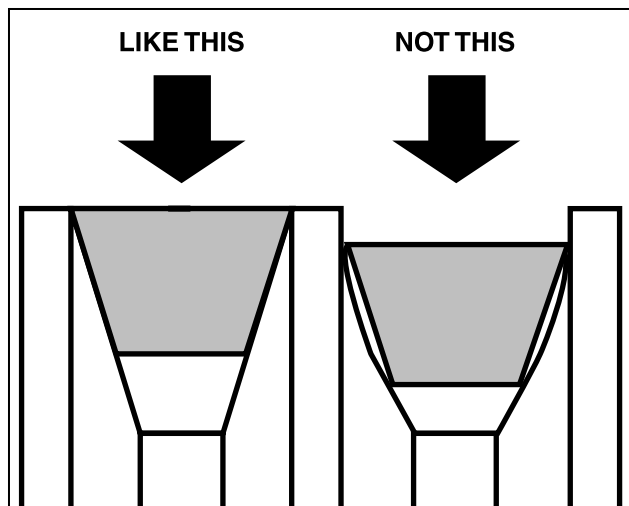
Use a stiff brush to clean off rust and dirt. Wipe clean of oil and grease.

WARNING

Do not reinstall damaged or worn sheaves on equipment. Repair or replace them.



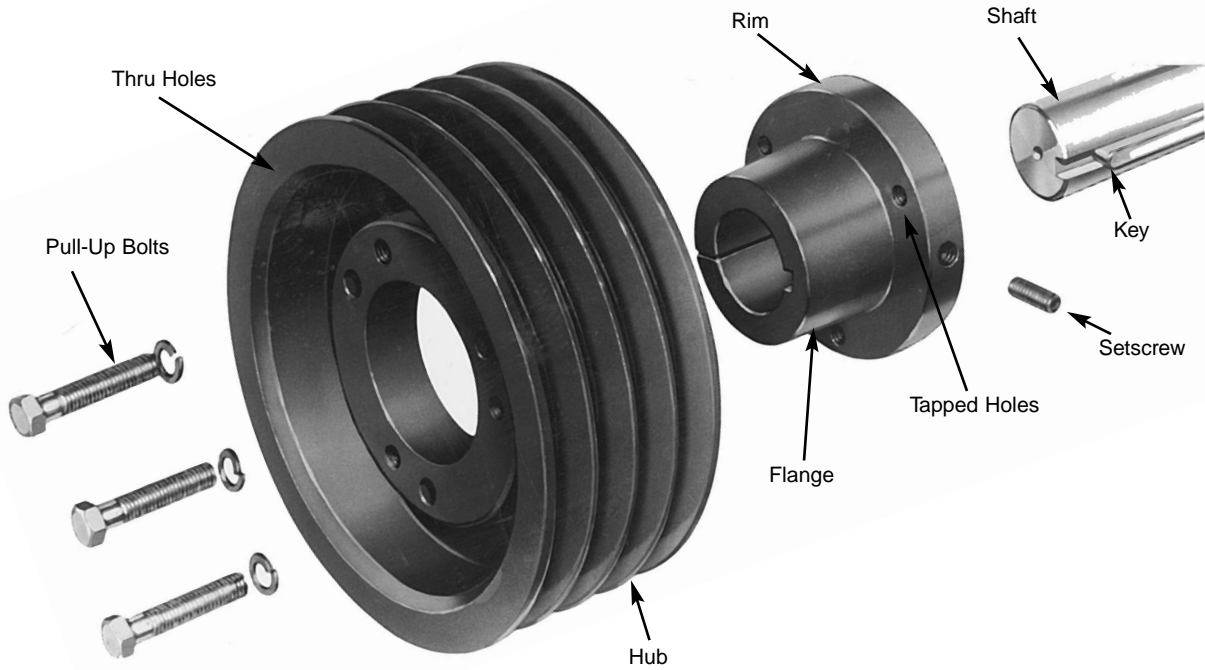
Select the proper sheave groove gauge and template for the sheave diameter. Insert the gauge in the groove and look for voids which indicate *dishing* or other uneven and abnormal wear.



Place a new belt in the sheave groove. The top of the belt should be flush with the outer diameter of the sheave. If the belt top is below the outer diameter of the sheave, the groove is worn.

2. MOUNT SHEAVES

THE QD® HUB (Conventional Mount) HOW TO MOUNT THE QD® HUB



*QD IS A REGISTERED TRADEMARK OF EATON CORP.

WARNING

Disconnect power supply to the machine before removing or installing sheaves.

Insert the hub in the rim and line up bolt holes.

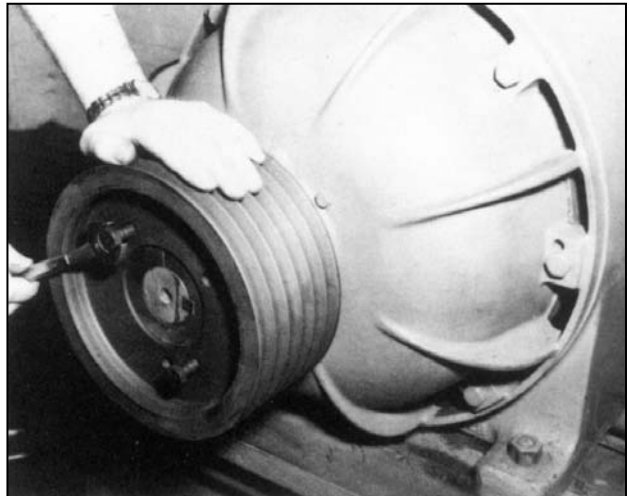
Insert the pull-up bolts and turn until finger tight.

Hold the loosely assembled unit so the hub flange is toward the shaft bearings. Slip the unit onto the shaft and align the rim in the desired position. See *Step 3*, Page 10, for alignment details.

Tighten the setscrew in the flange only enough to hold the assembly in position.

Tighten each pull-up bolt alternately and evenly.

Recheck alignment and completely tighten the setscrew onto the shaft.



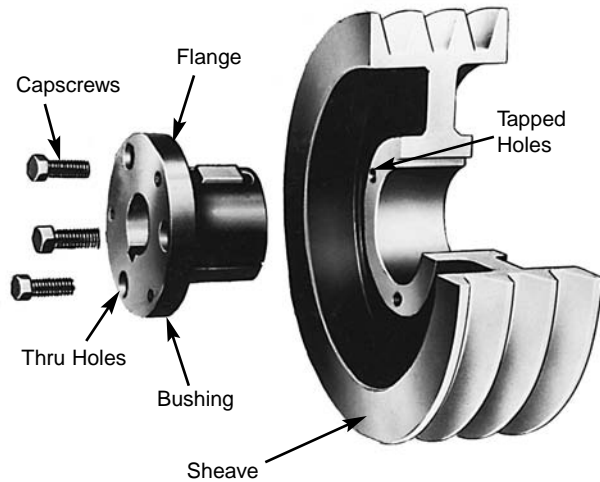
HOW TO REMOVE THE QD® HUB

Place two of the pull-up bolts in the tapped holes in the sheave. Turn the bolts alternately and evenly. They will push against the hub flange and act as jackscrews to break the grip between the hub and the rim.

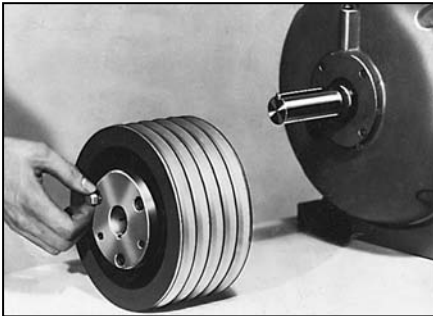
THE SPLIT TAPER BUSHING

WARNING

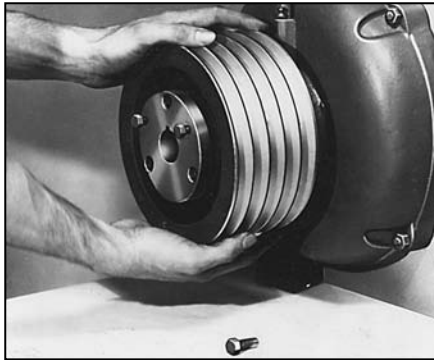
Disconnect power supply to the machine before removing or installing sheaves.



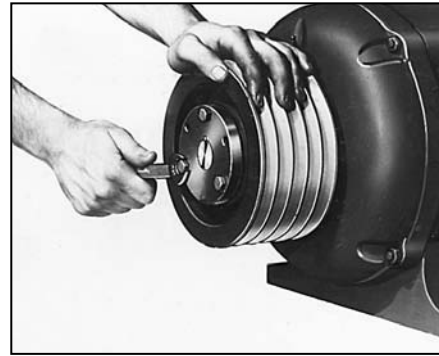
HOW TO MOUNT SPLIT TAPER BUSHING SHEAVES



Put the bushing loosely in the sheave and start the capscrews.

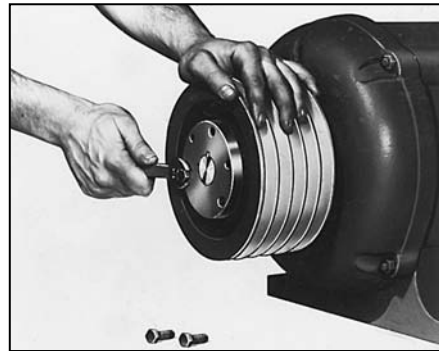


Place the assembly on the shaft. Align both edges of the sheave with the edges of its mating sheave (i.e. the sheave on the driven shaft). See Step 3, page 10, for details.



Tighten the capscrews according to the instructions furnished with the bushings.

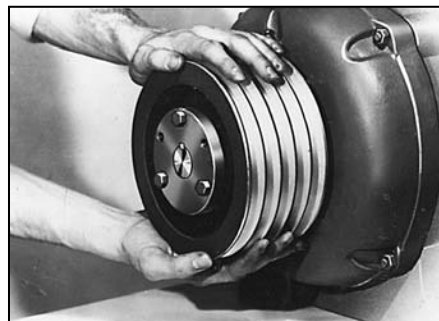
HOW TO REMOVE SPLIT TAPER BEARING SHEAVES.



Remove all capscrews.



Put two of the capscrews in the tapped holes in the flange of the bushing. Turn the bolts alternately and evenly until the sheave has loosened.



Remove the sheave/flange assembly from the shaft.

WARNING

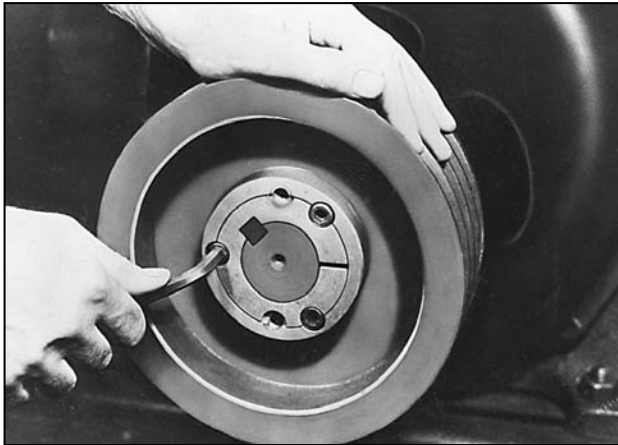
Disconnect power supply to the machine before removing or installing sheaves.

THE TAPER-LOCK* BUSHING

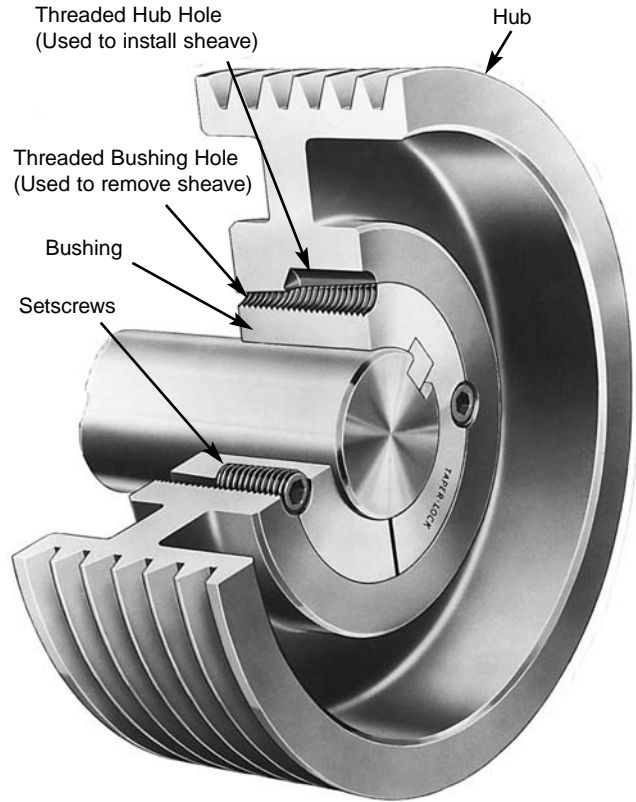
HOW TO MOUNT THE TAPER-LOCK BUSHING



Look at the bushing and the hub. Each has a set of half-holes. The threaded holes in the hub are the mates to the non-threaded holes in the bushing. Insert the bushing in the hub and slide it onto the shaft. Align the holes (*not the threads*). Start the setscrews into the holes that are threaded in the hub only. Do not tighten the setscrews yet.



Align both edges of the sheave with the edges of its mating sheave. See *Step 3*, page 10 for details. Tighten the screws alternately and evenly. This will wedge the bushing inward and cause it to contract evenly and grip the shaft.



*Taper-Lock: TM Reliance Electric Company

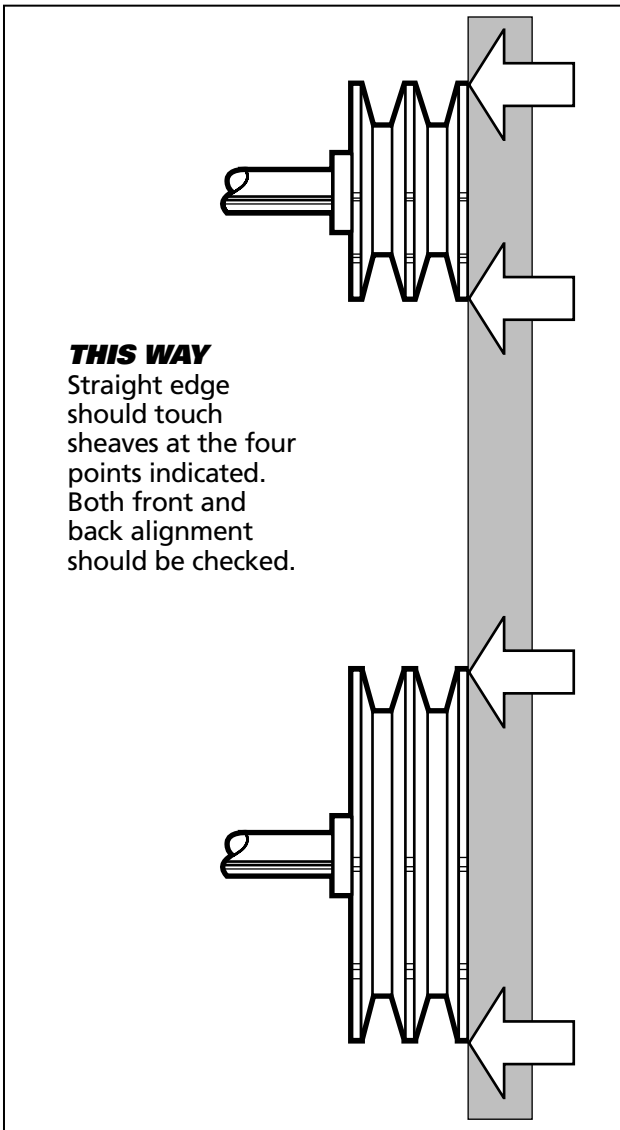
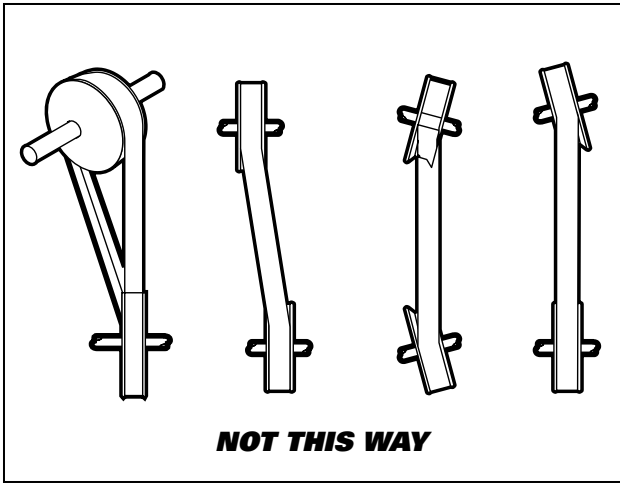
HOW TO REMOVE THE TAPER-LOCK BUSHING



Remove all the setscrews. Place two of the setscrews in the holes that are threaded in the bushing only. Turn the setscrews alternately and evenly. This will unlock the grip and permit easy removal of the assembly with no shock to the bearings or machinery.

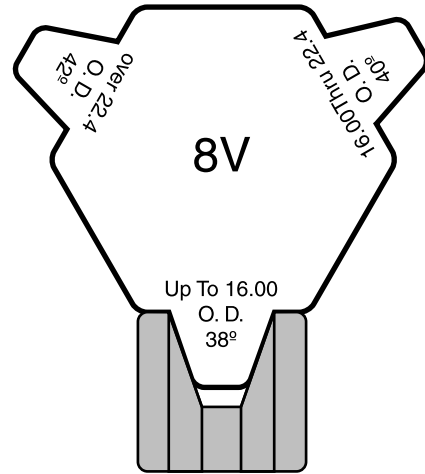
3. CHECK ALIGNMENT

Proper alignment is essential to maintain long V-belt life. Belt alignment should be checked every time belt maintenance is performed, each time belts are replaced and whenever sheaves are removed or installed.

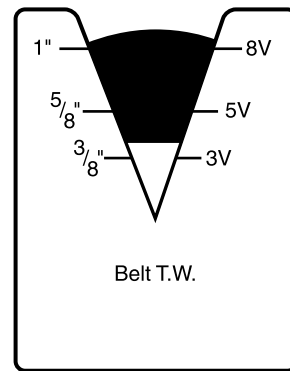


4. SELECT THE CORRECT BELT

Always select belts to match sheave grooves. Use a sheave groove gauge to determine the proper belt cross section. Use a belt gauge to verify the old belt cross-section used when belt identification is no longer legible.



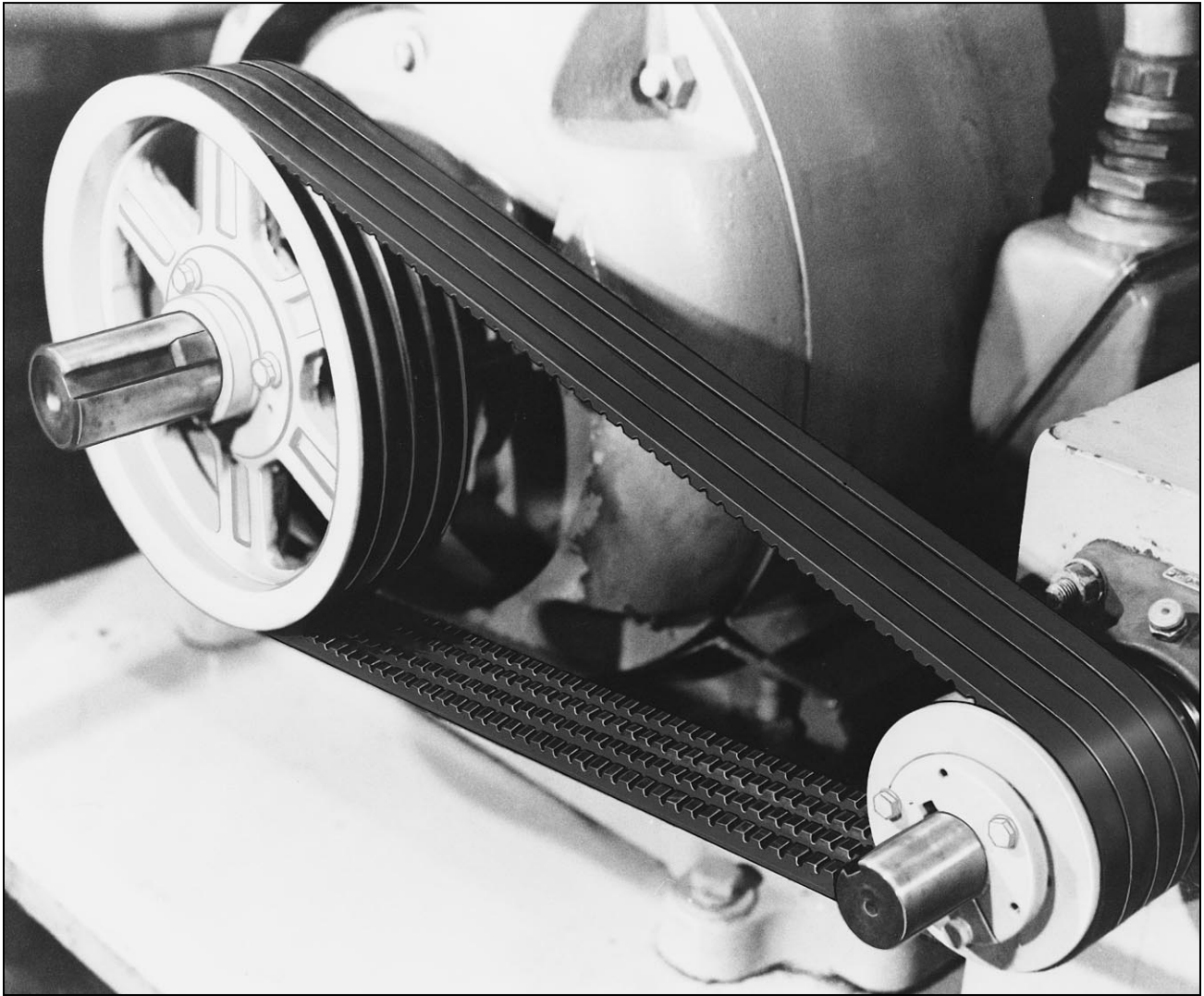
SHEAVE GROOVE GAUGE



BELT GAUGE

If the drive requires "A," "B," "C" or "D" section belts, select the Hy-T® or premium Torque-Flex® (not available in "D") belt recommended for your application. If you have experienced short belt life with standard belts, a higher grade of belt will increase service life.

5. MATCH THE BELTS



WARNING

Do not test or operate belt drives without guards in place.

All Goodyear V-belts are manufactured under rigid quality control procedures so that all belts produced in a given size may be matched with each other. It is not necessary to use matching code numbers and such numbers no longer appear on the belts.

The following procedures should be followed whenever a new set of belts is installed.

DON'T MIX BELT BRANDS

Each brand of V-belt has different performance characteristics. Drives will not deliver the power or service expected when a mix of belt brands is used.

DON'T MIX NEW AND USED BELTS

Always replace complete sets of V-belts with new V-belts, even if only one or two seem worn or damaged.

Do not attempt to assemble two or more used V-belts for a set. They will not perform as expected.

Reusing V-belts where matched sets are required will substantially reduce the life of the drive.

NOTE: Torque Team® belts (joined belts) provide the benefits of the joined principal as well as a wider team. A matched set of a two-belt and a three-belt Torque Team will provide service equal to five single belts in a team. Sheave wear is very important to long life for any V-belt, but critical for Torque Team belt applications. Worn sheaves will destroy joined belts very quickly.

6. HOW TO INSTALL BELTS



WRONG– Never force the belts into a sheave with a screwdriver or wedge. You will rupture the envelope fabric and break the cords.



Always move the drive unit forward so the belts can easily be slipped into the grooves without forcing them.

TABLE 3

Standard Length Designation	Minimum Allowance Below Standard Center Distance for Installation of Belts								Minimum Allowance Above Standard Center Distance for Maintaining Tension All Cross Sections
	A	B	B Torque Team	C	C Torque Team	D	D Torque Team	E	
Up to and Incl. 35	0.75	1.00	1.50						1.00
Over 35 to and Incl. 55	0.75	1.00	1.50	1.50	2.00				1.50
Over 55 to and Incl. 85	0.75	1.25	1.60	1.50	2.00				2.00
Over 85 to and Incl. 112	1.00	1.25	1.60	1.50	2.00				2.50
Over 112 to and Incl. 144	1.00	1.25	1.80	1.50	2.10	2.00	2.90		3.00
Over 144 to and Incl. 180		1.25	1.80	2.00	2.20	2.00	3.00	2.50	3.50
Over 180 to and Incl. 210		1.50	1.90	2.00	2.30	2.00	3.20	2.50	4.00
Over 210 to and Incl. 240		1.50	2.00	2.00	2.50	2.50	3.20	2.50	4.50
Over 240 to and Incl. 300		1.50	2.20	2.00	2.50	2.50	3.50	3.00	5.00
Over 300 to and Incl. 390				2.00	2.70	2.50	3.60	3.00	6.00
Over 390				2.50	2.90	3.00	4.10	3.50	1.5% of belt length

TABLE 4–HY-T WEDGE V-BELTS

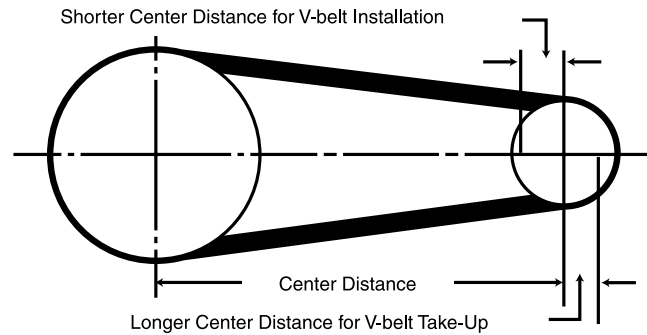
Standard Length Designation	Minimum Allowance Below Standard Center Distance for Installation of Belts, Inches						Minimum Allowance Above Standard Center Distance for Maintaining Tension, Inches All Cross Sections
	3V	3V Torque Team	5V	5V Torque Team	8V	8V Torque Team	
Up to and Incl. 475	0.5	1.2					1.0
Over 475 to and Incl. 710	0.8	1.4	1.0	2.1			1.2
Over 710 to and Incl. 1060	0.8	1.4	1.0	2.1	1.5	3.4	1.5
Over 1060 to and Incl. 1250	0.8	1.4	1.0	2.1	1.5	3.4	1.8
Over 1250 to and Incl. 1700	0.8	1.4	1.0	2.1	1.5	3.4	2.2
Over 1700 to and Incl. 2000			1.0	2.1	1.8	3.6	2.5
Over 2000 to and Incl. 2360			1.2	2.4	1.8	3.6	3.0
Over 2360 to and Incl. 2650			1.2	2.4	1.8	3.6	3.2
Over 2650 to and Incl. 3000			1.2	2.4	1.8	3.6	3.5
Over 3000 to and Incl. 3550			1.2	2.4	2.0	4.0	4.0
Over 3550 to and Incl. 3750					2.0	4.0	4.5
Over 3750 to and Incl. 5000					2.0	4.0	5.5

WARNING

Disconnect power supply to the machine before removing or installing sheaves or belts.

CENTER DISTANCE ALLOWANCE FOR BELT INSTALLATION AND TAKE-UP

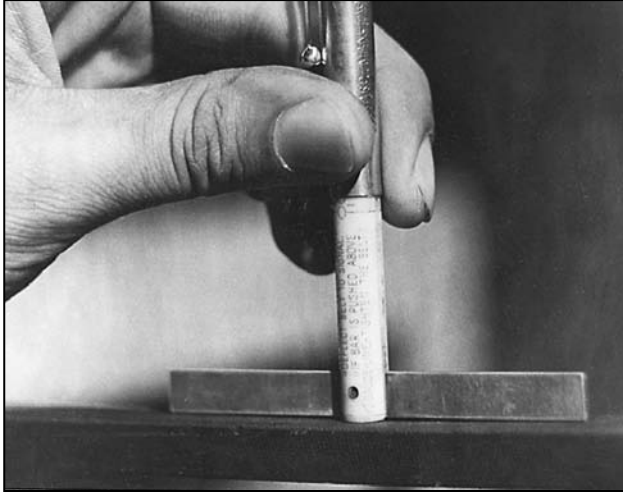
Tables 3 and 4 show the minimum movement below and above the standard center distance which is required between the sheaves. This movement allows the center distance to be shortened for new belt installation. It also allows the center distance to be increased to take up slack and maintain proper tension as the belt stretches. See Step 7 for additional information on belt tensioning.



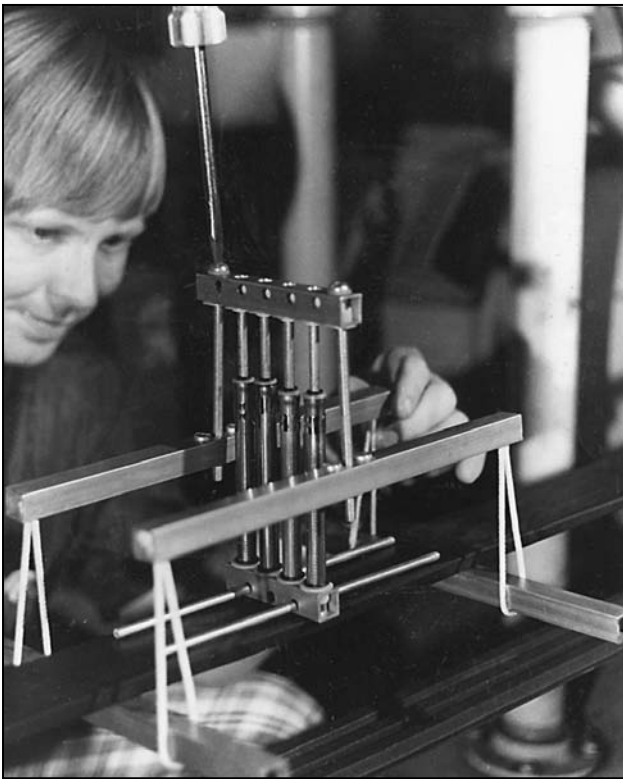
7. HOW TO TENSION THE BELTS

WARNING

Disconnect power supply to the machine before removing, installing or adjusting belts.



A tension tester is used to check V-belt tension values.

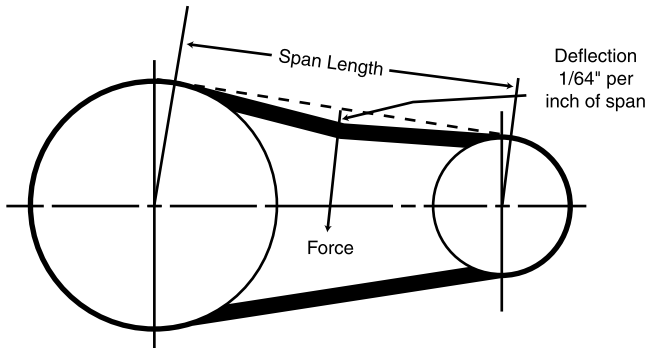


A multiple gauge tensioning device should be used to establish tension values on Torque Team® belts.

COMMON SENSE RULES OF V-BELT TENSIONING

- The ideal tension is the lowest tension at which the belt will not slip under peak load conditions.
- Check the belt tension frequently during the first 24-48 hours of run-in operation.
- Do not over tension belts. This shortens belt and bearing life.
- Keep belts free from foreign materials which may cause slippage.
- Inspect the V-drive periodically. Retension the belts if they are slipping.
- Maintain sheave alignment with a strong straight-edge tool while tensioning V-belts.

HOW TO CHECK THE TENSION IN A CONVENTIONAL V-BELT DRIVE



- 1.** Measure the span length, t . (See illustration)
- 2.** Mark the center of span t . At the center mark, use a tension tester and apply a force perpendicular to the span large enough to deflect the belt $1/64''$ for every inch of span length. (Ex: a 100" span requires a deflection of $100/64''$ or $1\ 9/16''$)
- 3.** Compare the force applied with the values in Tables 5 and 6 on the next page. A force between the value shown and 1.5 times (1.5X) the value shown should be satisfactory. A force below the tension value indicates an undertensioned drive and may result in slippage. A force above the tension value indicates an overtensioned drive and may result in belt and drive damage.

TABLE 5-BELT DEFLECTION FORCE

The values below are based on operating speeds of 1000–3000 feet per minute. For belt speeds in excess of 3000 feet per minute, reduce the deflection force by 20%. Check the factory for operating speeds less than 1000 feet per minute and for other conditions not covered in the tables.

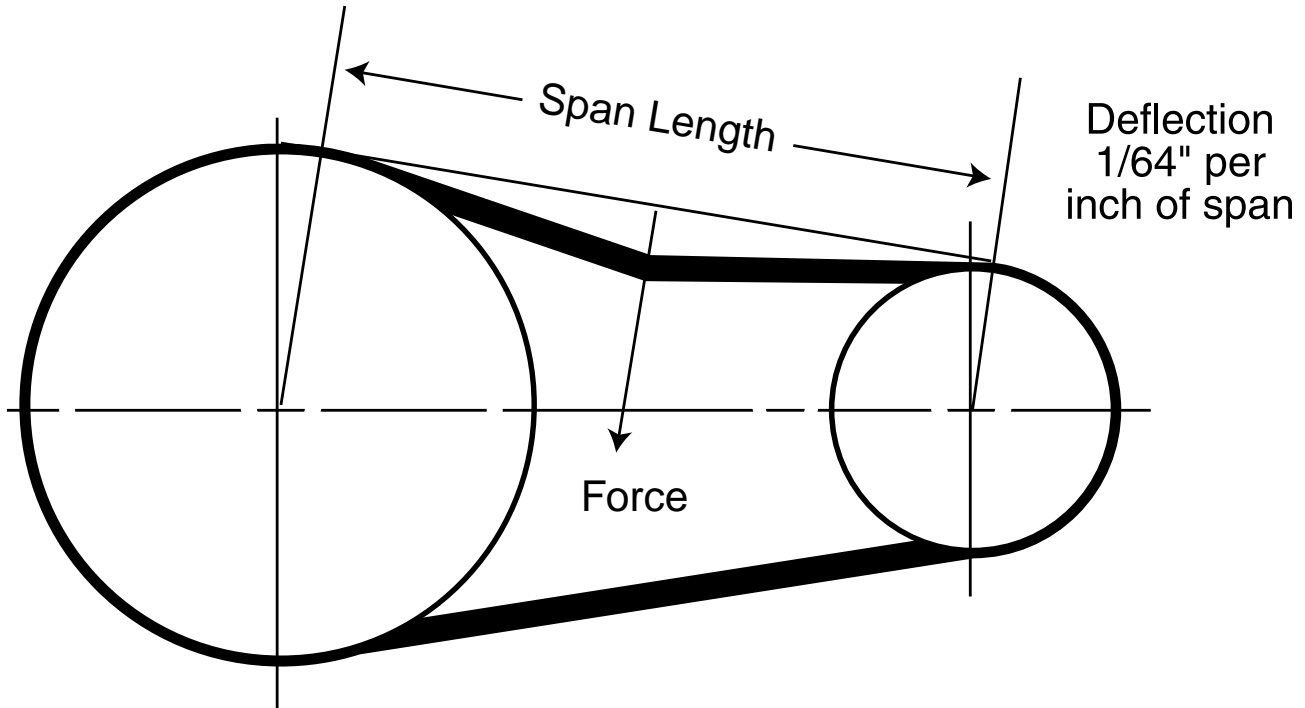


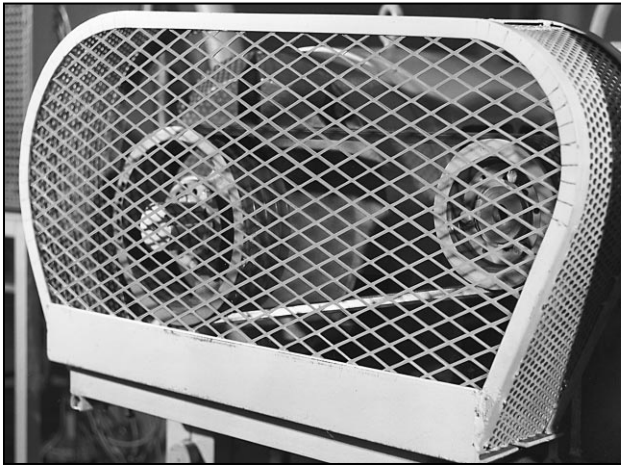
TABLE 5-BELT DEFLECTION FORCE

Cross Section	Smallest Sheave Diameter Range	RPM Range	Belt Deflection (Force Pounds)			
			Uncogged Hy-T Wedge Belts and Uncogged Hy-T Wedge Torque Team		Cogged Hy-T Wedge Belts and Hy-T Wedge Machine Edge Torque Team	
			Used Belt	New Belt	Used Belt	New Belt
A, AX	3.0- 3.6	1000-2500	3.7	5.5	4.1	6.1
		2501-4000	2.8	4.2	3.4	5.0
	3.8- 4.8	1000-2500	4.5	6.8	5.0	7.4
	2501-4000	3.8	5.7	4.3	6.4	
	5.0- 7.0	1000-2500	5.4	8.0	5.7	9.4
	2501-4000	4.7	7.0	5.1	7.6	
B, BX	3.4- 4.2	860-2500			4.9	7.2
		2501-4000			4.2	6.2
	4.4- 5.6	860-2500	5.3	7.9	7.1	10.5
	2501-4000	4.5	6.7	7.1	9.1	
	5.8- 8.6	860-2500	6.3	9.4	8.5	12.6
	2501-4000	6.0	8.9	7.3	10.9	
C, CX	7.0- 9.0	500-1740	11.5	17.0	14.7	21.8
	1741-3000	9.4	13.8	11.9	17.5	
	9.5-16.0	500-1740	14.1	21.0	15.9	23.5
	1741-3000	12.5	18.5	14.6	21.6	
D	12.0-16.0	200- 850	24.9	37.0		
	851-1500	21.2	31.3			
	18.0-20.0	200- 850	30.4	45.2		
	851-1500	25.6	38.0			

TABLE 6

Cross Section	Smallest Sheave Diameter Range	RPM Range	Belt Deflection (Force Pounds)			
			Uncogged Hy-T Wedge Belts and Uncogged Hy-T Wedge Torque Team		Cogged Hy-T Wedge Belts and Hy-T Wedge Machine Edge Torque Team	
			Used Belt	New Belt	Used Belt	New Belt
3V, 3VX	2.2- 2.4	1000-2500			3.3	4.9
		2501-4000			2.9	4.3
	2.65- 3.65	1000-2500	3.6	5.1	4.2	6.2
		2501-4000	3.0	4.4	3.8	5.6
4.12- 6.90	1000-2500	4.9	7.3	5.3	7.9	
	2501-4000	4.4	6.6	4.9	7.3	
5V, 5VX	4.4- 6.7	500- 1749			10.2	15.2
		1750- 3000	12.7	18.9	8.8	13.2
	3000-4000	11.2	16.7	5.6	8.5	
	7.1- 10.9	500- 1740	15.5	23.4	14.8	22.1
	1741- 3000	14.6	21.8	13.7	20.1	
	11.8- 16.0	500- 1740	33.0	49.3	17.1	25.5
	1741- 3000	26.8	39.9	16.8	25.0	
8V	12.5- 17.0	200- 850	39.6	59.2		
	851-1500	35.3	52.7			
	18.0- 22.4	200- 850				
	851-1500					

8. BELT GUARDS



V-belt drive guards insure cleanliness and safety. Screened, meshed or grilled belt guards are the most satisfactory because they allow air to circulate and heat to escape.

NOTE: Belt guard openings should be as described in O.S.H.A. 1910.219, Table Q-12.

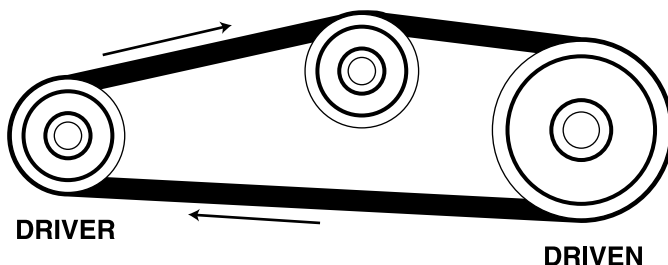
9. IDLERS

A properly designed multiple V-belt drive will not require an idler to deliver fully rated horsepower if proper belt tension can be maintained. Idlers always put an additional bending stress point on the belt. This reduces the belt horsepower rating and reduces belt life. The smaller the idler, the greater the stress and the more belt life is reduced.

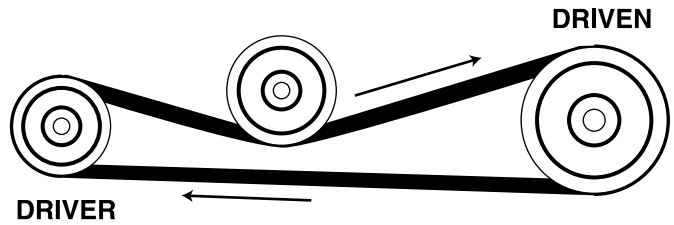
Avoid the use of idlers if at all possible. If the drive design requires an idler, the following design recommendations should be observed.

INSIDE IDLER

A V-grooved idler located on the inside of the belts on the slack side of the drive is recommended over a back side idler. The idler should be located near the large sheave to avoid reduction of the arc of contact with the small sheave. The size of the V-idler pulley should be equal to or (preferably) larger than the diameter of the small sheave.

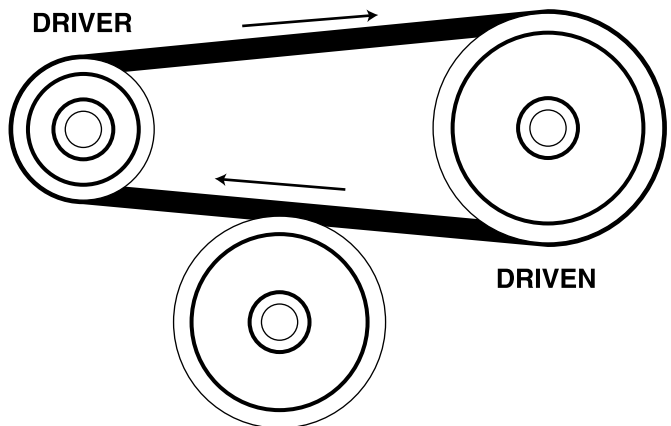


BACK SIDE IDLER



A back side idler increases the arc of contact on both sheaves. However, it forces a backward bend in the V-Belt that contributes to premature failure. The idler puts additional stress on the bottom portion of the belts which will result in bottom cracking. If a back side idler must be used, the diameter of the flat idler pulley should be at least 1.5 times (1.5X) the diameter of the small sheave. A backside idler should be located as close as possible to the small sheave.

KISS IDLER



A kiss idler differs from the back side idler because it does not penetrate the belt span and create a back bend on the belt. Consequently, it does not contribute to premature failure of the belt.

The use of a kiss idler can help provide control of belt vibration and whip on drives subject to shock and pulsating loads. The kiss idler could be used in single belt drives where joined belts are not applicable.

If a kiss idler is used, the diameter of the flat pulley should be at least 1.5 times (1.5X) the diameter of the small sheave.

Installation

Poly-V® Belts

1. INSPECT SHEAVES

WARNING

Do not clean sheaves while the machine is running. Disconnect power supply to the machine before removing or installing sheaves. Take sheaves off machines to inspect, clean and repair them.

INDUSTRY STANDARD DIMENSIONS FOR POLY-V BELT SHEAVES

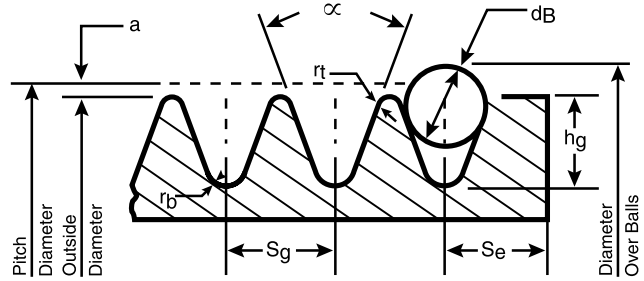


TABLE 7

Cross Section	Minimum Recommended Outside Diameter Inches	Groove α ± 0.25 Degrees	S_g^* Inches	r_t $+0.005$ -0.000 Inches	a Inches	r_b Inches	h_g Minimum Inches	d_B ± 0.0005 Inches	S_e Inches
H	0.50	40°	0.063 ± 0.001	0.005	0.003	0.013 $+0.000$ -0.005	0.041	0.0469	0.080 $+0.020$ -0.010
J	0.80	40°	0.092 ± 0.001	0.008	0.045	0.015 $+0.000$ -0.005	0.071	0.0625	0.125 $+0.030$ -0.015
K	1.50	40°	0.140 ± 0.002	0.010	0.110	0.020 $+0.000$ -0.005	0.122	0.1093	0.125 $+0.050$ -0.000
L	3.00	40°	0.185 ± 0.002	0.015	0.125	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	0.150	0.030 $+0.000$ -0.010	0.377	0.2812	0.500 $+0.100$ -0.040

*Summation of the deviations from "Sg" for all grooves in any one sheave shall not exceed ± 0.010 .



Damaged, worn or dirty sheaves will substantially reduce belt life. Nicks or gouges can cut the belt. Dirt in the grooves can abrade the belt and oil can attack the belt materials. Worn grooves will allow the belt to slip and become damaged.

Use a stiff brush to clean off rust and dirt. Wipe clean of oil and grease.

CAUTION

Do not reinstall damaged or worn sheaves on equipment. Repair or replace them.

2. MOUNT SHEAVES

WARNING

Disconnect power supply to the machine before removing or installing sheaves.

Sheaves for Poly-V® belts are installed and removed the same as those used for conventional V-belts. See pages 7, 8, and 9 of this *Guide* and the sheave manufacturer's recommendations for details.

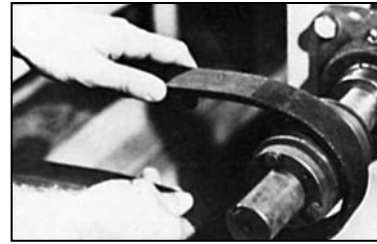
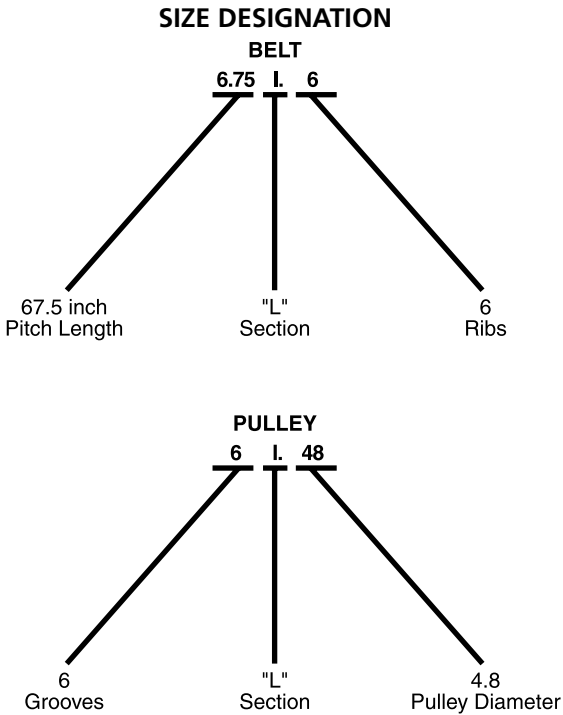
3. CHECK ALIGNMENT

Proper alignment is more critical for Poly-V sheaves than for conventional V-belt drives. Belt alignment should be checked every time belt maintenance is performed, each time belts are replaced, and whenever sheaves are removed or installed.

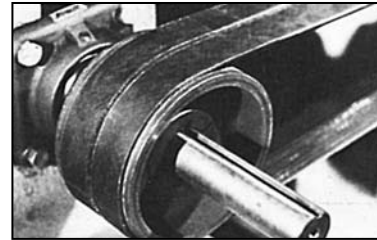
The procedures for Poly-V-belt sheaves alignment are the same as those used for conventional V-belt drives. See page 10 of this *Guide* for details.

4. SELECT THE CORRECT BELT

Always select belts to match sheave grooves.



Always move the drive unit forward so the belts can be easily slipped into the grooves without forcing them.



Leave one sheave groove open between matched belts to avoid interference between belts.

5. MATCH THE BELTS

WARNING

Do not test or operate belt drives without guards in place.

Matching is not required for most Poly V-belt drives. If you have a special application where matching is required, specify "matched belts" on the order. Additional order lead time is required. Matching code numbers will not be shown on the belts.

6. HOW TO INSTALL BELTS

WARNING

Disconnect power supply to the machine before checking, removing or installing belts.



WRONG –Never force the belts into a sheave with a screwdriver or wedge. You will damage the ribs or break the cords.

CENTER DISTANCE ALLOWANCE FOR BELT INSTALLATION AND TAKE-UP

Table 8 shows the minimum movement below and above the standard center distance which is required between the sheaves. This movement allows the center distance to be shortened for new belt installation. It also allows the center distance to be increased to take up slack and maintain proper tension as the belt stretches. See Step 7 for additional information on belt tensioning.

TABLE 8-POLY-V® BELT RECOMMENDED INSTALLATION AND TAKE-UP ALLOWANCES

Standard Effective Length, Inches	Minimum Allowance Below Standard Center Distance for Installation of Belts, Inches			Minimum Allowance Above Standard Center Distance for Maintaining Tension, inches All Cross Sections
	J	L	M	
Up To and Incl. 20.0	0.4			0.3
Over 20.0 To and Incl. 40.0	0.5			0.5
Over 40.0 To and Incl. 60.0	0.6	0.9		0.7
Over 60.0 To and Incl. 80.0	0.6	0.9		0.9
Over 80.0 To and Incl. 100.0	0.7	1.0	1.5	1.1
Over 100.0 To and Incl. 120.0	0.8	1.1	1.6	1.3
Over 120.0 To and Incl. 160.0		1.2	1.7	1.7
Over 160.0 To and Incl. 200.0		1.3	1.8	2.2
Over 200.0 To and Incl. 240.0		1.4	1.9	2.6
Over 240.0 To and Incl. 300.0			2.2	3.3
Over 300.0 To and Incl. 360.0			2.3	3.9
Over 360.0 To and Incl. 420.0			2.6	4.6
Over 420.0 To and Incl. 480.0			2.9	5.2
Over 480.0 To and Incl. 540.0			3.2	5.8
Over 540.0 To and Incl. 600.0			3.6	6.5

7. HOW TO TENSION THE BELTS

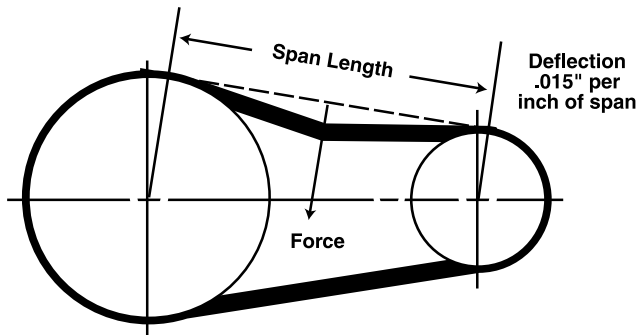
WARNING

Disconnect power supply to the machine before removing, installing or adjusting sheaves or belts.

1. Run the drive briefly to properly seat the belt. At least one sheave should rotate freely during the tensioning procedure.
2. Measure the span length. (See illustration)
3. Mark the center of span. At the center point, use a tension tester and apply a force perpendicular to the span large enough to deflect the belt 1/64" for every inch of span length. (Ex: a 100" span requires a deflection of 100/64" or 1 9/16.")
4. Compare the force applied with the values in Table 9. If there is a difference between the desired value and the actual value, adjust the center distance (span length) between the sheaves and repeat the tension testing procedure.

TABLE 9—BELT DEFLECTION FORCE

Belt Cross Section	Small Sheave Diameter Range	Force "F" lbs. per rib
J	1.32–1.67	0.4
J	1.77–2.20	0.5
J	2.36–2.95	0.6
L	2.95–3.74	1.7
L	3.94–4.92	2.1
L	5.20–6.69	2.5
M	7.09–8.82	6.4
M	9.29–11.81	7.7



MINIMUM SHEAVE DIAMETER

If the sheave driver is a standard electric motor, refer to Table 10 to be sure that the sheave diameter selected will meet the National Electrical Manufacturers Association Standard for minimum sheave diameters for electric motors 0.75 HP and larger. If the motor sheave is smaller than the minimum diameter shown in this table, increase the sheave diameter so that the motor-sheave will conform with the chart unless either an oversize or outboard bearing is installed.

TABLE 10

MINIMUM RECOMMENDED SMALL SHEAVE DIAMETERS FOR ELECTRIC MOTORS (FOR POLY-V & V-BELT DRIVES)						
Motor Nameplate Horsepower	STANDARD MOTOR R.P.M.					
	3450	1750	1160	870	675	575
	Small Sheave Diameters – Inches					
.12 or less	1.25	1.25	1.50			
.25	1.25	1.25	1.50			
.33	1.50	1.50	2.00			
.50	2.00	2.00	2.50			
.75	2.25	2.25	2.50	3.00	3.00	3.00
1	2.25	2.25	2.50	3.00	3.00	3.00
1.5	2.25	2.50	2.50	3.00	3.00	3.00
2	2.50	2.50	2.50	3.00	3.00	3.75
3	2.50	2.50	3.00	3.00	3.75	4.50
5	2.50	3.00	3.00	3.75	4.50	4.50
7.5	3.00	3.00	3.75	4.50	4.50	5.25
10	3.00	3.75	4.50	4.50	5.25	6.00
15	3.75	4.50	4.50	5.25	6.00	6.75
20	4.50	4.50	5.25	6.00	6.75	8.25
25	4.50	4.50	6.00	6.75	8.25	9.00
30		5.25	6.75	6.75	9.00	10.00
40		6.00	6.75	8.25	10.00	10.00
50		7.00	8.38	9.00	10.00	11.00
60		7.63	9.00	10.00	11.00	12.00
75		9.00	10.00	10.00	13.00	14.00
100		10.00	13.00	13.00	15.00	18.00
125		11.00	13.00	15.00	18.00	20.00
150			13.00	18.00	20.00	22.00
200				22.00	22.00	22.00
250					22.00	22.00
300					27.00	27.00

8. BELT GUARDS

V-belt drive guards insure cleanliness and safety. Screened, meshed or grilled belt guards are the most satisfactory because they allow air to circulate and heat to escape.

NOTE: Belt guard openings should be as described in O.S.H.A. 1910.219, Table Q-12.

9. IDLERS

Idlers are frequently used on Poly-V® Drives. The same recommendations apply to their use as was discussed under V-belts. Please refer to item 9, page 15 for the information.

Installation

Positive Drive Belts

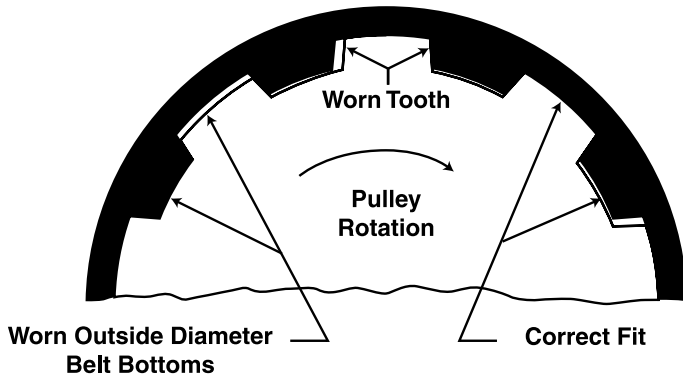
1. INSPECT PULLEYS

WARNING

Do not clean pulleys while the machine is running.

Disconnect power supply to the machine before removing or installing pulleys.

Take pulleys off machines to inspect, clean and repair them.

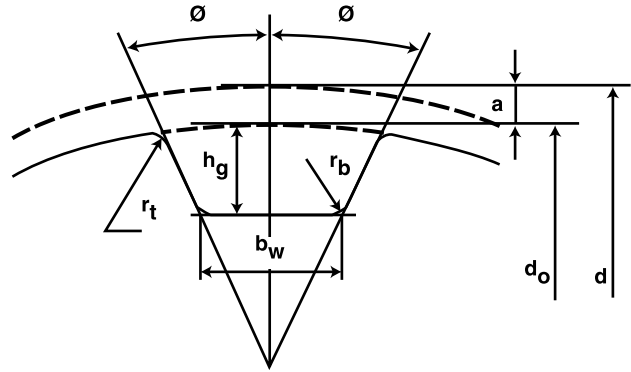


Damaged, worn or dirty pulleys will substantially reduce belt life. Worn teeth will cause belt wear and/or damage. Nicks or gouges can cut the belt. Dirt on the teeth and in the grooves can abrade the belt and oil can attack the belt materials. Use a stiff brush to clean off rust and dirt. Wipe clean of oil and grease.

CAUTION

Do not reinstall damaged or worn pulleys on equipment. Repair or replace them.

TYPICAL POSITIVE DRIVE PULLEY GROOVE PROFILES



NOTE: Pulley diameter taper must be held to a minimum, preferably zero. Taper will result in excessive belt side thrust and early failure.

It should be realized that if commercially available pulleys or tooling are used, a slightly different tooth profile will result, depending upon the number of teeth in the pulley and the type of hob or shaper tooling used. The pulley outside diameter, however, should remain the same.

Since it is difficult to check the groove profile, we suggest that you check for wear and proper diameter. Purchase new pulleys from a reputable source.

TABLE 11

Pitch Code	b_w in.	h_g in.	θ Degrees $\pm 1.5^\circ$	r_b max. in.	r_t in.	$2a$ in.
XL	0.052 ± 0.002	$0.065 \begin{smallmatrix} 0 \\ -0.003 \end{smallmatrix}$	25	0.016	$0.025 \begin{smallmatrix} +0.002 \\ 0 \end{smallmatrix}$	0.020
L	0.120 ± 0.004	$0.105 \begin{smallmatrix} 0 \\ -0.004 \end{smallmatrix}$	20	0.047	$0.046 \begin{smallmatrix} +0.005 \\ 0 \end{smallmatrix}$	0.030
H	0.165 ± 0.005	$0.120 \begin{smallmatrix} 0 \\ -0.005 \end{smallmatrix}$	20	0.063	$0.063 \begin{smallmatrix} +0.005 \\ 0 \end{smallmatrix}$	0.054
XH	0.311 ± 0.006	$0.281 \begin{smallmatrix} 0 \\ -0.005 \end{smallmatrix}$	20	0.078	$0.094 \begin{smallmatrix} +0.005 \\ 0 \end{smallmatrix}$	0.110
XXH	0.479 ± 0.007	$0.406 \begin{smallmatrix} 0 \\ -0.005 \end{smallmatrix}$	20	0.156	$0.125 \begin{smallmatrix} +0.005 \\ 0 \end{smallmatrix}$	0.120

TYPES OF PULLEYS

Various types of pulleys are used on positive drive belt drives. The type furnished (spoke, web, etc.) is governed by the number of grooves and the pulley manufacturer's preference. Generally, pulleys of small diameter do not use bushings, but are of the integral hub style. The larger pulleys generally use bushings. The basic types of positive drive belt pulleys shown are typical of the wide variety used.

NOTE: Plastic pulleys are recommended only for light duty applications.

FOR USE WITH BUSHINGS

WITH INTEGRAL HUB

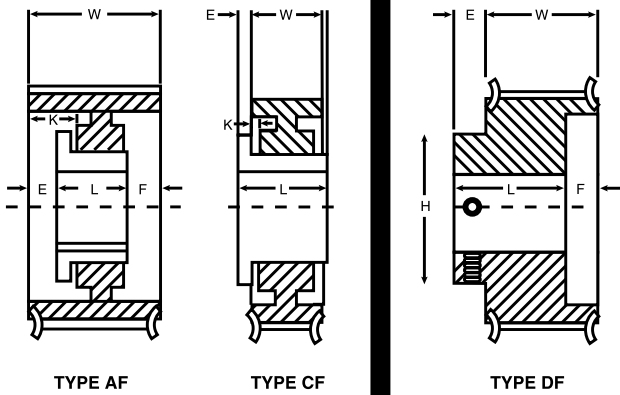


TABLE 12 MINIMUM PULLEY DIAMETER

Pitch	Speed RPM	Recommended Minimum*	
		Pitch Diam. in.	No. of Grooves
1/5 in. (XL)	3500	.764	12XL
	1750	.700	11XL
	1160	.637	10XL
3/8 in. (L)	3500	1.910	16L
	1750	1.671	14L
	1160	1.432	12L
1/2 in. (H)	3500	3.183	20H
	1750	2.865	18H
	1160	2.546	16H
7/8 in. (XH)	1750	7.241	26XH
	1160	6.685	24XH
	870	6.127	22XH
1 1/4 in. (XXH)	1750	10.345	26XXH
	1160	9.549	24XXH
	870	8.753	22XXH

*Smaller diameter pulleys can be used if a corresponding reduction in belt service life is satisfactory.

2. MOUNT SHEAVES

WARNING

Disconnect power supply to the machine before removing or installing sheaves.

Positive drive pulleys are installed and removed the same as the sheaves used for conventional V-belts. See pages 7, 8, and 9 of this *Guide* and the sheave manufacturer's recommendations for details.

3. CHECK ALIGNMENT

Proper alignment is more critical for Positive Drive pulleys than for conventional V-belt drives. Belt alignment should be checked every time belt maintenance is performed, each time belts are replaced, and whenever sheaves are removed or installed.

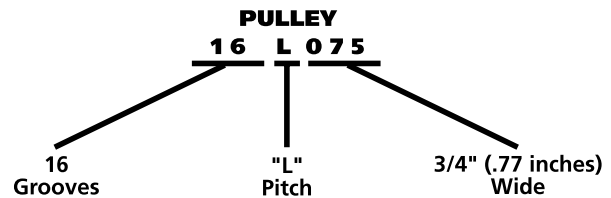
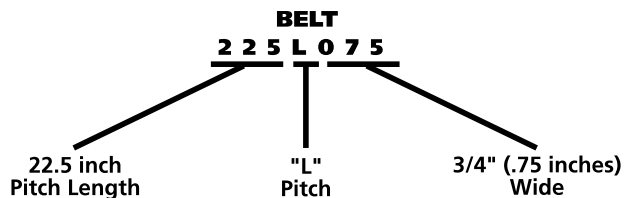
The procedures for Positive Drive pulley sheave alignment are the same as those used for conventional V-belt drives. See page 10 of this *Guide* for details.

DETERMINE THE DIRECTION OF SIDE TRAVEL

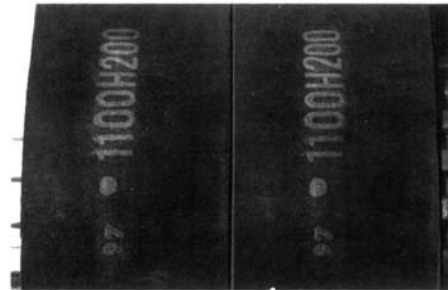
Stock or standard positive drive belts will ride toward the left flange. If only one flange is used, it should be placed on the left. If a drive requires that the belt ride toward the right flange, *special order* the belts in mandrel quantities from the manufacturer.

4. SELECT THE CORRECT BELT

Always select belts to match pulley teeth arrangement.



5. MATCH THE BELTS



WARNING

Do not test or operate belt drives without guards in place.

Matching is not required for most positive drive belt drives. If you have a special application where matching is required, specify "matched belts" on the order. Additional order lead time is required. Matching code numbers will not be shown on the belts.

6. HOW TO INSTALL BELTS

WARNING

Disconnect power supply to the machine before removing or installing belts.

Never force the belts onto a pulley with a screwdriver or wedge. You will rupture the facing fabric, damage the belt teeth or break the cords.

Always move the drive unit forward so the belts can be easily slipped into the pulleys without forcing them.

NOTE: To assure smooth operation and prevent premature failure, belts should be protected against sharp bending during handling and storage. They should not be subjected to extreme heat, low temperatures or high humidity.

7. HOW TO TENSION THE BELTS

WARNING

Disconnect power supply to the machine before removing, installing or adjusting sheaves and belts.

Positive drive belts should be installed with a snug fit. The snug fit will provide longer belt life, less wear on bearings and quieter operation. The belt's positive grip eliminates the need for high initial tensioning which could cause premature belt failure.

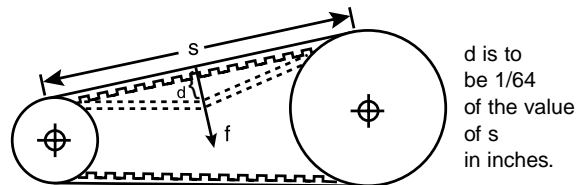
If the torque is unusually high a loose belt may jump teeth during start-up. If this occurs, gradually increase the tension until the belt operates satisfactorily. A good rule of thumb is to install the belt under 1/2 of the allowable working tension shown on page 60 of the Goodyear Positive Drive Engineering Design Manual. The precise tension can also be determined by using the method shown here.

Tensioning Method

1. Apply a force at the midpoint of the span between the two pulleys. Deflect the belt 1/64" for each inch of span length.
2. Installation tension should be regulated so that the value of this applied force equals the value of f given in the formula:

$$f = \frac{T + (s/L)K}{16}$$

Where s = the span distance in inches
 T = the tension in pounds (found in the table)
 K = the constant (from the table)
 L = the length of the belt



3. If the deflecting force is less than that given in the formula, the belt is too loose. If the deflecting force is greater than that given in the formula, the belt is too tight.

8. BELT GUARDS

Belt guards insure cleanliness and safety. Screened, meshed or grilled belt guards are the most satisfactory because they allow air to circulate and heat to escape.

NOTE: Belt guard openings should be as described in O.S.H.A. 1910.219, Table Q-12.

9. IDLERS

Neither inside nor outside idlers are recommended for positive drive belts and they should not be used except for power take-off or functional requirements. If an idler is necessary, it should be on the slack side of the belt. Inside idlers must be grooved unless in excess of 40 grooves. Flat idlers must not be crowned (use edge flanges). Idler diameters must equal or exceed the diameter of the small pulley. Idler arc of contact should be held to a minimum.

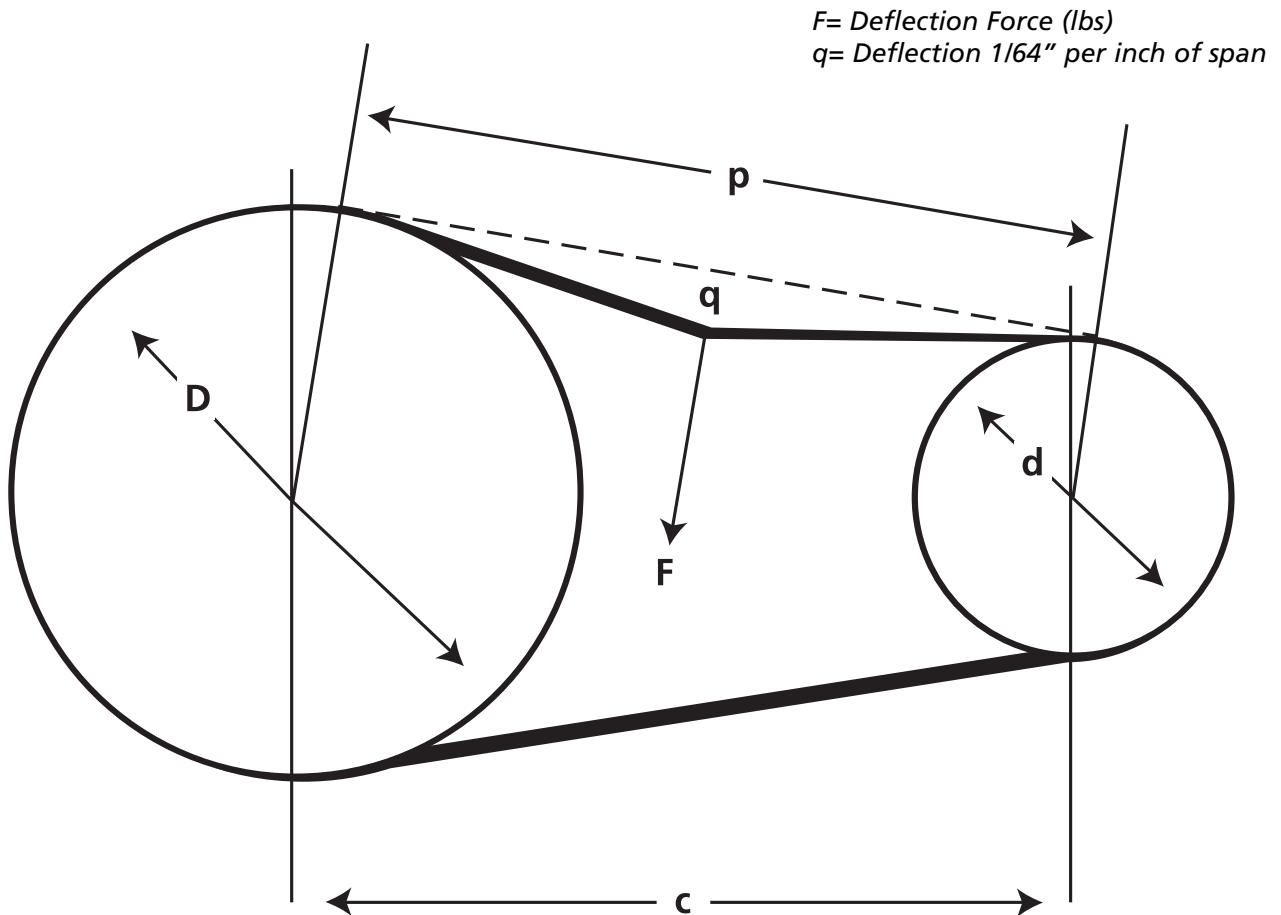
BELT WIDTH	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8	1	1 1/4	1 1/2	1 3/4	2	2 1/2	3	3 1/2	4	5	6	7	8	9	10	11	12	13	14
1/5" Pitch T K	2	3	4	5.5	7	8.5	10	11.5	14.5	17.5	20.5																		
3/8" Pitch T K			7.5	9.5	11.5	13.5	15.5	19.5	23.5	27.5	35.5	43	50.5	59	75	92.5													
1/2" Pitch T K						29.5	35	40	49.5	60	70	90.5	109	129	150	190	235	284	333	430	525								
7/8" Pitch T K															204	260	321	387	454	587	716	849	985	1117	1251	1376	1512	1639	1778
1 1/4" Pitch T K															254	318	393	375	557	719	877	1040	1207	1369	1532	1686	1853	2007	2178
															310	410	500	610	710	920	1100	1300	1500	1700					

Hi-Performance Pd Plus™ Belts

HI PERFORMANCE PD PLUS TENSIONING PROCEDURE

Belt installation should be a snug fit, neither too tight nor too loose. The belts positive grip and tooth engagement eliminates the need for a high initial tension. Consequently, a belt when installed with a snug fit and not too taunt assures longer life, less wear on bearings and a quieter operation. Preloading, often the cause of premature failure, is not necessary.

As shown in the diagram, apply a deflection Force F at the midpoint of the span between the two pulleys. Deflect the belt $1/64$ " for each inch of span length using the Deflection Force " F ". Adjustments in center distance and belt tension will be necessary to reach the desired deflection and thus the proper installation tension.



Span length is approximately equal to the center distance of the drive. A more exact figure can be determined as follows:

$$P = \frac{D-d}{2 \tan[\sin^{-1}(\frac{D-d}{2C})]}$$

$P =$ Span length (in)
 $C =$ Center Distance (in)
 $D =$ Large Pulley Pitch Diameter (in)
 $d =$ Small Pulley Pitch Diameter (in)

Hi-Performance Pd Plus™ Belts

DEFLECTION FORCE "F"

Pitch	Width	Number of Teeth (Small Pulley)	Deflection Force "F"(lbs)	
			Used Belt	New Belt
5	9	36 or less	1.2	1.5
8	9	37 or more	1.3	1.7
14	15	36 or less	2.1	2.7
20	15	37 or more	2.3	2.9
	25	36 or less	3.7	4.7
	25	37 or more	4.0	5.2
	20	31 or less	4.0	5.0
	20	32 or more	5.0	7.0
	30	31 or less	6.0	8.0
	30	32 or more	8.0	11.0
	50	31 or less	11.0	14.0
	50	32 or more	14.0	19.0
	85	31 or less	–	–
	85	32 or more	25.0	32.0
	40	34 or less	14.0	19.0
	40	35 or more	17.0	22.0
	55	34 or less	22.0	28.0
	55	35 or more	24.0	32.0
	85	34 or less	35.0	46.0
	85	35 on more	40.0	52.0
	115	34 or less	50.0	65.0
	115	35 or more	56.0	74.0
	170	34 or less	–	–
	170	35 or more	85.0	110.0
	115	All Sizes	80.0	105.0
	170	All Sizes	120.0	160.0
	230	All Sizes	165.0	220.0
	290	All Sizes	215.0	285.0
	340	All Sizes	250.0	340.0

Note: Deflection Force "F" is normally sufficient for drive installation. Actual installation tension will depend on starting torque, peak loads and the number of teeth in mesh. For more accurate tensioning on demanding applications, contact Power Transmission Products Development.

Hi-Performance Pd Plus™ Belts

CENTER DISTANCE ALLOWANCES

In addition to the calculated or tabulated center distance, a provision must be made for belt installation to avoid belt damage and insure proper belt tension. A center distance adjustment, or decrease in center distance, is necessary to install a belt. In addition, an increase in center distance will be necessary for proper tensioning.

If a belt is to be installed together with pulleys, allow the following decrease in center distance for installation and an increase in center distance for tensioning.

<i>Pitch Length Range (mm)</i>	<i>Allowance (Decrease) For Installation 5M, 8M, 14M, 20M Belts (mm/in)</i>	<i>Allowance (Increase) For Take-Up 5M, 8M, 14M, 20M Belts (mm/in)</i>
Less than 1525	2.5/0.1	2.5/0.1
1525-3050	5.0/0.2	5.0/0.2
Greater than 3050	7.5/0.3	7.5/0.3

If the belt is to be installed over one flanged pulley and one unflanged pulley with the pulleys already installed on the drive, allow the following decrease in center distance for installation and increase in center distance for tensioning.

<i>Pitch Length Range (mm)</i>	<i>Allowance (Decrease) For Installation (mm/in)</i>				<i>Allowance (Increase) For Take-Up 5M, 8M, 14M, 20M Belts (mm/in)</i>
	<i>5M, Belts</i>	<i>8M, Belts</i>	<i>14M, Belts</i>	<i>20M, Belts</i>	
Less than 1525	14.5/0.6	22.5/0.9	36.5/1.4		2.5/0.1
1525-3050	17.0/0.7	25.0/1.0	39.0/1.5	51.0/2.0	5.0/0.2
Greater than 3050		27.5/1.1	41.5/1.6	53.5/2.1	7.5/0.3

If the belt is to be installed over two flanged pulleys that are already installed on the drive, allow the following decrease in center distance for installation and increase in center distance for tensioning.

<i>Pitch Length Range (mm)</i>	<i>Allowance (Decrease) For Installation (mm/in)</i>				<i>Allowance (Increase) For Take-Up 5M, 8M, 14M, 20M Belts (mm/in)</i>
	<i>5M, Belts</i>	<i>8M, Belts</i>	<i>14M, Belts</i>	<i>20M, Belts</i>	
Less than 1525	20.5/0.8	34.5/1.4	59.5/2.3		2.5/0.1
1525-3050	23.0/0.9	37.0/1.5	62.0/2.4	81.0/3.2	5.0/0.2
Greater than 3050		39.5/1.6	64.5/2.5	83.5/3.3	7.5/0.3

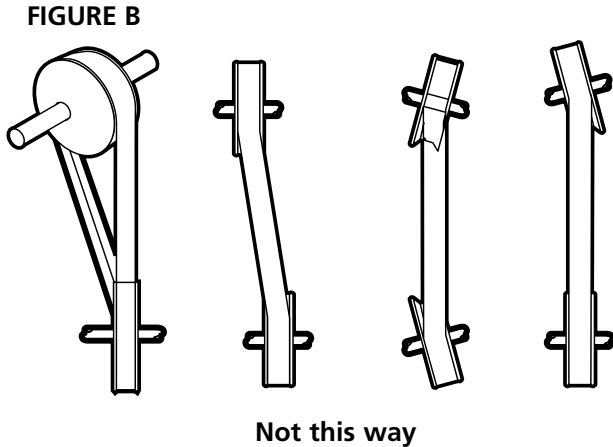
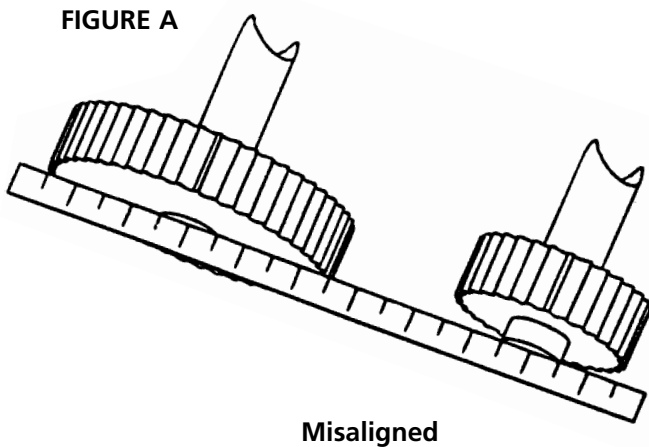
Hi-Performance Pd Plus™ Belts

DRIVE ALIGNMENT

Synchronous belts are very sensitive to misalignment. Tension carrying member is generally twisted, multiple strands of fiberglass cord. Fiberglass has a high tensile strength and resistance to elongation, resulting in a very stable belt product. Any misalignment will lead to inconsistent belt wear, uneven load distribution and premature tensile failure. In general, synchronous drives should not be used where

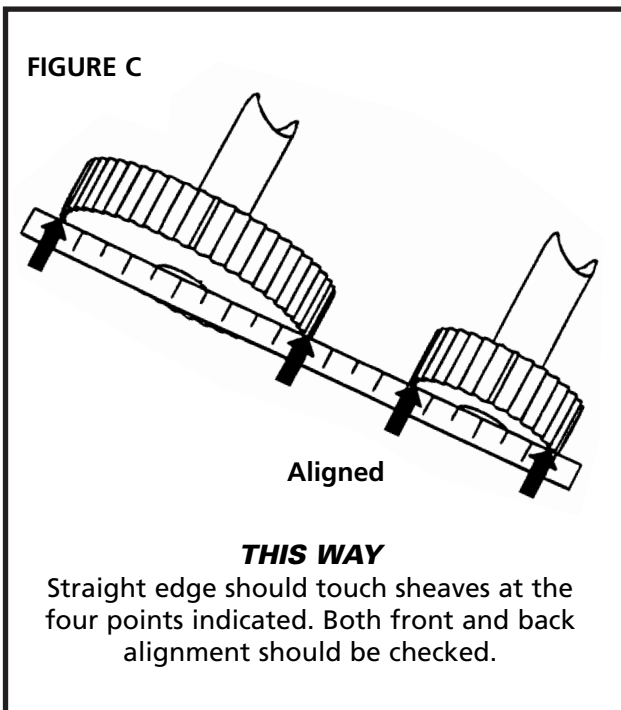
misalignment is a problem. Misalignment should be limited to $1/3$ degree or $1/16$ " per foot of center distance.

Misalignment can be defined in one of two ways. First, if two pulleys are not located on shafts, pulleys are then misaligned, as in Figure A. Second, shafts may not be parallel, resulting in misalignment, as in Figure B.



Any degree of misalignment will reduce belt life and cause edge wear. Therefore, a straight edge should be used to check proper alignment verifying that pulleys and shafts are parallel, as in Figure C. Misalignment, at times, may cause tracking problems. Although some tracking is normal and won't affect belt performance, it may be caused by poorly aligning pulleys.

Flanges may control a tracking problem. Considering a two pulley drive, belt contact on a single flange is acceptable. Belt contact with the opposite flanges of two pulleys should be avoided. Misalignment can also be attributed to the improper installation of a bushing or loose drive framework. Refer to pulley manufacturer guidelines for proper bushing installation. Secure motor and framework to eliminate vibration center to center fluctuations.



Installation of Super Torque Pd™ Belts

GENERAL RECOMMENDATIONS

The installation of a Super Torque Positive Drive Belt drive requires no more care than that of any other form of power transmission. However, to assure long belt life, a minimum of wear, and quiet operation, reasonable attention should be given to these important recommendations.

BELT TENSION

Super Torque Positive Drive Belts should be installed with a snug fit, equal to the effective tension required for the drive, as calculated in the effective belt tension formula on page 27. The belt's positive grip eliminates the need for excessive tension, assuring longer life, less wear on bearings, quieter operation. Excessive preloading, often the cause of premature failure, is not necessary.

PULLEY ALIGNMENT

Misalignment of drive results in unequal tension and extreme edge wear. Consequently, pulley alignment should be proved with a straight-edge and shafts checked to assure parallelism. On a long-center drive – because of the belt's tendency to run against one flange of the driveR pulley – it is often advisable to offset the driveN pulley slightly to compensate.

On a long-center drive, it is imperative that the teeth on tension and slack sides of the belt be prevented from intermeshing. The belt should be kept sufficiently taut.

It is important that the frame supporting the pulleys be rigid at all times. A non-rigid frame causes variation in center distance and resulting belt slackness. This, in turn, can lead to jumping of teeth – especially under starting load with shaft misalignment.

PULLEY DIAMETER

Experience of our field service engineers reveals that an extremely high percentage of belt drive difficulties are caused by using pulley diameters that are too small. As a rule of thumb, a drive carrying the full recommended design loading per inch of belt width should not have a pulley diameter less than the drive belt width – even though the pulley diameter falls within the acceptable range shown in table of minimum pulley diameters (See chart).

BELT HANDLING

On installation, the belt should never be forced or pried over the pulley flange. Reduction of center distance or idler tension usually permits the belt to slide onto the pulley easily. Otherwise, one or both pulleys should be removed.

To assure smooth operation and prevent premature failure, belts in storage should be protected against sharp bending or creasing. They should not be subject to extreme heat, low temperature or high humidity.

DRIVE IDLERS

When an idler is necessary, it should be on the slack side of the belt. Inside idlers must be grooved unless in excess of 40 grooves. Flat idlers must not be crowned (use edge flanges). Idler diameters must exceed the smallest diameter drive pulley. Idler arc of contact should be held to a minimum.

MINIMUM PULLEY DIAMETERS *

Minimum	Speed rpm	Number of grooves
S3M (3mm)	3500	18
	1750	16
	1160	14
S5M (5mm)	3500	24
	1750	20
	1160	16
	870	14
S8M (8mm)	3500	32
	1750	28
	1160	24
	870	22
S14M (14mm)	1750	30
	1160	28
	870	28

* Smaller diameter pulleys can be used if a corresponding reduction in belt service life is satisfactory.

Super Torque Pd™ Tensioning Procedure

BELT TENSION

Super Torque Positive Drive belt installation tension is very important for proper functioning of the drive. Insufficient tension will result in tooth jumping. An over tensioned belt will put unnecessary stresses on the belt and other drive components, bringing about premature failure.

The first step is to determine exactly what the belt installation tension should be. This is in terms of "strand" tension (T_s) on one side of the drive with both pulleys free to rotate. The following calculations must be made:

Belt Speed, S , ft/minute
 $S = (d)(RPM)(0.262)$

where: d = Pulley pitch diameter inches
 RPM = Revolutions per minute of Pulley "d".

Effective Belt Tension, T_e , lbs

$$T_e = \frac{(HP)(33,000)}{S}$$

where: HP = Net horsepower transmitted. Do not use Design HP since the service factor includes conditions which do not affect drive tension.

Tight Side Tension, T_A , lb (uncorrected for centrifugal tension)

$$T_A = (T_e)(A_R)$$

where A_R = Tension ratio factor (See Table 1).

Slack Side Tension, T_B , lb (uncorrected for centrifugal tension)

$$T_B = T_A - T_e$$

The values T_A and T_B are used for calculating "running" hub loads since centrifugal tension is internal to the belt when the drive reaches operating speed. However, centrifugal tension must be accounted for in drive installation.

Centrifugal Tension, T_C , lb per belt strand (See Table 2).

$$T_C = \frac{W(S_1)^2}{g}$$

where: W = belt weight, lb/foot
 S_1 = belt speed, ft/sec = $S/60$
 $g = 32.2 \text{ ft/sec}^2$

Corrected Tight Side Tension, T_1 and Slack Side Tension, T_2 , lbs per belt strand

$$T_1 = T_A + T_C$$

$$T_2 = T_B + T_C$$

Installation Strand Tension, T_s , lb

$$T_s = \frac{T_1 + T_2}{2}$$

This calculated value (T_s) is the minimum installation strand tension for a new belt. It is recommended that the maximum installation strand tension for a new belt be $1.40(T_s)$. The strand tension for retensioning a used belt is T_s .

Minimum installation strand tension = T_s
 Maximum installation strand tension = $1.40T_s$
 Retension used belt to strand tension = T_s

Belt Tensioning Example:

Using the data from the example on page 14.

28 Groove Driver	40 Groove Driver
10 HP motor	3500 RPM

26.134 inch center to center distance

$$S = (2.807)(3500)(.262) = 2574 \text{ ft/min}$$

$$T_e = \frac{(10)(33000)}{2574} = 128 \text{ lbs}$$

$$\frac{D-d}{C} = \frac{4.010-2.807}{26.134} = .046$$

$$A_R = 1.11$$

$$T_A = (T_e)A_R = 142$$

$$T_B = T_A - T_e = 142 - 128 = 14$$

$$T_C = \frac{(.096) \left(\frac{2574}{60}\right)^2}{32.2} = 5$$

$$T_1 = 142 + 5 = 147$$

$$T_2 = 14 + 5 = 19$$

$$T_s = \frac{147 + 19}{2} = 83$$

Proper belt tension is achieved by applying a Force F , lbs, to the center of the belt span as shown in Figure 1. When the force applied yields to deflection q , inches, belt tension is correct.

The value q is always equal to $1/64$ " per inch of span length. The span length is approximately equal to the center distance on average drives. For drives with high speed ratio and short center distances, the span length may be calculated from the following formula:

$$P = \frac{D-d}{2 \tan \left[\sin^{-1} \left(\frac{D-d}{2C} \right) \right]}$$

where: P = Span length, inches
 C = Center distance, inches
 D = Large pulley pitch diameter, inches
 d = Small pulley pitch diameter, inches

Super Torque Pd™ Tensioning Procedure

Figure 1

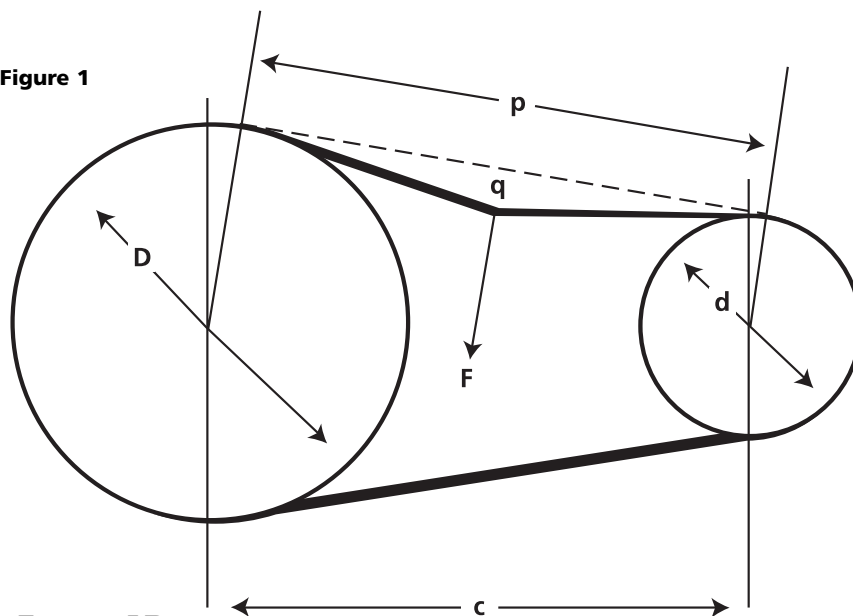


Table 1
Tension Ratio Factor, AR

D-d c	Arc of Contact On Small Pulley degrees	AR	AR PD Flat
0.00	180	1.07	2.00
0.10	174	1.08	1.96
0.20	169	1.09	1.92
0.30	163	1.09	1.88
0.40	157	1.10	1.84
0.50	151	1.11	1.81
0.60	145	1.13	1.78
0.70	139	1.14	1.75
0.80	133	1.16	1.72
0.90	127	1.17	1.69
1.00	120	1.20	1.66
1.10	113	1.22	1.63
1.20	106	1.25	1.60
1.30	99	1.29	1.58
1.40	91	1.34	1.55
1.50	83	1.40	1.52

D = Large pulley pitch diameter, inches
 d = Small pulley pitch diameter, inches
 c = Center distance, inches

Determine Force F according to the following formulas: (See Table 3 for values of "K")

1. For Positive Drive belts

$$F = \frac{Y + (P/L)K}{16}$$

where: Y = installation strand tension (recommend 1.4 TS maximum for new belt, and TS for used belt)
 F = deflection force, lb
 P = span length, inches
 L = belt length, inches
 K = belt modulus factor (Table 3)

Belt Cross Section	W
S3M	.041
S5M	.067
S8M	.096
S14M	.200

Table 2
Belt Weight W,
lb/foot (per
inch width)

Table 3
Belt Modulus Factor K

Belt Width (MM)		4	8	10	15	20	25	30	40	50	60	80	100
Pitch	3	3.3	7.4	9.5	15	21	27	33	65	84	171	237	452
	5												
	8												
	14												

Eagle Pd™ Belt & Sprocket Installation

The installation of **EAGLE Pd** belts and sprockets will not be difficult for those familiar with other power transmission products and QD bushings. The following instructions are written so that those less familiar with power transmission products can easily install an **EAGLE Pd** drive. Drive size and location may mandate different assembly methods than the one outlined here.

Follow all safety policies and requirements of federal, state and local authorities, as well as the regulation of the employer, when working on power equipment. Always lock out the power source to the machinery before performing any work.

PREPARATION

OBJECTIVE: Verify that all necessary tools and parts are available and ready for installation.

1. Eagle Pd belts and sprockets from Goodyear are identified with a unique Color Spectrum System. The six colors used for identification are: Yellow, White, Blue, Green, Orange and Red. Each color represents a different size so that Blue belts are made to operate with Blue sprockets. Make sure the same color belt and sprockets have been obtained.

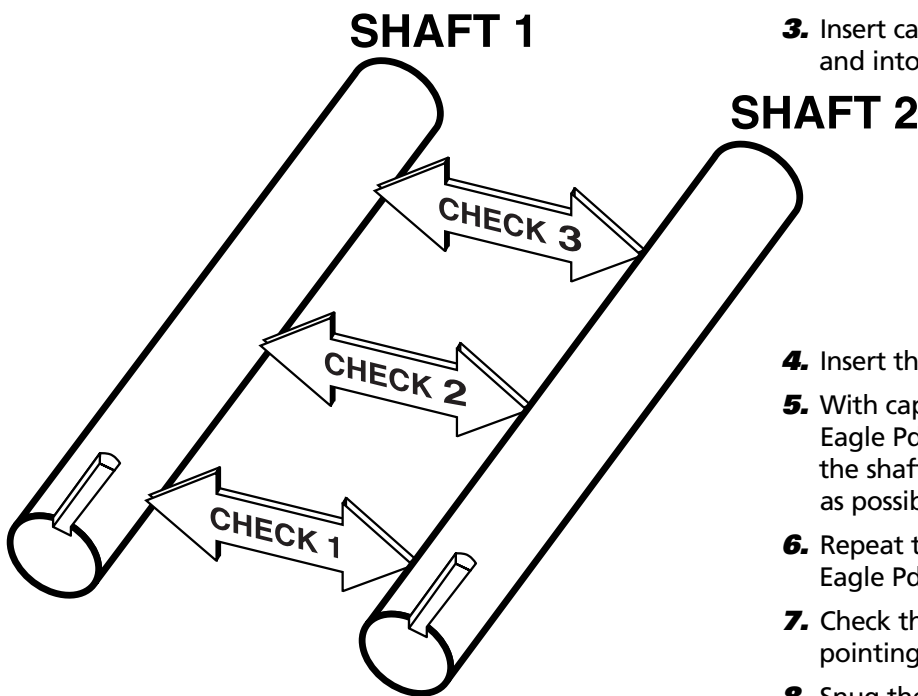
2. The following tools are recommended for proper belt and sprocket installation.

- A straight edge
- Socket and open end wrenches
- A torque wrench
- A belt tension gauge
- A tape measure
- A file and sandpaper
- A clean cloth
- Deflection force values for tensioning the belts



Eagle Pd™ Sprocket & Bushing Installation

3. Make sure the components are ready for installation. Clean all shafts, removing any nicks or burrs. Clean all mating surfaces of the sprocket; bushing and shaft. **No lubrication (or antiseize) should be used on and of these surfaces, including thread holes.** Use of lubrication can create higher torque which will cause premature failure.



4. Make sure the shafts are true and parallel by accurately measuring the distance between the shafts at three points along the shaft. The distance between the shafts should be the same at all three points as shown. Also make sure the shafts are rigidly mounted. Shafts should not deflect when the belt is tensioned.

OBJECTIVE: Align the **EAGLE Pd** sprockets and secure them to the shafts.

1. Goodyear recommends that the bushing flange be installed facing outward in order to minimize bearing load and increase bearing life.
2. Insert bushing into the sprocket, aligning the drilled holes in the bushing flange with the tapped holes in the sprocket hub.
3. Insert capscrews through the drilled holes and into the tapped holes.

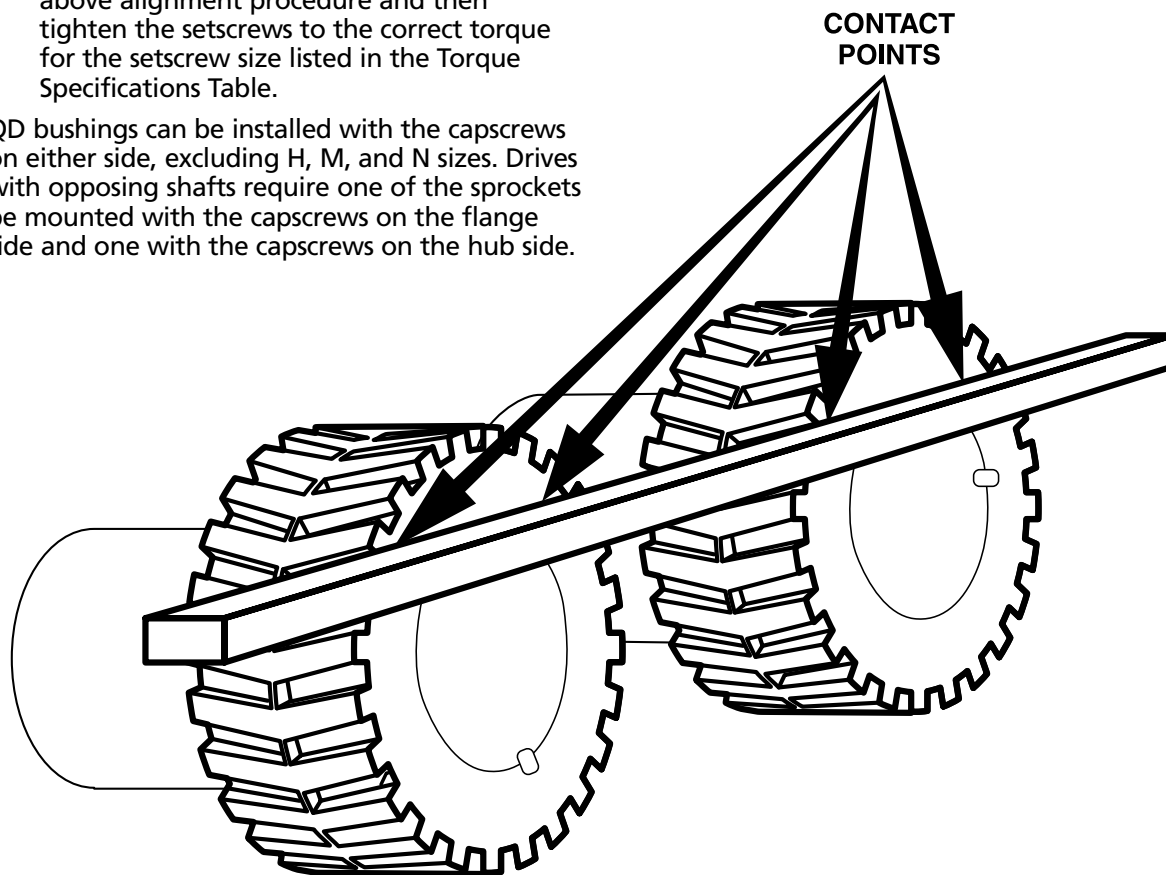
4. Insert the key into the keyseat of the shaft.
5. With capscrews to the outside, place the Eagle Pd sprocket and bushing assembly on the shaft, positioning the assembly as close as possible to the motor bearing.
6. Repeat the procedure for the other Goodyear Eagle Pd sprocket.
7. Check that the teeth of both sprockets are pointing in the same direction.
8. Snug the capscrews so that the sprocket/ bushing assembly can still move on the shaft.
9. Align the sprockets using a straight edge. Check for contact in 4 places as shown. Do not use bearings or drive shafts as reference points for sprocket alignment (see page 31).
10. Using a torque wrench, tighten the capscrews to the torque values listed on the next page. If there is not a gap of 1/8" to 1/4" between the bushing flange and the sprocket hub then disassemble the parts and determine the reason for the faulty assembly.
11. The sprocket will draw onto the bushing during tightening. Always recheck alignment after tightening the capscrews. If alignment has changed return to step 8 (see page 31).

Eagle Pd™ Sprocket & Bushing Installation

12. Tighten the setscrews over the keyway to the torque values listed in the table below.

13. If the sprockets are straight bore use the above alignment procedure and then tighten the setscrews to the correct torque for the setscrew size listed in the Torque Specifications Table.

QD bushings can be installed with the capscrews on either side, excluding H, M, and N sizes. Drives with opposing shafts require one of the sprockets be mounted with the capscrews on the flange side and one with the capscrews on the hub side.



Torque Specifications

Bushing	Capscrew Torque		Setscrew Torque	Setscrew Size
	(in-lb)	(ft-lb)	(in-lb)	(in)
H	95	8	—	—
SH	108	9	87	1/4
SDS	108	9	87	1/4
SK	180	15	87	1/4
SF	360	30	165	5/16
E	720	60	290	3/8
F	900	75	290	3/8
J	1620	135	290	3/8
M	2700	225	290	3/8
N	3600	300	620	1/2

Eagle Pd™ Belt Installation & Tensioning

OBJECTIVE: The **EAGLE Pd** must be installed and tensioned properly to insure optimum performance. Sprocket alignment must be preserved while tensioning the drive.

Before beginning inspect the belt for damage and verify that the sprockets are properly mounted with the teeth pointing in the same direction. Belts should never be crimped or bent to a diameter less than the minimum sprocket diameter, approximately 2 inches for Yellow and White belts and 4.5 inches for Blue, Green, Orange and Red belts.

1. Shorten the center distance or release the tensioning idler to install the Goodyear

EAGLE Pd belt. Do not pry the belt onto the sprocket. Refer to the Center Distance Allowance tables below for the required center distance adjustment.

2. Place the belt on each sprocket and ensure proper engagement between the sprocket and the belt teeth.
3. Lengthen the center distance or adjust the tensioning idler to remove any belt slack.
4. Using a tape measure, measure the span length of the drive. Refer to dimension "P" in the diagram below. The span length can be calculated using the formula below.

Center Distance Allowances

Pitch Length Range (mm)	Center Distance Decrease for Installation		Center Distance Increase for Tensioning
	Yellow, White	Blue, Green, Orange, Red	
Less than 1525	0.4"	0.6"	0.1"
Greater than 1525	0.6"	0.7"	0.2"

F = Deflection Force

q = Deflection, 1/64" per inch of span length

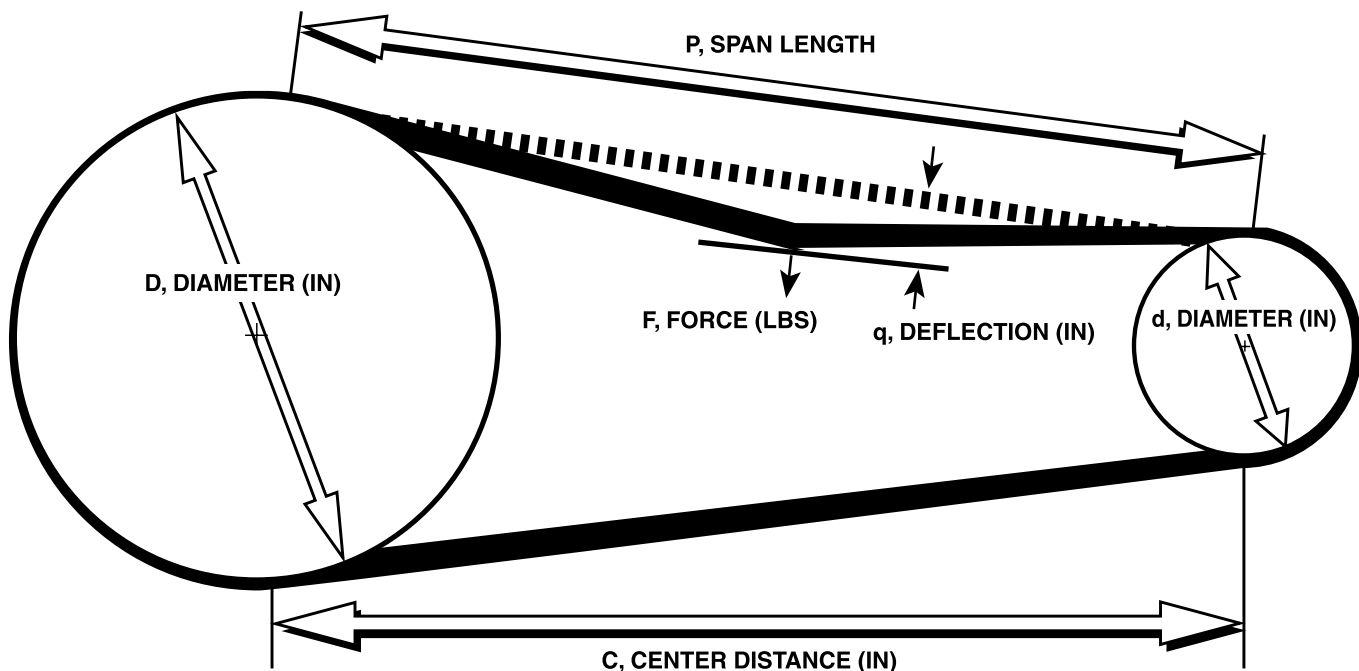
c = Center Distance

D = Large Sprocket Pitch Diameter

d = Small Sprocket Pitch Diameter

P = Span Length

$$P = \frac{(D - d)}{2 \tan[\sin^{-1}[\frac{(D - d)}{2c}]]}$$



Eagle Pd™ Belt Installation & Tensioning

5. Place a straight edge or reference line across the top of the belt.
6. First determine the proper deflection force to tension the belt. Deflection forces are given in the following tables and can also be calculated using the formulas given on page 28. Deflection forces are also given on the output of the **EAGLE Pd** computer drive analysis.

a) If using the **EAGLE Pd** tension gauge the deflection scale is calibrated in inches of span length. Check the force required to deflect the belt the proper amount. There is an O-ring to help record the force. If the measured force is less than the required deflection force then

DEFLECTION FORCE FOR BELT TENSIONING (lbs)

RPM of Small Sprocket	Yellow Belts						White Belts						Blue Belts					
	New Belt			Used Belt			New Belt			Used Belt			New Belt			Used Belt		
	Number of Teeth on Smaller Sprocket																	
	18 to 23	24 to 31	32 & up	18 to 23	24 to 31	32 & up	18 to 23	24 to 31	32 & up	18 to 23	24 to 31	32 & up	24 to 31	32 to 39	40 & up	24 to 31	32 to 39	40 & up
Under 100	13	16	17	10	12	13	26	32	34	19	24	25	50	55	57	37	41	42
101 to 300	12	14	16	9	10	12	24	28	32	18	21	24	45	50	51	33	37	38
301 to 600	11	13	14	8	10	10	22	26	28	16	19	21	41	45	46	30	33	34
601 to 900	10	12	13	7	9	10	20	24	26	15	18	19	38	42	43	28	31	32
901 to 1200	9	11	12	7	8	9	18	22	24	13	16	18	35	39	40	26	29	30
1201 to 2000	9	10	11	7	7	8	18	20	22	13	15	16	34	37	38	25	27	28
2001 to 3500	8	9	11	6	7	8	16	18	22	12	13	16	32	34	37	24	25	27
3501 & up	8	9	10	6	7	8	16	18	20	12	13	15	32	36	42	24	27	31

Table values are typically larger because they must work for all possible drives in the RPM and sprocket range.

Eagle Pd™ Belt Installation & Tensioning

lengthen the center distance. If the measured force is greater than the required deflection force than shorten the center distance.

b) If using other means to apply force to the belt then adjust the center distance so that the belt is deflected 1/64" per inch of span length when the proper force is applied.

7. After the belt is properly tensioned lock down the center distance adjustments and recheck the sprocket alignment. Recheck the belt tension, alignment and capscrews torque after 8 hours of operation to ensure the drive has not shifted.

DEFLECTION FORCE FOR BELT TENSIONING (lbs) (CONTINUED)

RPM of Small Sprocket	Green Belts			Orange Belts			Red Belts											
	New Belt		Used Belt	New Belt		Used Belt	New Belt		Used Belt									
	Number of Teeth on Smaller Sprocket																	
	24 to 31	32 to 39	40 & up	24 to 31	32 to 39	40 & up	24 to 31	32 to 39	40 & up	24 to 31	32 to 39	40 & up						
Under 100	75	83	86	56	61	63	100	110	114	74	81	84	150	165	171	111	122	127
101 to 300	68	75	77	50	56	57	90	100	102	67	74	76	135	150	153	100	111	113
301 to 600	62	68	69	46	50	51	82	90	92	61	67	68	123	135	138	91	100	102
601 to 900	57	63	65	42	47	48	76	84	86	56	62	64	114	126	129	84	93	96
901 to 1200	53	59	60	39	43	44	70	78	80	52	58	59	105	117	120	78	87	89
1201 to 2000	51	56	57	38	41	42	68	74	76	50	55	56	102	111	114	76	82	84
2001 to 3500	48	51	56	36	38	41	64	68	74	47	50	55	96	102	111	71	76	82
3501 to 10000	48	54	63	36	40	47	64	72	84	47	53	62	96	108	126	71	80	93

Table values are typically larger because they must work for all possible drives in the RPM and sprocket range.

Eagle Pd™ Calculating The Installation

Tension Based On Drive Conditions

If a more accurate tensioning value is needed, the installation tension can be calculated from the following:

Belt Speed, S = 287 ft/min

Effective Tension, $T_E = 575$ lbs.

Centrifugal Tension $T_c = 0.1$ lbs (T_c can be assumed to be 0 for low speed drives, less than 1000 rpm)

Tight Side Tension, $T_1 = 663$ lbs

Slack Side Tension, $T_2 = 58$ lbs

Installation Strand Tension for a New Belt, $T_N = 484$ lbs

Deflection Force, F = 32.7 lbs

Belt Weight Per Foot

Color:	Yellow	White	Blue	Green	Orange	Red
W (lb/ft):	0.046	0.092	0.14	0.21	0.28	0.42

Tight Side Tension (lbs), $T_1 = (T_e * AR) + T_c$,

Slack Side Tension (lbs), $T_2 = T_e * (AR - 1) + T_c$,
where AR is the ratio factor from the following table.

Tensioning Ratio Factor

(D-d)/c *:	0.0	0.2	0.4	0.6	0.8	1.0	1.1	1.2	1.3	1.4	1.5
Arc deg.:	180	169	157	145	133	120	113	106	99	91	83
AR:	1.07	1.09	1.10	1.13	1.16	1.20	1.22	1.25	1.29	1.34	1.40

*D is the large sprocket pitch diameter, d is the small sprocket pitch diameter, and c is the center to center distance

Installation Strand Tension for a New Belt (lbs), $T_N = 0.7 * (T_1 + T_2)$

Installation Strand Tension for a Used Belt (lbs), $T_U = 0.5 * (T_1 + T_2)$

Finally the Deflection Force (lbs),
$$F = \frac{Y + \frac{P * K}{L}}{16}$$

where Y is the installation strand tension (T_N or T_U), P is the span length (in) (if it cannot be measured directly then it can be calculated with the formula on page 32), L is the belt length (in), and K is the belt modulus factor from the table on page 36.

Eagle Pd™ Calculating the Tension

Belt Modulus Factor

Color:	Yellow	White	Blue	Green	Orange	Red
K:	45	90	135	200	270	400

Below are the results of these calculations using the drive in example 1 page 47.

Belt Speed, $S = 287$ ft/min

Effective Tension, $T_e = 575$ lbs.

Centrifugal Tension $T_c = 0.1$ lbs (T_c can be assumed to be 0 for low speed drives, less than 1000 rpm)

Tight Side Tension, $T_1 = 633$ lbs

Slack Side Tension, $T_2 = 58$ lbs

Installation Strand Tension for a New Belt, $T_N = 484$ lbs

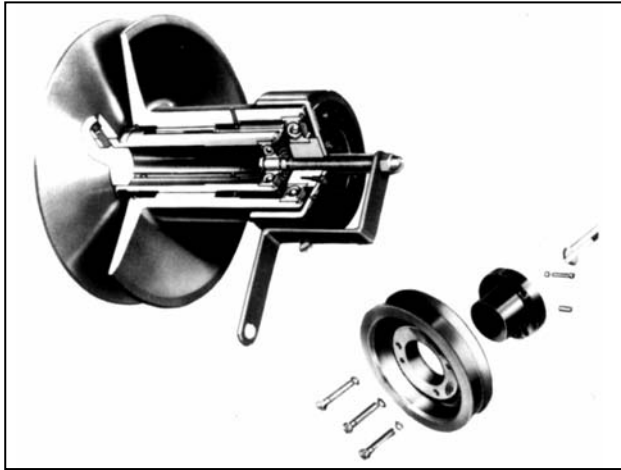
Deflection Force, $F = 32.7$ lbs

This is less than the table value of 56 lbs. Tensioning the belt with 56 lbs deflection force will not decrease belt service life but may reduce bearing life. The table values are larger because they must work for all possible drives in the rpm and sprocket range. The tension must be measured accurately at installation to insure optimum belt life. Contact your local Goodyear distributor for information on belt tension gauges.

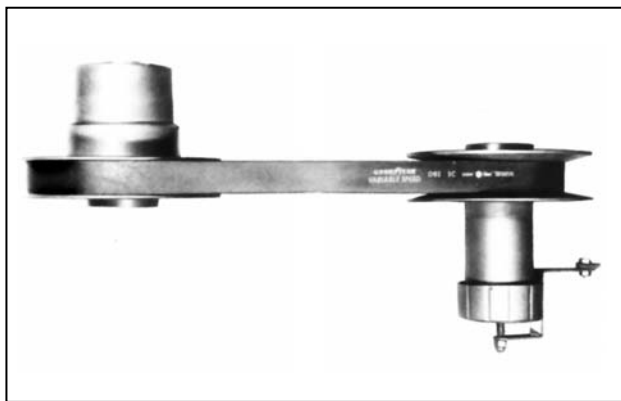
INSTALLATION

Variable Speed Belts

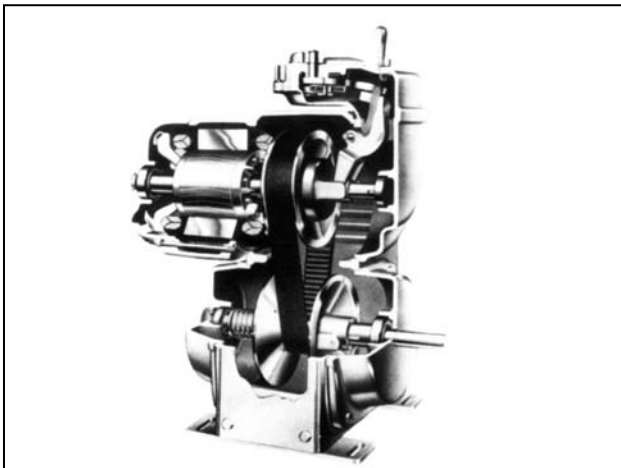
Types of Variable Speed Drives



Variable to Fixed Sheave



Both Sheaves Variable



Motorized Unit, Both Sheaves Variable

1. INSPECT SHEAVES

WARNING

Do not clean pulleys while the machine is running.

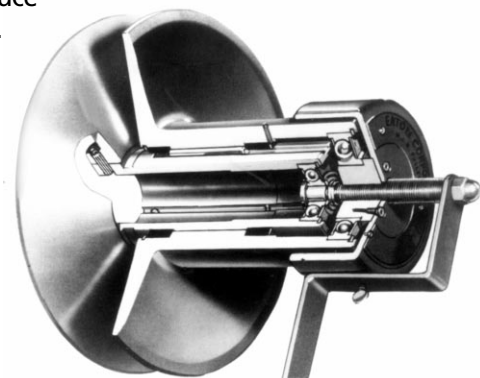
Disconnect power supply to the machine before removing or installing pulleys.

Take pulleys off machines to inspect, clean and repair them.



Damaged, worn or dirty pulleys will substantially reduce belt life. Worn sidewalls also interfere with the shifting action. Nicks or gouges can cut the belt. Dirt on the belt and in the grooves can abrade the belt and oil can attack the belt materials. Use a stiff brush to clean off rust and dirt. Wipe clean of oil and grease.

Inspect all moving parts for freedom of movement and wear. Worn moving parts cause vibration and reduce belt life.



WARNING

Do not reinstall damaged or worn pulleys on equipment. Repair or replace them.

2. CHECK ALIGNMENT

Proper alignment is more critical for Variable Speed Drive sheaves than for conventional V-belt drives. Belt alignment should be checked every time belt maintenance is performed, each time belts are replaced and whenever sheaves are removed or installed.

The procedures for Variable Speed Drive pulley sheave alignment are similar to that used for conventional V-belt drives. See page 10 of this *Guide* for details.

This belt is misaligned. To correct the alignment, move one sheave so that the straight edge is equidistant from both sides of the narrow sheave. The belt edges should also be equidistant from the straight edge.

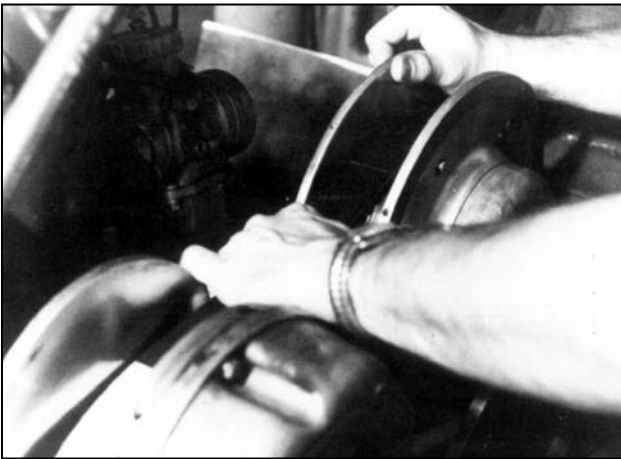
3. SELECT THE CORRECT BELT

Refer to the drive manufacturer's recommendations. The belt length is most critical on fixed center drives with both pulleys variable since accurate length is required to achieve precise drive speed variations. Belt length with one variable and one fixed pulley is also critical as it affects the allowable increase and decrease in center distances.

4. HOW TO INSTALL BELTS

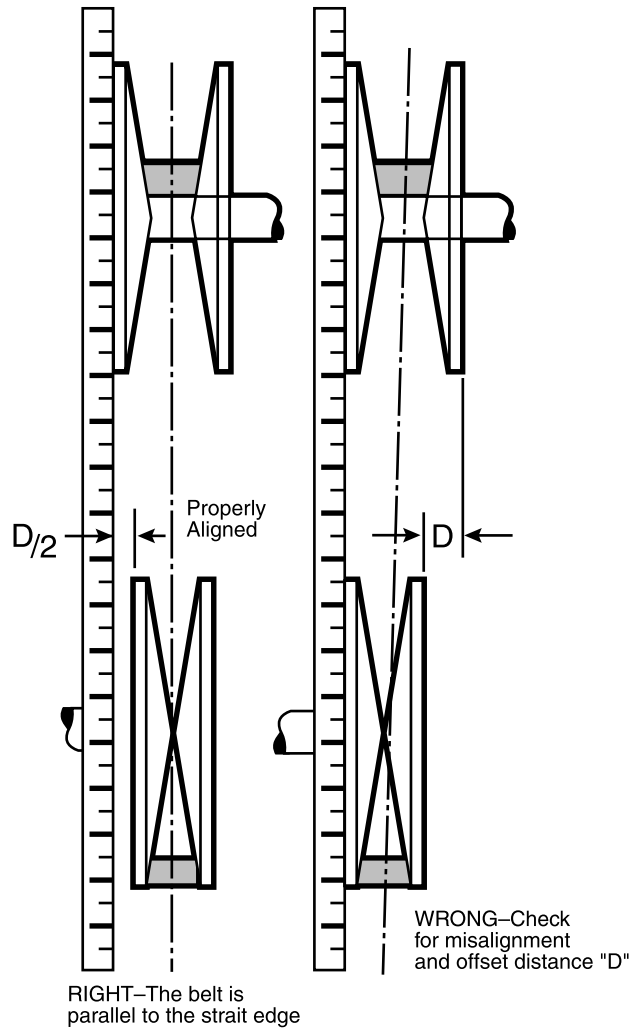
WARNING

Disconnect power supply to the machine before removing or installing belts.



5. BELT TENSIONING

The spring loaded sheave pulley(s) apply the tension required to handle the design load.



6. BELT GUARDS

Belt guards insure cleanliness and safety. Screened, meshed or grilled belt guards are the most satisfactory because they allow air to circulate and heat to escape.

NOTE: Belt guard opening should be as described in O.S.H.A. 1910.219, Table Q-12.

7. IDLERS

Idlers are not recommended for variable speed drives.

Special care should be taken during the installation of variable speed belts to avoid damage to the belts and sheaves. The variator sheaves may have to be fully opened to facilitate installation. The drive center distance may also have to be shortened to allow for easy installation. One or both sheaves may have to be removed. After assembly, the drive center distance should be returned to normal and the drive alignment rechecked.

MAINTENANCE

V-belt drives are recognized as an extremely reliable and efficient means of power transmission. Since they are basically trouble-free, they are often ignored and do not receive the minimal attention they do require in order to deliver the full benefits they offer and achieve the long life they should provide.

V-belt drive maintenance is not complicated, nor does it require a great deal of time or a large variety of special tools. The main ingredients of good maintenance are to look and listen to the drive, and then to correct any apparent problems.

WARNING

Do not clean pulleys while the machine is running.

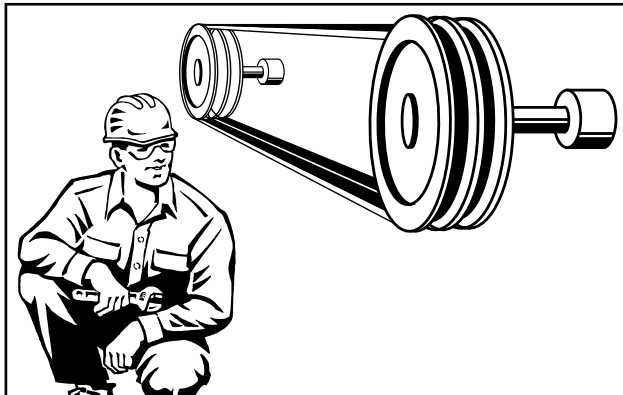
Disconnect power supply to the machine before removing or installing pulleys and belts.

Take pulleys off machines to inspect, clean and repair them.

Look and Listen



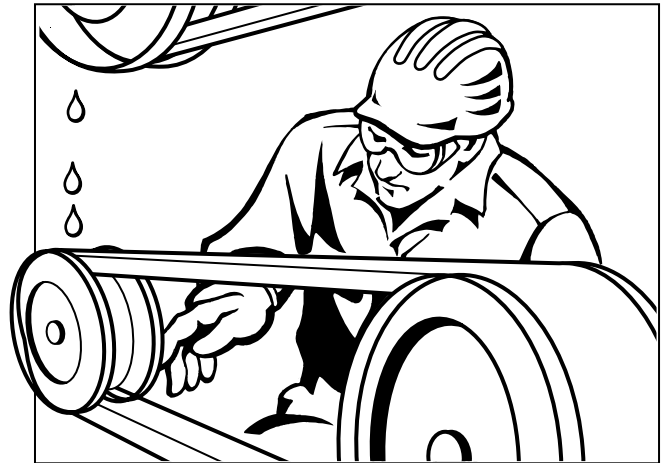
After installation or maintenance of belts, inspect the drive and watch it run.



Inspection of a V-belt drive is simply a matter of looking and listening.

WHAT TO LOOK FOR

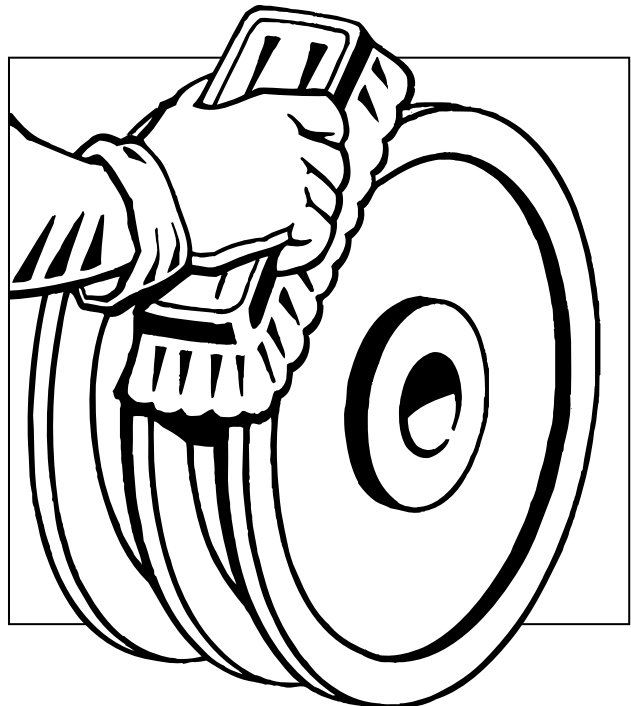
1. OIL AND GREASE



Belts exposed to oil in spray, liquid or paste form will fail prematurely. A drive should be well polished. Leaky bearings should be repaired immediately. Excess oil on a bearing will splash on the belts. If these conditions cannot be corrected, special oil-resistant belts should be used. Too little lubrication will cause bearing failure which is often blamed on the belts. This condition may also cause belt failure when bearing drag becomes excessive.

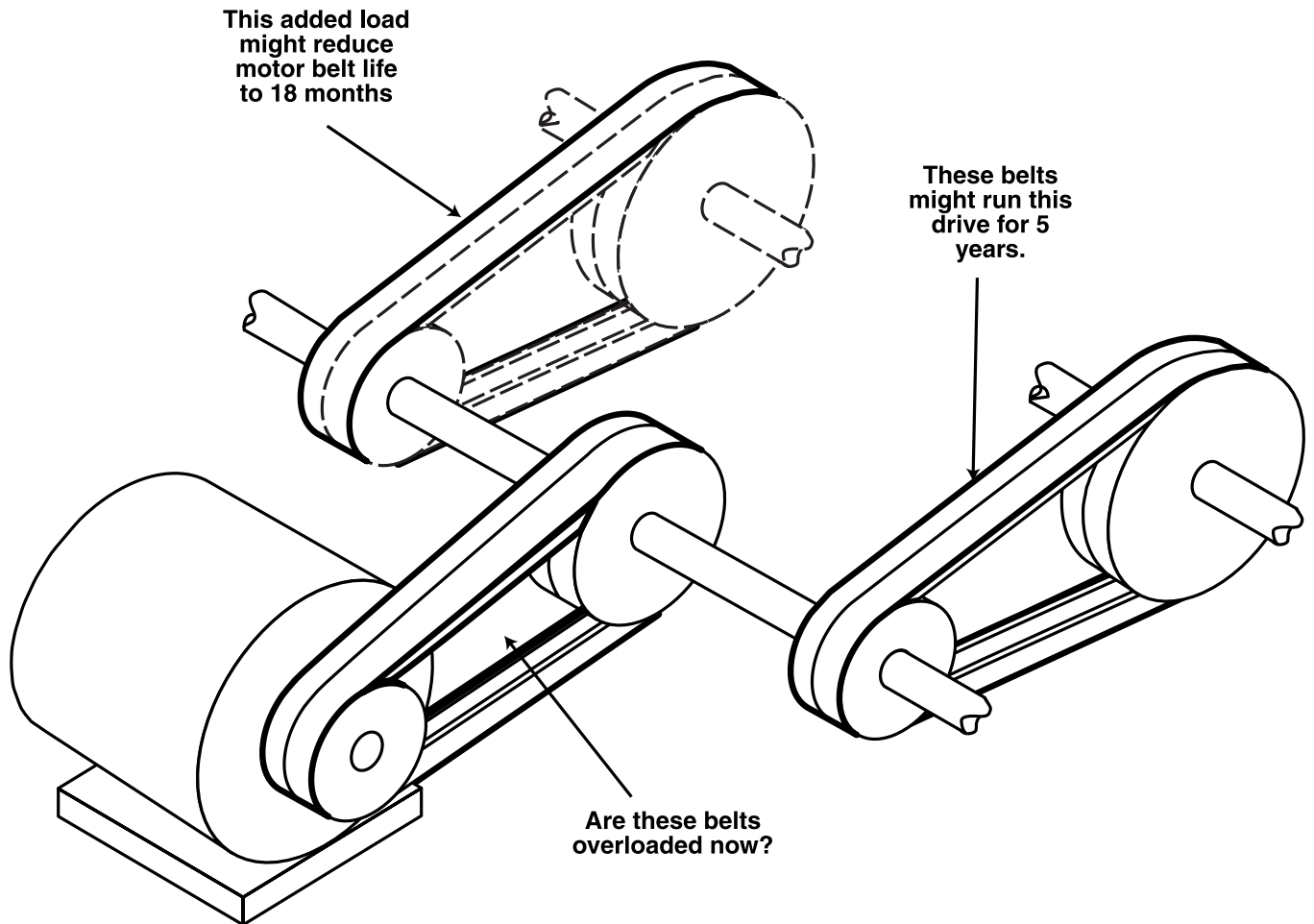
2. DIRT

No equipment operates best when it is dirty. Belts are no exception. Dirt accelerates belt wear and dirt build-up in a sheave groove impairs traction.



3. ADDED LOADS

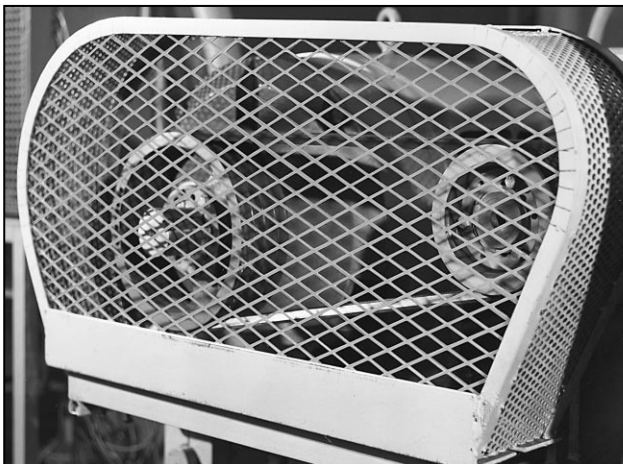
Added loads shorten belt life. A check should be made to see that no additional loads have been added since the original drive was selected.



4. BELT GUARDS

Belt guards insure cleanliness and safety. Screened, meshed or grilled belt guards are the most satisfactory because they allow air to circulate and heat to escape.

NOTE: Belt guard openings should be as described in O.S.H.A. 1910.219, Table Q-12.



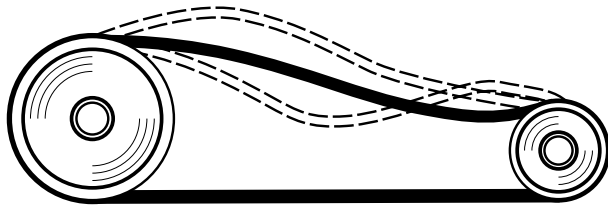
5. CRACKING

Bottom cracking will not reduce the tensile strength or the operating efficiency of the belt. It is not necessary to replace a belt simply because bottom cracking has been observed. High temperatures, small diameter pulleys, and dust will accelerate bottom cracks. Bottom cracking can be reduced by using larger sheaves and larger reverse bend idler sheaves.

6. BELT DRESSING

Do not use belt dressing of any kind. Certain dressings are meant to build a tacky surface, but only interfere with proper belt and groove fit as any other foreign material would. Other types attack the belt rubber and fabric to make it tacky. This actually accelerates the time to failure. If belts slip or squeak, the problem should be identified and corrected.

7. VIBRATION

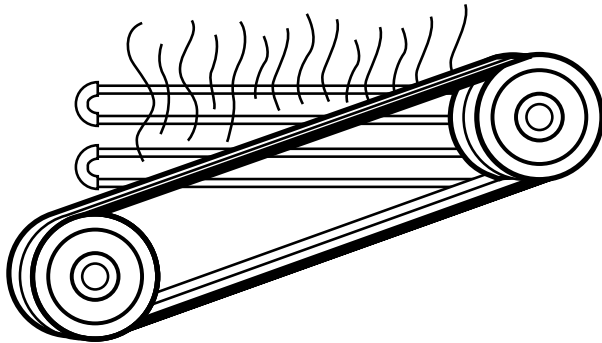


Prevent belt whipping

8. TENSION

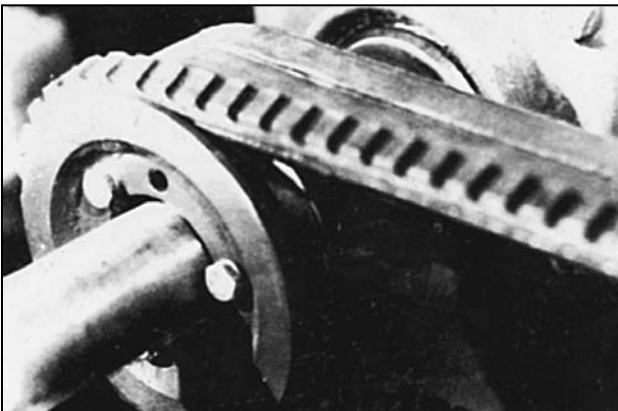
Adjust tension to the values shown in the tables provided in this *Guide*. See section on "Installation" for the type of belt involved for additional information.

9. HEAT



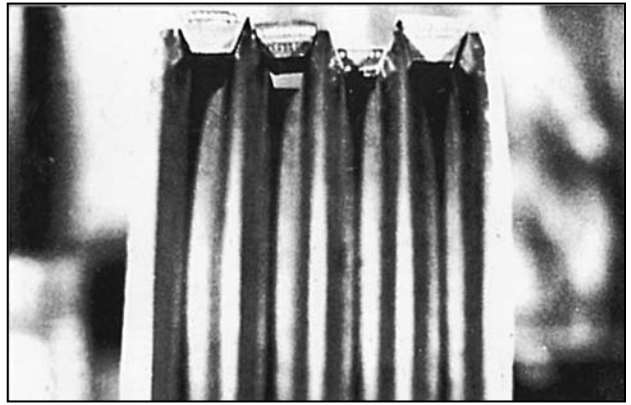
All belts are cured in a scientifically controlled time and temperature process. Belts which operate in temperatures of less than 140°F are not materially affected. At higher temperatures overcuring occurs and shortens belt life. Belts operating in temperatures above 140°F should be checked frequently and a special heat-resistant construction should be considered if belt life is not satisfactory.

10. BELT TURN OVER



Turned over belts indicate drive misalignment, worn sheaves or excessive vibration.

11. CHANGE IN RIDE OUT



A change in ride out indicates uneven belt wear or worn sheaves.

12. LATERAL VIBRATION

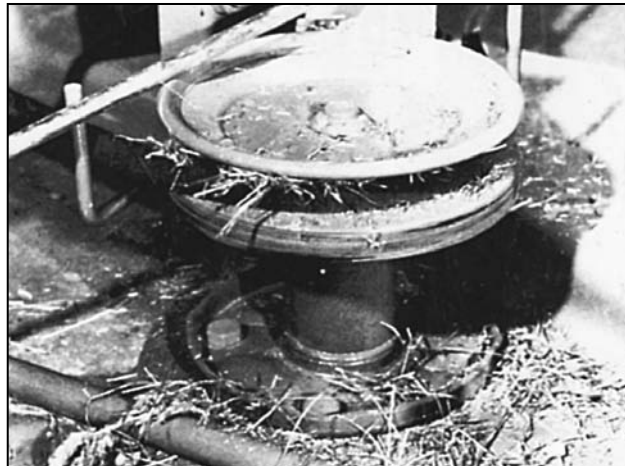


13. BELT WEAR



Wear on belt sidewalls indicates consistent slippage, excessive dust, or rough sheaves.

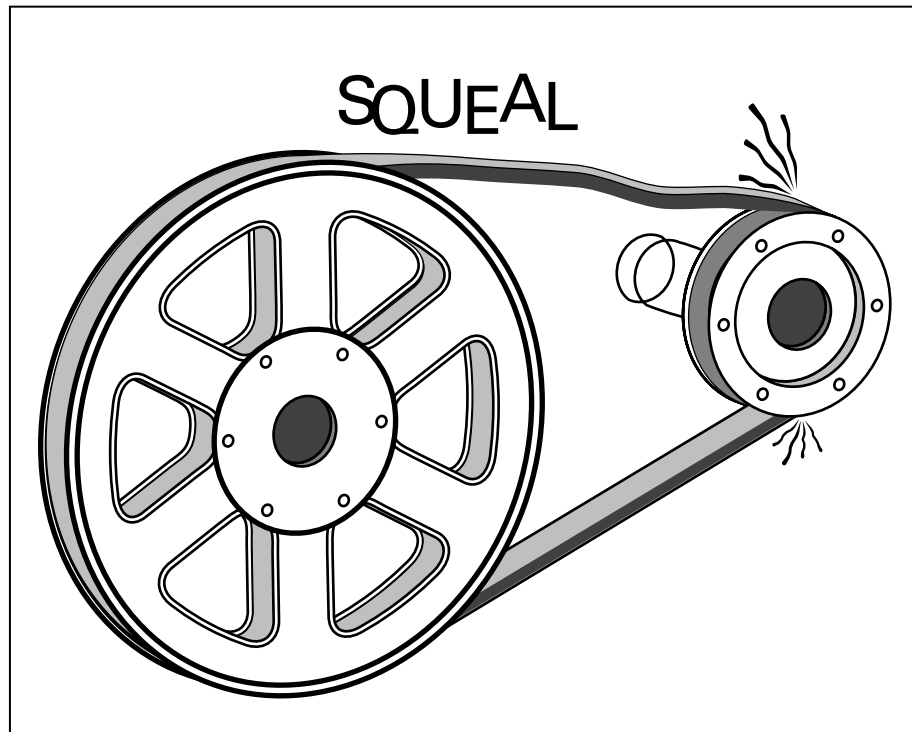
14. FOREIGN MATTER



Broken belts or excessive vibration wear can result from the presence of foreign material in the sheaves or on the belts.

WHAT TO LISTEN FOR

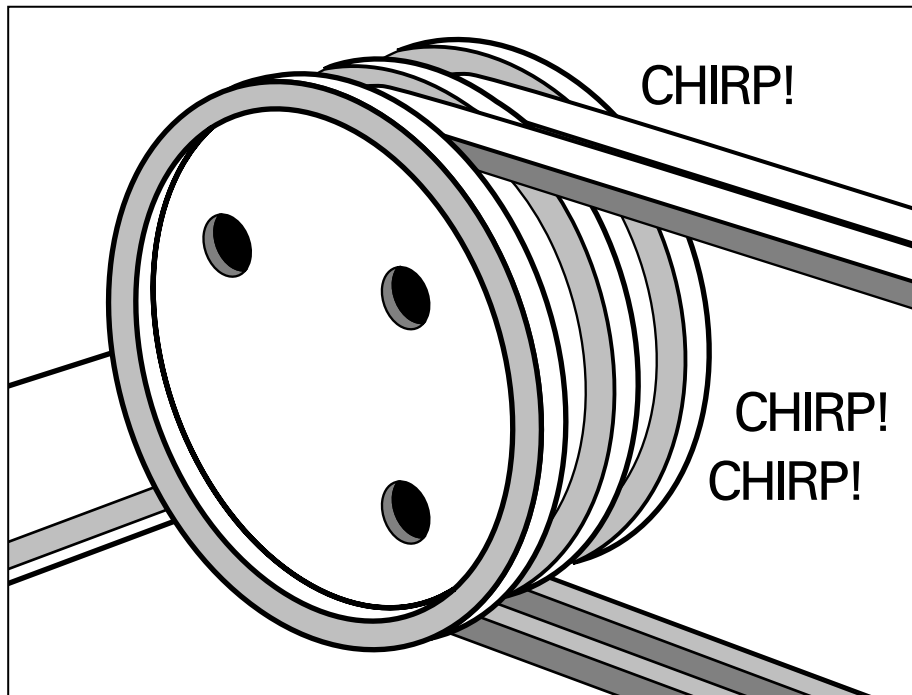
1. SQUEAL



Squeal noise occurs during motor acceleration or when the motor is operating near or at full load. It is an indication of belt slippage and requires prompt investigation. Squeal is usually a result

of insufficient belt tension. If it persists after all belts have been checked and their tension adjusted, the drive itself should be examined for overloading.

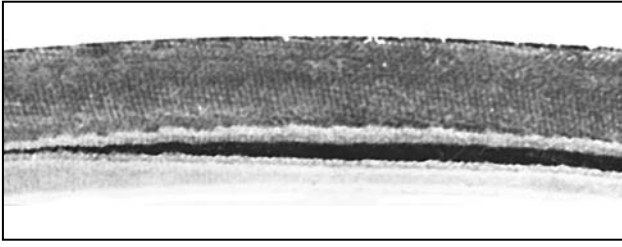
2. CHIRP OR SQUEAK



Chirp, a sound like that of a chirping bird, indicates a dry bearing. Chirp also occurs on all types and all makes of belts. Dust is often a contributing factor. Never apply dressing or oil

to a belt in an effort to eliminate chirps or squeaks. Realignment of an idler may help. Chirps or squeaks are often annoying, but will not harm belts.

TROUBLESHOOTING-V-BELT PERFORMANCE ANALYSIS



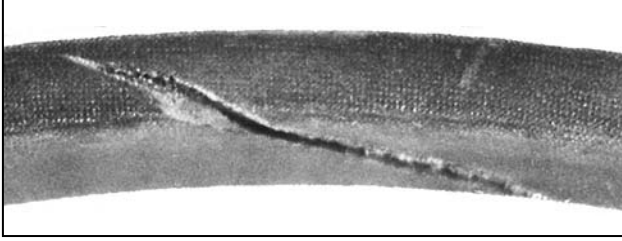
Cause of Failure — Excessive exposure to oil or grease has caused the belt to swell, become soft and the bottom envelope seam to “open up”.

Correction — Provide splash guards, do not over lubricate, clean belts and sheaves with gasoline.



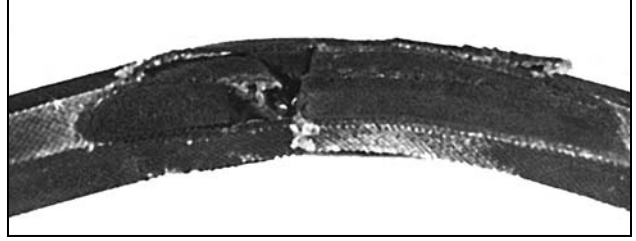
Cause of Failure — Weathering or “crazing” caused by the elements and aggravated by small sheaves.

Correction — Provide protection for the drive and replace belt or belts.



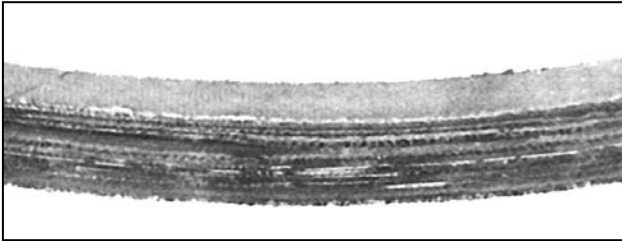
Cause of Failure — Cut bottom and sidewall indicate belt was pried over sheave and damaged during installation.

Correction — Be sure to use proper length belt and move tensioning all the way “in” when installing belt.



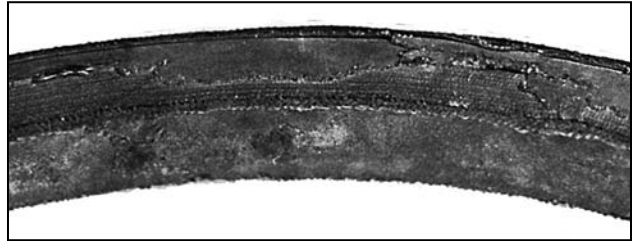
Cause of Failure — Severe localized wear caused by a frozen or locked driven sheave.

Correction — Determine that the drive components turn freely and tighten belt, if necessary.



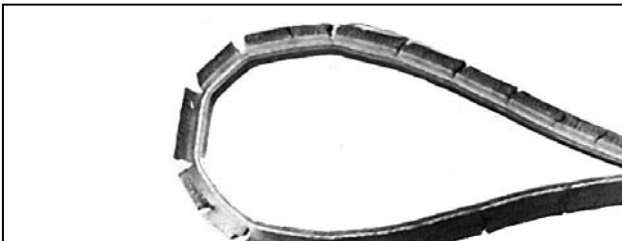
Cause of Failure — Constant slippage caused by insufficient tension in belt.

Correction — Tension drive in accordance with the recommendations of the equipment manufacturer and this manual.



Cause of Failure — Rough sheave sidewalls cause the cover to wear off in an uneven pattern.

Correction — File or machine out the rough spot on the sheave groove. If beyond repair, replace the sheave.



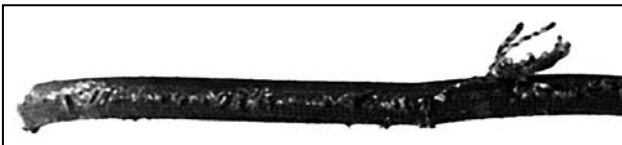
Cause of Failure — Belt has evenly spaced deep bottom cracks from use of a substandard backside idler.

Correction — Replace backside idler with the minimum size recommendation.



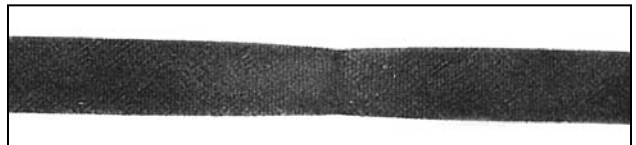
Cause of Failure — Ply separation caused by substandard sheave diameter.

Correction — Redesign drive to use proper size sheaves.



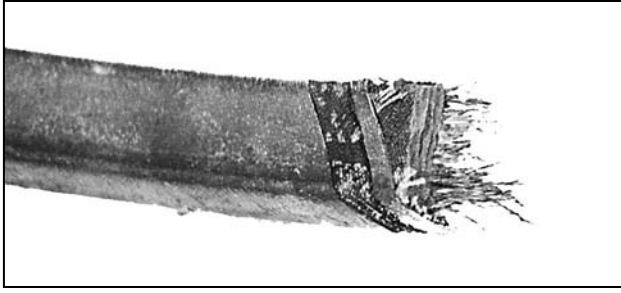
Cause of Failure — Split on side at the belt pitch line indicates use of a sheave with a substandard diameter.

Correction — Redesign drive to utilize proper size sheaves.

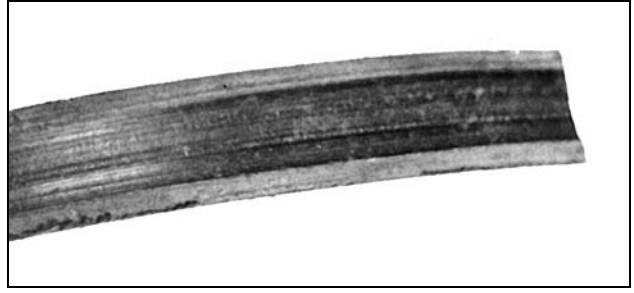


Cause of Failure — The load carrying member has been broken by a shock load or damage during installation.

Correction — Maintain proper tensioning and observe proper installation procedures.



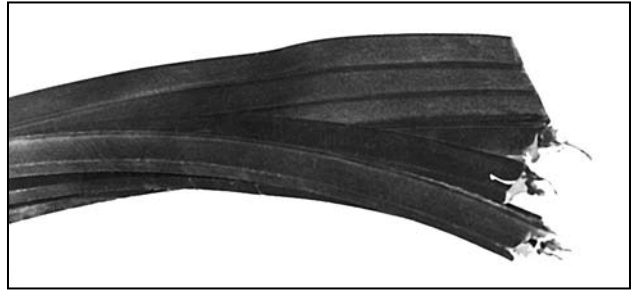
Cause of Failure — Tensile breaks can be caused by high shock loads, foreign object between the bottom of the sheave and the bottom of the belt or damage during installation.
Correction — Maintain proper drive tension and installation procedures. Provide guard to keep foreign material from coming in contact with the drive.



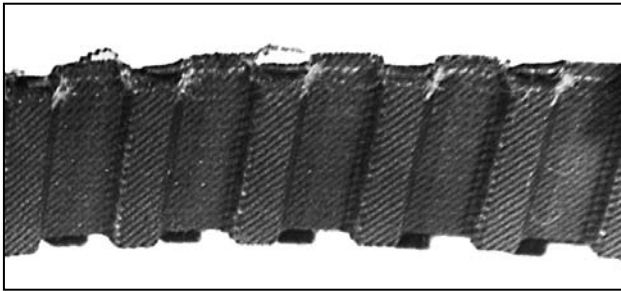
Cause of Failure — Back of the belt has been rubbing on a belt guard or other appurtenance.
Correction — Provide adequate clearance between belt and guard or any appurtenances.



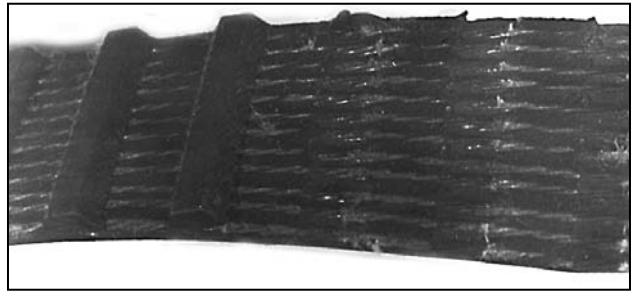
Cause of Failure — Excessive dust and rough sheaves combine to cause severe envelope wear and early belt failure.
Correction — Maintain sheave condition, alignment and attempt to protect drive from excessive dust exposure.



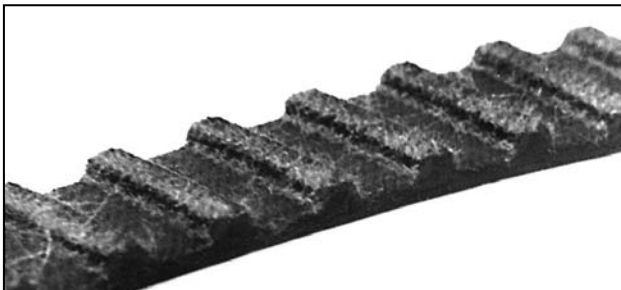
Cause of Failure — Worn sheave grooves allow the joined belt to ride too low cutting through to the top band.
Correction — Replace sheaves and maintain proper belt tension and sheave alignment.



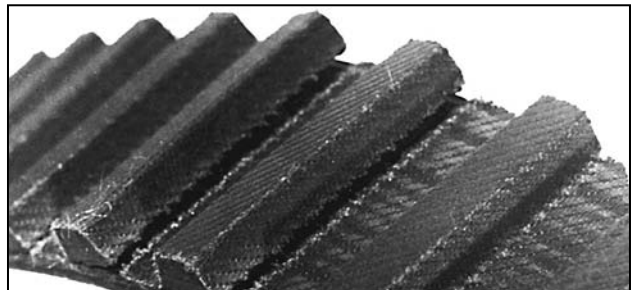
Cause of Failure — Flange wear on PD synchronous belt.
Correction — Adjust and maintain proper pulley alignment.



Cause of Failure — Web fabric wear caused by improper belt and pulley fit.
Correction — Check belt/pulley fit and replace worn or out-of-spec pulleys.



Cause of Failure — Tooth shear caused by belt overload condition from improper application or shock loads.
Correction — Consult engineering manual to proper application and maintain proper belt tension.



Cause of Failure — Fabric wear caused by insufficient belt tension or pulleys which are not to the standard PD pulley dimensions and tolerances.
Correction — Maintain proper tension and replace the out-of-spec pulleys.

Eagle Pd™ System Troubleshooting Chart

TYPE OF FAILURE		POSSIBLE CAUSE OF FAILURE	CORRECTIVE ACTION
PRIMARY CAUSE	POSSIBLE CAUSE		
		Excessive Edge Wear	Remove obstruction or use idler to reroute belt
		Excessive Tooth Wear	Redesign drive
		Uneven Tooth Wear	Use tensioning gauge to set proper tension (see pg.32)
		Apparent Belt Stretch	Use tensioning gauge to set proper tension (see pg.32)
		Cracks in Backing	Replace sprocket
		Tooth Shear	Align shafts and sprockets (see pg. 29)
		Tensile Failure	Replace sprocket, never attempt to remachine
		Excessive Drive Noise	Use harder sprocket material
		Tooth Skipping (Ratchiting)	Shield drive
		Belt Tracking	Check lock down bolts on motors and shafts
		Excessive Sprocket Wear	Reinforce drive structure
		Excessive Drive Vibration	Moderate temperature especially at startup
		Belt Hitting Obstruction	Shield drive, eliminate chemicals
		Excessive Load	Redesign drive to increased sprocket diameters
		Belt Overtensioned	Redesign to reduce wrap on backside idler
		Belt Undertensioned	Eliminate shock loading or redesign drive to handle it
		Rough or Damaged Sprocket	Increase wrap on sprocket
		Misalignment	Replace sprocket
		Worn Sprocket	Replace product, don't crimp belt or drop sprockets
		Sprocket Out of Tolerance	Replace bearings or reinforce mountings
		Soft Sprocket Material	Alignment is critical (see pg.29)
		Debris in Sprocket or Drive	Check sprocket balance
		Center Distance Changed	
		Weak Drive Structure	
		Excessive Low Temperature	
		Excessive High Temperature	
		Exposure to Oil, Solvents, Chemicals	
		Sprocket Diameter Sub Minimum	
		Backside Idler	
		Shock Loading	
		Less than 6 Teeth in Mesh	
		Excessive Sprocket Runout	
		Damage Due to Handling	
		Vibrating Bearings/Mountings	
		Center Distance Greater than 8x Small Sprocket Diameter	
		Sprocket Not Properly Balanced	

PRIMARY CAUSE

POSSIBLE CAUSE

COULD CAUSE BUT NOT LIKELY

V-Belt Troubleshooting Chart

PROBABLE CAUSES

PROBLEM	Excessive Oil	Exposure to Elements	Pried Over Sheaves	Contact w/ Obstruction	Insufficient Tension	Stalled Drive Sheaves	Constant Slippage	Rough Sheaves	Substandard Sheaves	Excessive Tension	Shock Load	Foreign Material	Excessive Dust	Drive Misalignment	Worn Sheaves	Excessive Vibration	High Ambient Temperature	Excessive Tension	Drive Underbelled	Inadequate Tension	Damaged Tensile Member	Incorrect Belts	Incorrect Drive Setup	Insufficient Take Up	Improper Matching	Mixed Old & New Belts	Non Parallel Shafts	Different Manufacturers	Belt/Pulley, Incompatible
Loose Cover & Swell	■																												
Weathering or "Craze" Cracks	■																												
Gouges			■	■																									
Spin Burn					■	■																							
Envelope Wear							■						■																
Uneven Envelope Wear								■																					
Ply Separation									■	■																			
Side Split									■																				
Broken Belts											■	■																	
Belts Turn Over													■	■	■														
Hardening & Premature Cracking																	■												
Belt Squeal											■																		
Excessive Stretch																									■	■	■	■	■
Excessive Vibration					■																■								
Belts Too Long At Installation																						■	■	■					
Belts Too Short At Installation																							■	■					
Mismatched Belts At Installation															■														
Cut Thru on Top (Joined Belts)															■														
Flange Wear (Synchronous Belts)														■															
Web Fabric Wear (Synchronous Belts)																													■
Tooth Shear (Synchronous Belts)											■										■		■						

V-Belt Troubleshooting Chart

SOLUTION

PROBLEM	Lubricate Property	Clean Sheaves & Belt	Replace Belts	Provide Protection	Install Property	Check for Belt Length	Remove Obstruction	Tension Property	Free Sheaves	Replace Sheaves	File Smooth	Redesign Drive	Operate Property	Align Drive	Provide Ventilation	Check for Proper Belt	Check Machinery	Use Only New Belts	Use Single Source	Check Fit	Replace Pulleys	
Loose Cover & Swell																						
Weathering or "Craze" Cracks																						
Gouges																						
Spin Burn																						
Envelope Wear																						
Uneven Envelope Wear																						
Ply Separation																						
Side Split																						
Broken Belts																						
Belts Turn Over																						
Hardening & Premature Cracking																						
Belt Squeal																						
Excessive Stretch																						
Excessive Vibration																						
Belts Too Long At Installation																						
Belts Too Short At Installation																						
Mismatched Belts At Installation																						
Cut Thru on Top (Joined Belts)																						
Flange Wear (Synchronous Belts)																						
Web Fabric Wear (Synchronous Belts)																						
Tooth Shear (Synchronous Belts)																						



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