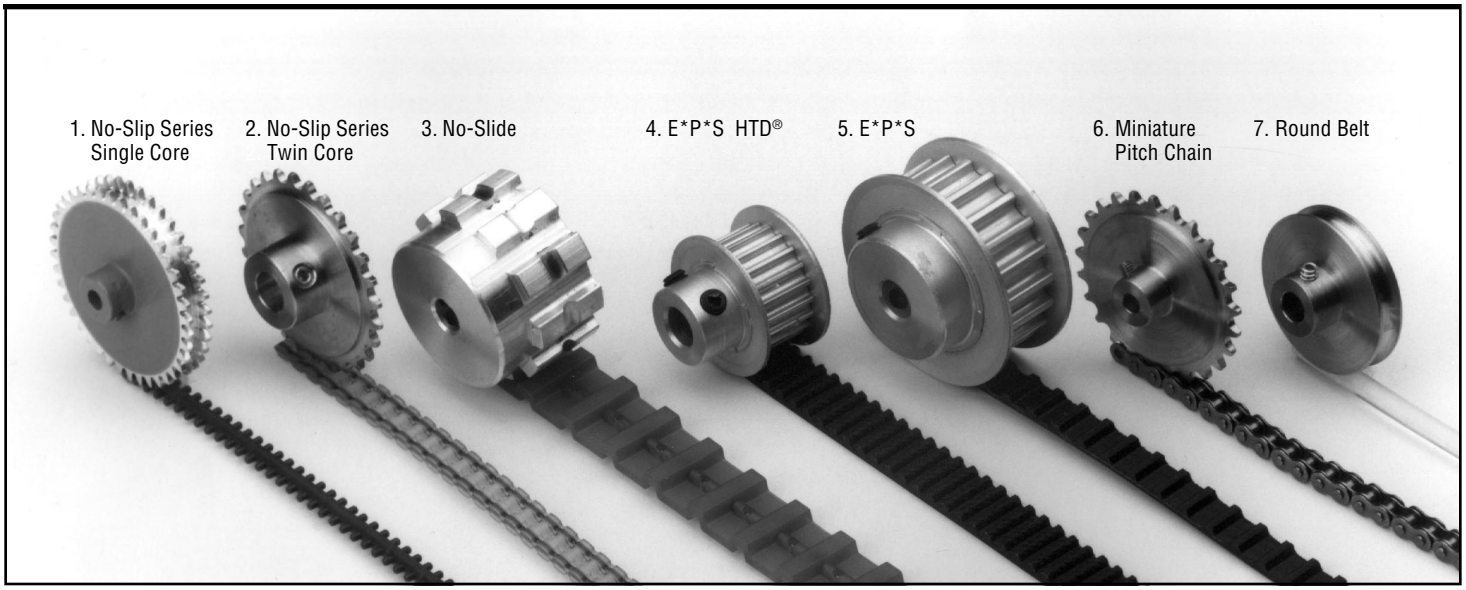
PIC DESIGN®

PRECISION INDUSTRIAL COMPONENTS

BELTS AND PULLEYS



PIC Design has increased its range of belts and pulleys to provide users with the most complete line for motion control and light power transmission. Designers are no longer confined to the use of one type of drive system. PIC Design offers No-Slip™ Positioning Timing Belts, No-Slide™, E*P*S, E*P*S HTD® (Metric), Round Belts, and Miniature Chain. All come with appropriate pulleys or sprockets in various materials.

PIC Design Belts and Pulleys — A Brief Overview

NO-SLIP™ POSITIONING BELTS

No-Slip series timing belts feature many design elements. The polyurethane belts operate backlash free without lubrication and have excellent chemical and abrasion resistance for use in medical and food processing applications. Positive tooth engagement offers silent No-Slip drive. No-Slip belts are available with Aramid (Kevlar) or stainless steel cable cores in single or twin core configurations. Sprockets are available in either aluminum or stainless steel. Belts are available in lengths up to 100 feet and can be spliced in the field for added versatility.

NO-SLIDE™ TIMING BELTS

A new series of synchronous belts, combined with a grooved flangeless pulley, offers high performance timing. No-flange pulleys allow air to escape and prevents it from being trapped between the belt and flange. No-Slide belts are molded in polyurethane with a stainless steel core (cable). They require no lubrication, handle higher load capacities than standard timing belts, are available in lengths up to 100 feet, and can be spliced in the field for added versatility.

No-Slide belts are excellent for medical, packaging, and labeling applications, and where higher load capacity is required. No-Slide pulleys are available in aluminum.

E*P*S TIMING BELTS

The E*P*S synchronous timing belt is the classical timing belt that provides positive, non-slip power transmission. These belts are available in neoprene rubber with nylon facing and a fiberglass tensile member, or urethane with a polyester tensile member as shown. A Kevlar tensile member is also available as an option. These belts are directly interchangeable with each other. The urethane belts have excellent flex characteristics which allows them to operate on pulleys with as few as 10 teeth, and ratios of 8:1 on smaller center distances.

The E*P*S line is recommended for use on office, mailing, and data processing equipment, printers, plotters, robotics, optical, and photographic equipment.

E*P*S HTD® TIMING BELTS

The E*P*S HTD® timing belts provide positive non-slip transmission at both low and high speeds and offer a higher load carrying capability than the E*P*S trapezoidal design, due to the deeper curvilinear shape of the belt tooth. E*P*S HTD® belts can transmit more power with a more compact package as compared to E*P*S belts, and can be used in applications where shock load is evident, such as vacuum cleaners, floor polishers, sanders, centrifuges and power tools, as well as office equipment drive systems. Pulleys are available in machined aluminum.

ROUND BELTS

Round belt or O-ring drive belt systems are used in a wide variety of applications such as vibration dampening in precision mechanisms and reduction of distortion in audio equipment. Round belts also provide overload protection and can act as a clutch in certain applications. Grooved pulleys are available in stainless steel and aluminum.

MINIATURE PITCH CHAIN

Miniature pitch chains are made of non-magnetic grade stainless steel. The large joint bearing area construction permits greater loads and speeds. Precision control of chain length allows for positioning accuracy between the driver and driven sprockets. Continuous and positive lubrication is recommended for maximum life and efficiency. Sprockets are available in stainless steel and aluminum.

TECHNICAL SECTION

Application Information

To assist customers in selecting the most appropriate flexible drive system in particular applications, PIC Design has included an Application Guide along with a Flexible Drive System Comparison Chart.

The Application Guide assists in determining the drive system suitable for your application. If your specific applications are not listed, use ones which are most similar.

The Comparison Chart will enable users to choose the drive system that will best suit a particular application. The features of these drive systems are listed so that the drive system selected will provide the most economical, maintenance-free and longest life for a particular application.

No-Slip Series belts fulfill the need for the most accurate and smoothest running drive system, while the **E*P*S Series** provides and economical solution to positive power transmission. **No-Slide timing belts** offer higher load capacities, run on no-flange pulleys, offer quiet operation, and can be used in smaller areas. **Miniature chains** offer a positive drive system for heavier duty applications, while **Round Belts** are most suitable for low-load applications not requiring positioning accuracy.

Users are encouraged to request advise or answers to questions not covered here — please don't hesitate to consult PIC Design directly.

Application Guide

	Flexible Drive Systems				
	No-Slip Belts	No-Slide Belts	Timing Belts	Chain	Round
CNC Positioning Devices	X	X	X		
Magnification & Focusing Adjustment Devices	X				
Laser Alignment Mechanisms	X				
Gear Boxes	X	X	X	X	
Paper Feeds		X	X		X
Household Appliances		X	X		X
Centrifuges		X	X		
Encoders — High Resolution Std. Resolution	X X	X	X		
Plotters	X				
Plating Room Equipment	X	X	X		X
High Speed Printers		X	X		
Manual Positioning Mechanisms	X	X	X	X	X
Power Tools, Sanders, etc.		X	X		
Machinery Drives		X	X	X	X
Advertising Displays	X	X	X	X	X
Stepper Motor Drives	X	X	X		
Business Machines	X	X	X	X	X
Audio & Visual Equipment	X	X	X	X	X

Flexible Drive System Feature Comparison

Drive Type	No-Slip	No-Slide	E*P*S (Timing)		E*P*S HTD®	Chain	Round
Catalog Series and Pitch	**F, F32 - 32DP, F24C - .1309CP, FR - .1475CP, FL, FM, F20TS - 20DP, F25C - .250CP**	**F8B-40DP (.0816CP), F20B-.200CP, F37B-.375CP**	**EPS-A-.080CP, EPS-D-.200CP, EPS-J-.375CP**	**EPS-A-.080CP, EPS-D-.200CP, EPS-C-.0816CP (40DP)**	**EPS-F-3mm, EPS-G-5mm**	**EL-.1475CP EL25-.250CP**	**AF2-1/16" Thick AF3-3/32" Thick AF4-1/8 " Thick AF5-3/16" Thick AF6-1/4 " Thick**
Body Material	Polyurethane	Polyurethane	Neoprene	Polyurethane	Neoprene	Stainless Steel	Polyurethane
Reinforcement	Stainless Steel or Aramid Fiber	Stainless Steel or Aramid Fiber	Fiber Glass	Polyester Fiber	Fiber Glass	—	None
Drive Both Sides of Belt	Yes [1]	No	No	No	No	Yes	Yes
Right Angle Drive	FS & FA [2]	No	No	No	No	No	Yes
Resistance to Oils and Chemicals	Stainless Steel - Excellent Aramid - Good	Stainless Steel - Excellent Aramid - Good	Good	No	No	No	Yes
Pulley to Pulley [3] Misalignment	Single Core — up to 5° Double Core — up to 1/10°	Up to 1/10°	Up to 1/4°	Up to 1/4°	Up to 1/4°	No	Yes
Pulley Tooth Form	32DP — Involute 20DP, 24DP, .1475CP, .250CP — Precision Sprocket	Trapezoidal	Trapezoidal	Trapezoidal	HTD® Curvilinear	Precision Sprocket	Radius Groove
Abrasion Resistance	Excellent	Excellent	Good	Excellent	Good	Good	Excellent
Pulleys Mesh With Standard Spur Gears	32DP — Yes 20DP, 24DP — Option Available .1475CP, .250CP — No	No	No	No	No	No	No
Ability to Withstand Shock Loads	Fair	Fair	Limited	Good	Fair	Limited	Excellent
Temperature (°F)	-65 to +180 [4]	-65 to +180 [4]	-30 to +185	-65 to +180	-30 to +185	—	-40 to +180

Notes:

Note [1] Driving stainless steel reinforced belts on both sides, results in a reduction of belt life due to reverse bending.

Note [2] Twisting of the belt may cause the belt to wear excessively and reduce belt life. Shafts at right angles require a center distance at least 5 1/2 times the larger pully diameter.

Note [3] Misalignment of pulleys will cause abrasive wear on the belt and reduce belt life.

Note [4] Practical operating temperatures are -10°F to +140°F.

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No-Slip / No-Slide	Catalog Belt Series	Pitch	Reinforcement Cable Diameter (Inch)	Positional Accuracy	Recommended Minimum Pulley Diameter (Inch)	Recommended Minimum Number Of Teeth In Mesh	Recommended Maximum Belt Operating Speed (No Load / Load) (Feet per Min.)	Recommended Maximum Operating Belt Tension (LBS)	Ultimate Static Tensile Strength For Endless Belt (LBS)
No-Slip	FA	32DP .0982CP Single Core	.032 Aramid Fiber	Excellent	.500	8	900 / 300	4-5	25
	FS		.032 Stainless Steel		.750	8	900 / 350	6-8	50
	F32BS18		.018 Stainless Steel		.500	8	800 / 350	4-5	20
	F32CS	32DP / .0982CP Double Core	.018 Stainless Steel	Very Good	.750	8	850 / 350	6-7	50
	FLA	20DP .15708CP Single Core	.032 Aramid Fiber	Good	.750	6	1100 / 500	5-6	25
	FLS		.032 Stainless Steel		.750	6	1100 / 600	10-12	50
	FMA	20DP .15708CP Double Core	.032 Aramid Fiber	Good	.750	6	1300 / 550	10-12	50
	FMS		.032 Stainless Steel		.750	6	1300 / 700	20-25	100
	F20TS	20DP Triple Core	.032 Stainless Steel	Good	.750	6	1300 / 700	20-25	100
	FRA	.1475CP Double Core	.032 Aramid Fiber	Good	.750	6	1300 / 550	10-12	50
	FRS		.032 Stainless Steel		.750	6	1300 / 700	20-25	100
	F24CA	24DP .1309CP Double Core	.032 Aramid Fiber	Good	.750	6	1300 / 550	10-12	50
	F24CS		.032 Stainless Steel		.750	6	1300 / 700	20-25	100
	F25CA	.250CP Double Core	.032 Aramid Fiber	Good	.750	5	1300 / 550	10-12	50
	F25CS		.032 Stainless Steel		.750	5	1300 / 700	20-25	100
No-Slide	F8BS	40DP, .0816CP Single Core	.018 Stainless Steel	Good	.500	8	700 / 300	4-5	20
	F20BA	.200CP Single Core	.032 Aramid Fiber	Very Good	.750	6	1200 / 550	5-6	25
	F20BS		.032 Stainless Steel		.750	6	1200 / 650	10-12	50
	F37BS	.375CP Single Core	.047 Stainless Steel	Good	1.375	6	800 / 450	25-30	125

PIC's No-Slip and No-Slide High Performance Positioning Drive Systems

The No-Slip principle was introduced by PIC over 25 years ago. The No-Slip principle allows the drive system to function primarily as a precise positioning device by locating the drive pins on the belt pitch line, allowing them to mesh smoothly with the pulleys without the clearance required for standard belts and pulleys. The elimination of the clearance makes the drive system "backlash free" and an excellent means of maintaining the accuracy for precision positioning applications.

No-Slip belts utilize round drive pins which are molded perpendicularly to one or more molded tensile members. These molded tensile members are larger than the drive pins, which are located on the pitch line of the tensile member. The molded tensile member(s) surround a reinforcing cable(s) providing strength and minimal stretch while the loads are transferred through the tensile members to the pulley shoulders or grooves.

The 32DP (diametral pitch) No-Slip drive system is an industry standard. The single core belt runs on pulleys that are generated with precision involute form teeth. This fine pitch results in a greater number of teeth engaged, which produces the highest positioning devices. The involute form of the pulleys allows a spur gear to be driven by the belt or pulley. The 32DP twin core design No-Slip drive system offers additional strength for higher loads.

The .1475CP and .2500 CP No-Slip drive systems are twin core belts that are an economical solution to miniature pitch stainless steel chain. These belts are for high load carrying applications requiring No-Slip accuracy. These belts have replaced miniature pitch stainless steel chain in many existing applications.

The No-Slide principle allows the drive system to operate using pulleys without flanges. The belt stays on the center of the pulley due to an encapsulated stainless steel or Aramid cable in the center of the belt and a matching groove in the pulley.

The elimination of a flange results in two major benefits. It produces a more compact drive system and it also eliminates the air trapped by the flanges found on conventional synchronous belts — therefore making it a quieter running belt.

No-Slide belts are produced by a continuous polyurethane molding process with either a stainless steel or Aramid core. The finished belt is joined by crimping the cable ends within a stainless steel ferrule, which is then overmolded for added strength and protection of the pulley.

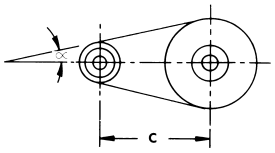
These polyurethane belts have inherent chemical and abrasion resistance that allow operation in applications where carbon dusting encountered with neoprene belts cannot be tolerated. The No-Slide series of belts are excellent for medical and packaging applications.

The design guide (shown on previous page) enables users to select the appropriate system for a particular application. The belt length calculations are included to insure that the proper belt length has been selected for the center distance and ratio of your drive system.

BELT LENGTH CALCULATIONS

D = Pitch Diameter Large Pulley (inches)
d = Pitch Diameter Small Pulley (inches)
C = Center Distance (inches)
α = Angle Between Belt and Centerline
L = Belt Pitch Length (inches — approx.)

For Parallel Shafts:



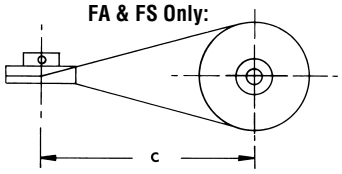
$$\alpha = \sin^{-1}\left[\frac{D-d}{2C}\right]$$

$$L = 2C\cos\alpha + \frac{\pi(D+d)}{2} + \frac{\pi\alpha(D-d)}{180}$$

or

$$L_{APPROX} = 2C + 1.57(D+d) + \frac{(D-d)^2}{4C}$$

For Right Angle Shafts FA & FS Only:



$$L = \frac{\pi}{2}(D+d) + \sqrt{4C^2 + D^2 + d^2}$$

BELT SPEED CALCULATIONS

BS (fpm) = (.262) x PD x RPM

CENTER DISTANCE CALCULATIONS

$$C = \frac{K + \sqrt{K^2 - 32(D-d)^2}}{16}$$

Where $K = 4L - 2\pi(D+d)$

STANDARD CALCULATIONS

Required	Given	Formula
Speed ratio (R)	Shaft speeds (rpm)	$R = \frac{\text{rpm (faster shaft speed)}}{\text{rpm (slower shaft speed)}}$
	Pulley Diameters (D & d)	$R = \frac{\text{D (larger pulley diameter)}}{\text{d (smaller pulley diameter)}}$
	Number of pulley grooves (N & n)	$R = \frac{\text{N (larger pulley groove no.)}}{\text{n (smaller pulley groove no.)}}$
Horsepower (hp)	Torque (T) in in.- lbs. Shaft speed (rpm)	$hp = \frac{T \times rpm}{63{,}025}$
Torque (T) in in.- lbs.	Shaft horsepower (hp) Shaft speed (rpm)	$T = \frac{63{,}025 \times hp}{rpm}$
Effective tension (Te)	Shaft horsepower (hp) Belt speed (BS)	$Te = \frac{33{,}000 \times hp}{BS}$
Effective tension (Te) in pounds	Torque (T) in in.- lbs. Pulley pd in inches	$Te = \frac{2 \times T}{pd}$

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