BRECOflex CO., L.L.C.

High Precision Drive Components

The World Leader in Polyurethane Timing Belts

Pulley Design Guidelines

Materials, and Finishes

Pulley Pitch Range

T-Series

Available Pitches

- T2
- T2.5
- T5
- T10
- T20

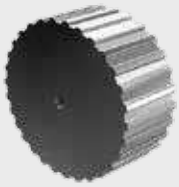
AT-Series

Available Pitches

- AT3
- AT5
- AT10
- AT(S)15
- AT20

*Contact us about AT8

ATN®-Series



Available Pitches

- ATN10
- ATN12.7
- ATN20

ATL-Series

Available Pitches

- ATL5
- ATL10
- ATL20

Imperial-Series

Available Pitches

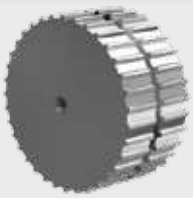
- MXL
- XL
- L
- H
- XH

HTD/STD-Series

Available Pitches

- HTD 3M
- HTD 5M
- HTD 8M
- HTD 14M
- STD S5M
- STD S8M

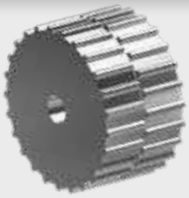
Self-Tracking-Series



Available Pitches

- TK5K6
- TK10K6
- TK10K13
- TK20K13
- ATK5K6
- ATK10K6
- ATK10K13
- ATK20K13
- ATN10K6
- ATN12.7K6
- HK13

SFAT-Series



Available Pitches

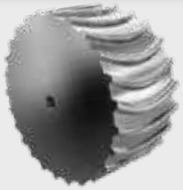
- SFAT10
- SFAT15
- SFAT20

ATP-Series

Available Pitches

- ATP10
- ATP15

ARC-POWER®-Series



Available Pitches

- BAT10
- BATK10
- BAT15
- BATK15

Pulley Customizations

Made-to-order pulleys come in a wide variety of options. BRECO*flex* CO., L.L.C. can provide any customizations with one of the fastest lead times in the industry thanks to our highly skilled CNC machinists, engineers and production staff at our USA headquarters. Our application engineers and customer service staff can assist with your order and in most cases, custom pulleys will ship in 8 days or less. Our flexibility and production capabilities enable you to order prototypes and short runs as well as production quantities.

Single Flanged Pulley

Screwed on Flanges

Unflanged Pulley

Bolt Hole

Counterbore

Keyway

Lightening Holes

Mounting Holes

Setscrew Face

Pulley Customizations

Set Screw Hub

Snap Ring

TL Bushing

Self-Tracking Guide

Hub

Holes for QD Bushing

Rolled on Flanges

Lightening Groove

Pilot Bore

BRECO*flex* CO., L.L.C. will also manufacture pulleys in materials including steel, stainless steel and Delrin® with a variety of special finishes. See page 178 for more details.

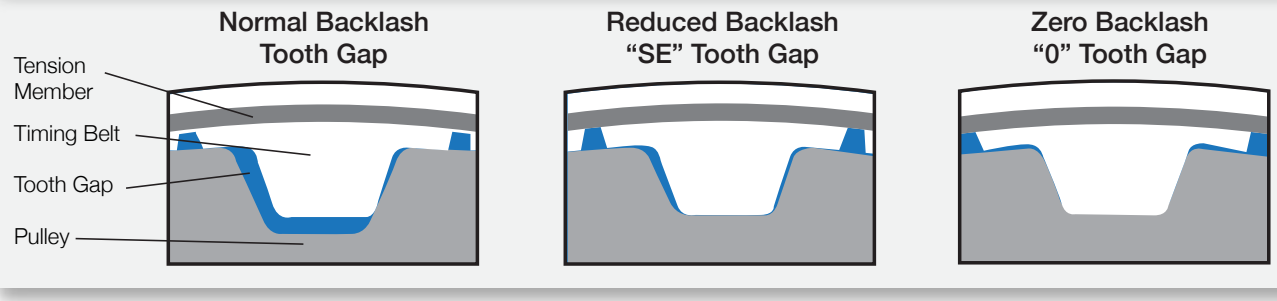
Pulley Tooth Design

Overview

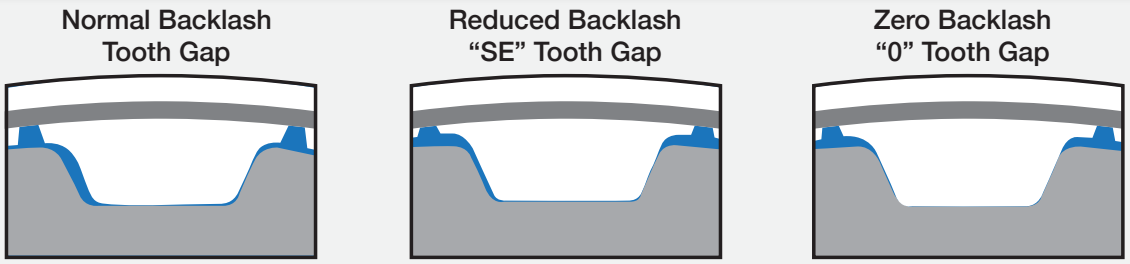
Selecting a special pulley tooth gap can increase the accuracy of the timing belt system by decreasing or eliminating "play" between the timing belt and the pulley. Linear drives and systems requiring precise positioning and high repeatability or fast settling times can benefit from reduced "play." The illustrations below show the meshing of the timing belt with the tooth gap designs available for metric pitches.

For drive designs using "SE" or "0" - tooth gap pulleys, please consult BRECO*flex* CO., L.L.C. applications engineering department.

T-Series

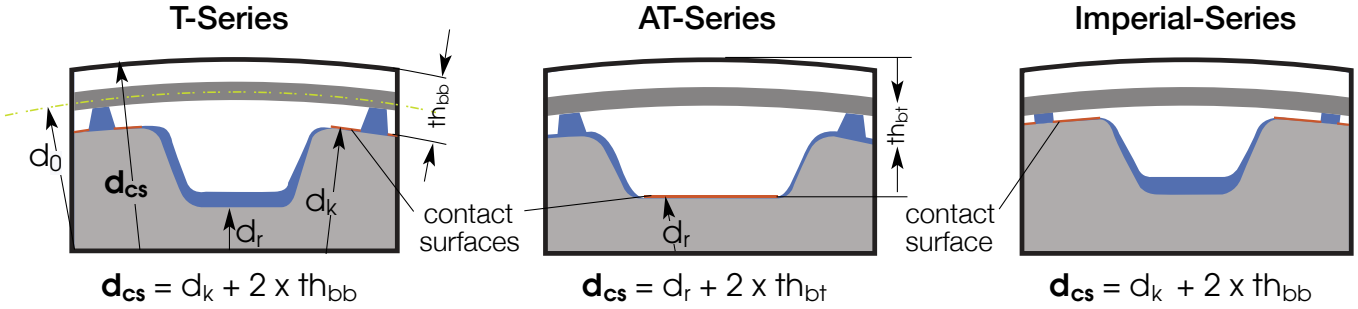


AT-Series



NOTE: Tooth gap will vary with the number of pulley teeth (See chart on next page)

Belt Elevation and Contact Surface Comparison



d_{cs} = d_k + 2 x th_{bb} | **d_{cs}** = d_r + 2 x th_{bt} | **d_{cs}** = d_k + 2 x th_{bb}

d_{cs} = Belt diameter at carrying side	d_k = pulley outside diameter	th_{bt} = belt thickness including tooth
d_r = pulley root diameter	th_{bb} = belt thickness without tooth	d_0 = pitch diameter

Pulley Tooth Design

BRECO*flex* CO., L.L.C. offers three pulley tooth designs for metric pitches as follows:

NORMAL BACKLASH | REDUCED BACKLASH | ZERO BACKLASH

Standard - Standard tooth design will be supplied if no options are specified when ordering.
Options - Optional tooth design must be specified at the time of ordering otherwise the standard tooth gap design will be provided.

Tooth Designs Based on the Number of Pulley Teeth

Overview of available tooth gaps

Pulley Pitch	T-Series Pulley		AT-Series Pulley			Imperial-Series Pulley
	≤20 Teeth	>20 Teeth	(Excl. AT20) All Teeh	AT20 18-20 Teeth	AT20 >21 Teeth	All Teeth
Normal Gap	**N/A**	**Standard**	**Standard**	**N/A**	**Standard**	**Standard**
Reduced Backlash "SE"	**Standard**	**Optional**	**N/A**	**Standard**	**Optional**	**N/A**
Zero Backlash "0"	**Optional**	**Optional**	**Optional**	**Optional**	**Optional**	**N/A**

Pitches That Apply to the Chart (Including Self-Tracking)

T2.5	T20	AT10	ATN10
T5	AT3	ATS15	ATN12.7
T10	AT5	AT20	ATN20

Ordering Example:

NORMAL BACKLASH	AL 42 AT10 / 24-2
REDUCED BACKLASH "SE"	AL 42 AT10 - **SE** / 24-2
ZERO BACKLASH "0"	

Precision Pulleys

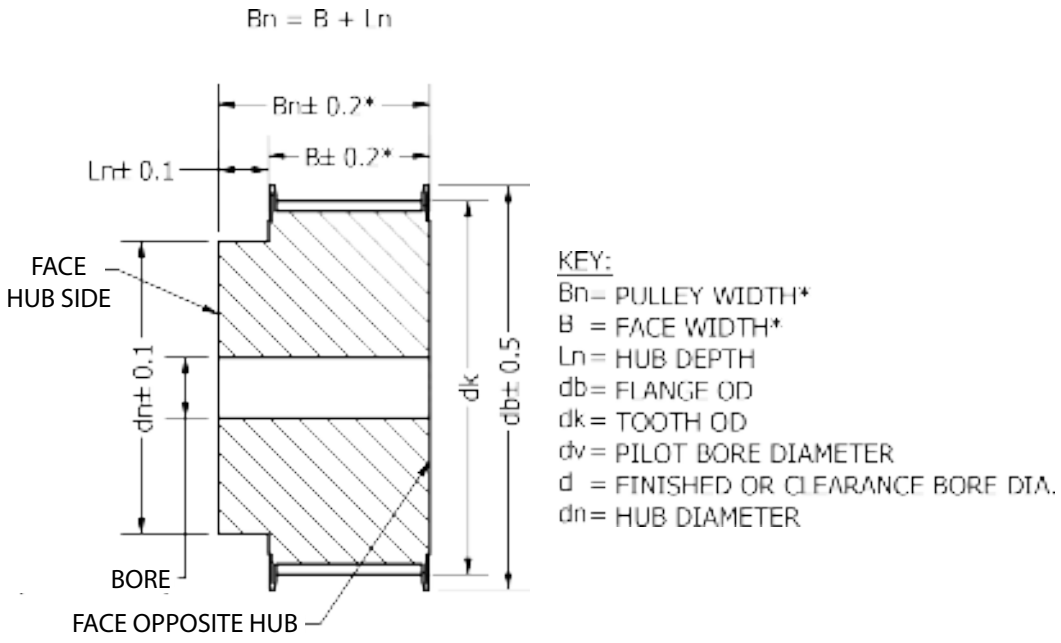
Belt Width in Relation to Pulley Face Width

Metric Pitches

Belt Width (mm)	4	6	8	10	16	20	25	32	50	75	100	150
Flanged/un-Flanged Pulleys												
Pulley Face Width (mm)	8	12	14	16	22	26	32	40	60	85	110	160
Self-Tracking												
Pulley Face Width (mm)	–	–	–	–	21	25	30	37	55	80	105	155

English Pitches

Belt Width (mm)	6.35	7.94	9.53	12.7	19.1	25.4	38.1	50.8	76.2	101.6	152.4
Belt Width (inch)	.25	.313	.375	.5	.75	1.0	1.5	2.0	3.0	4.0	6.0
Flanged/un-Flanged Pulleys											
Pulley Face Width (mm)	12	14	16	19	25	32	44	59	84	111	163
Pulley Face Width (inch)	.472	.551	.63	.748	.984	1.26	1.732	2.323	3.307	4.37	6.417
Self-Tracking											
Pulley Face Width (mm)	–	–	–	–	–	30	43	55	80	105	157
Pulley Face Width (inch)	–	–	–	–	–	1.181	1.693	2.165	3.15	4.134	6.181



Precision Pulleys

Minimum Number of Pulley Teeth and Idler Diameter

Pitch (mm)	No Back Bending Min. # of Pulley Teeth	With Back Bending Min. # of Pulley Teeth	Min. Diameter of Flat Idler running on tooth side (mm)	Min. Diameter of Flat Idler running on belt back (mm)
T2	10	18	15	15
T2.5	15	18	15	18
T5	10	15	30	30
T10	12	20	60	60
T20	15	25	120	120
AT3	15	25	30	30
AT5	15	20	25	60
AT10	15	25	50	120
ATS15	25	40	120	250
AT20	18	25	120	180
ATN10	25	-	80	-
ATN12.7	20	-	80	-
ATN20	20	-	125	-
ATL5	25	25	40	60
ATL10	25	25	80	150
ATL20	25	25	60	250
ATP10	15	25	50	120
ATP15	20	30	100	160
MXL	10	18	15	15
XL	10	15	30	30

Pitch (mm)	No Back Bending Min. # of Pulley Teeth	With Back Bending Min. # of Pulley Teeth	Min. Diameter of Flat Idler running on tooth side (mm)	Min. Diameter of Flat Idler running on belt back (mm)
L	15	20	60	60
H	14	20	60	80
XH	18	25	150	180
BAT10	20	25	60	120
BATK10	20	25	60	120
BAT15	20	30	100	150
BATK15	20	30	100	150
SFAT10	15	25	50	120
SFAT15	20	25	100	150
SFAT20	18	25	120	180
TK5K6	25	25	60	80
TK10K6	25	25	60	80
TK10K13	25	25	80	120
TK20K13	18	25	120	180
ATK5K6	20	20	60	80
ATK10K6	25	25	60	120
ATK10K13	20	25	60	120
ATK20K13	20	25	120	120
ATN10K6	25	-	80	-
ATN12.7K6	20	-	80	-
HK13	18	20	80	120

Pulley Materials and Finishes

Type	Material	Properties
(AL)	**Aluminum**	• Suitable for moderate power transmission • Lightweight / reduced rotational inertia • Moderate chemical and corrosion resistance • Standard material for stock pulleys
(VA)	**Stainless Steel**	• Suitable for high power transmission • Durable / Abrasion resistance • Meets FDA regulations • Excellent chemical and corrosion resistance
(ST)	**Steel**	• Suitable for high power transmission • Durable / abrasion resistant • Limited chemical and corrosion resistance
(POM)	**Delrin®**	• Limited power transmission • Excellent chemical and corrosion resistance • Non-metallic • Stainless steel flanges recommended

Note: Other materials available upon request.

Aluminum Surface Finishes	Properties
Anodizing	• Increased chemical and corrosion resistance • Available in clear, black or colored • Limited increase of surface hardness • Aesthetic treatment
Hard Anodizing	• Excellent chemical and corrosion resistance • Increased surface hardness • For abrasive environments

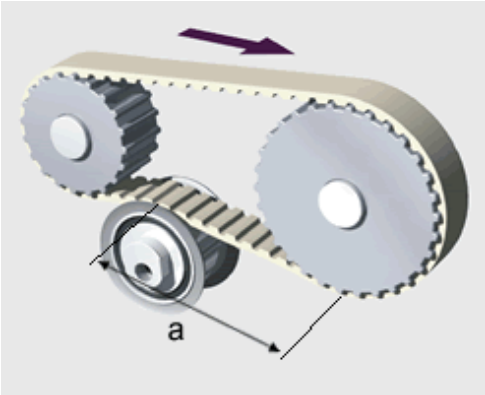
Steel Surface Finishes	Properties
Black Oxide	• Increased chemical and corrosion resistance • Aesthetic treatment
Zinc Plated	• Increased corrosion resistance
Chromate	• Increased chemical and corrosion resistance
Nickel Plated	• Increased chemical and corrosion resistance

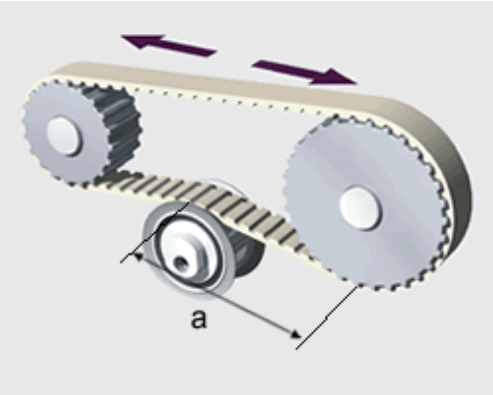
Note: Other finishes available upon request.

Pulley Locations

Pulley vs Idler

In general, timing belt systems are tensioned with the help of idlers. For one directional drives, idlers are placed best close to an engaging belt into a pulley. For bi-directional drives, the idler should be placed in the center between both pulleys. In both cases, “a” should be at least 5x belt width.

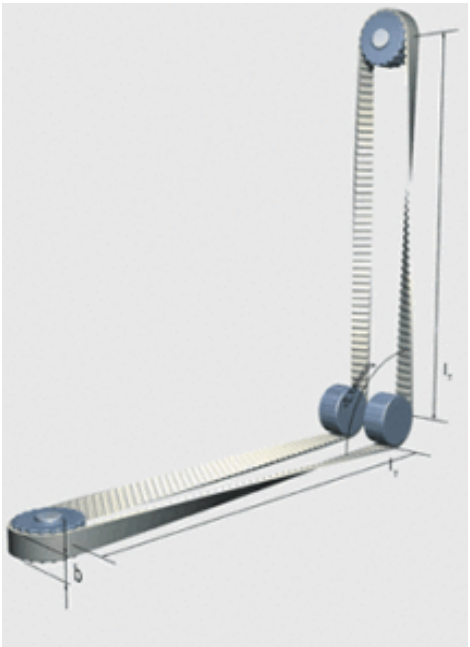




Perpendicular Drive

BRECO*flex* CO., L.L.C. timing belts and pulleys can be used for angular drives. Some general guidelines should be considered. The outside tension members experience more stress, so the following sizing recommendations should be maintained.

IT = CTC distance
b = belt width IT / b >=20



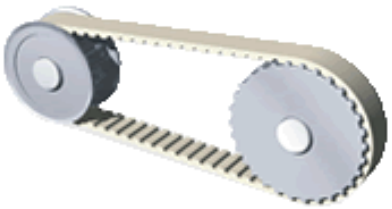
Flanges and Alignments

Flange Recommendations

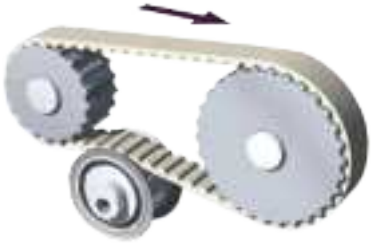
Pulley flanges are the appropriate method of belt tracking for most timing belt drive and conveying systems. Flanges retain the belt on the pulley by resisting lateral forces that pull the belt to one side or the other. Flanges are attached to the pulleys by a rolling process or fastened with screws depending on tooth profiles and pulley diameter. Small and medium pitch pulleys up to approximately 250mm in diameter are usually supplied with rolled on flanges. Large pitch pulleys such at T20, AT20, and XH, are commonly supplied with screwed on flanges.

For general recommendations concerning where to use flanges, please see the illustrations below.

Pulley Tracking with Flanges



Flanges can be used on one pulley only for systems with close center-to-center distances.

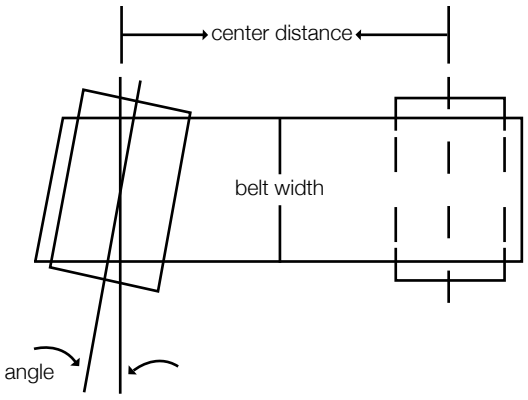


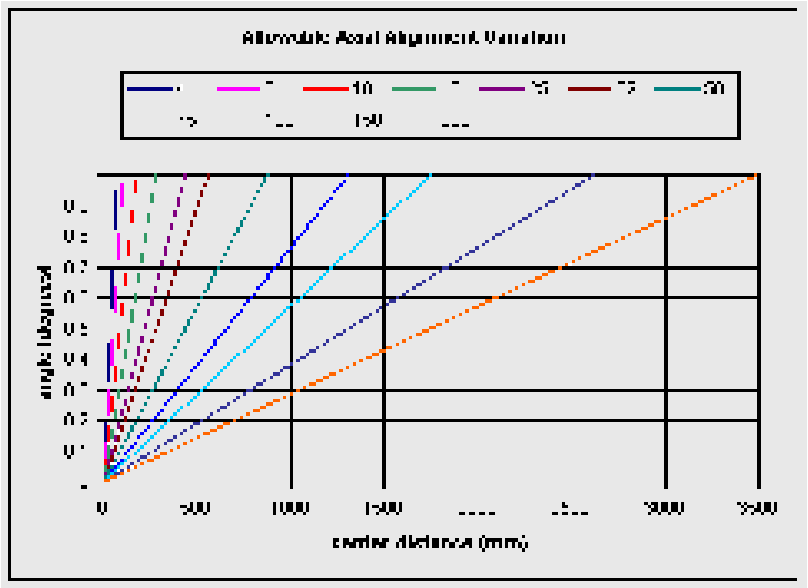
Flanges on back side idlers can be used to track belts when flanges on the tooth pulleys are not an option. Always locate the idler on the slack side of the belt towards the return pulley as shown.

For reversing applications, locate the idler between the pulleys.

Alignment

$$angle = \arctan \frac{a \times 10^{-3}}{b} \leq 1°$$





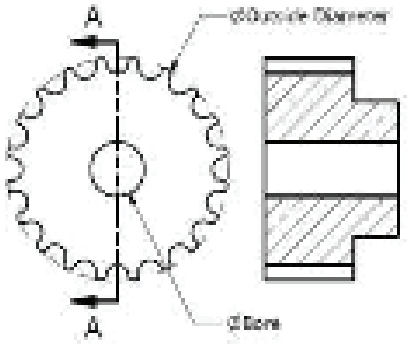
Tolerances

Geometric Tolerances

BRECO*flex* CO., L.L.C. offers the most precise tolerances for superior belt drive performance. BRECO*flex* metric pitch pulleys conform to DIN 7721 tolerances while English pitch pulleys conform to DIN ISO 5294 tooth forms. All other pulley dimensions conform to DIN 7168 standards. Choosing a BRECO*flex* belt and pulley guarantees optimal belt matching and low friction drive components.

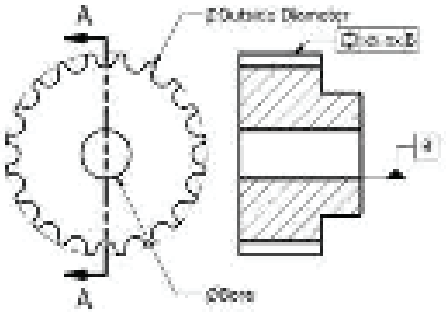
Outside Diameter and bore

Tolerance	
Outside Diameter	h8
Bore	H7



Concentricity

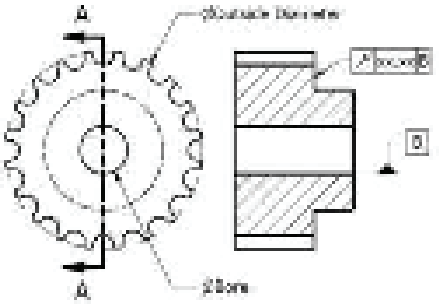
Outside Diameter	Max Concentricity
0 to 200	0.05mm
Over 200	Additional 0.005mm each extra 10mm O.D.



Note: Made-to-order pulleys: Outside diameter to Bore Stock Pulleys: Hub to Bore

Run-out

Outside diameter	Max Run-out
0 to 100	0.10mm
over 100 to 250	0.01mm each extra 10mm O.D.
over 250	Additional 0.005mm per 10mm of outside diameter



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BRECO*flex* CO., L.L.C.

High Precision Drive Components

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