BRECOflex CO., L.L.C.
High Precision Drive Components

ISO 9001 CERTIFIED COMPANY

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FIRST Robotics Competition

Engineering Recommendations for Robots

Thank you for your interest in using BRECO*flex* timing belts and pulleys in your design. We are pleased to offer your team precision drive components of the highest quality for use in your competition. We are also happy to extend an educational discount on these items so you can focus on designing, building, and testing your robot with less worry on budget constraints.

The purpose of this guide is to offer the BRECO*flex* products most likely to assist your team in reaching your goals. This will offer your team the greatest flexibility in your design while keeping lead times short and costs low.

Base Belt Selection

Our belts are made from white 92 durometer Shore A polyurethane and high carbon steel tension members. The belts have a temperature range 0°C to +80°C.

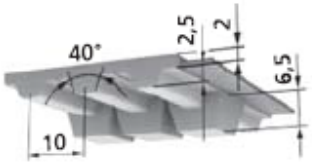

Figure 1. TK10K13 belt profile

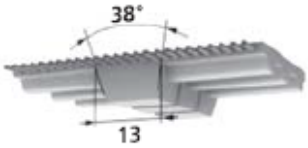

Figure 2. K13 serrated self-tracking guide

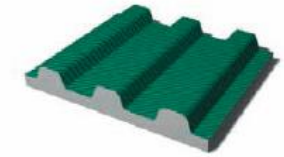

Figure 3. PAZ nylon tooth facing

The recommended base belt is a 50 TK10K13 spliced and welded belt. The belt is 50 mm wide, 10 mm tooth-to-tooth pitch, and has a K13 serrated self-tracking guide. For certain applications, we can also offer a green nylon coating on the toothside of the belt called PAZ. This reduces friction and noise and is extruded with the belt, so it adds no additional thickness.

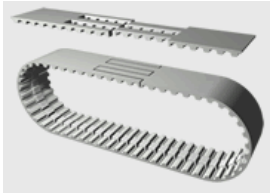

Figure 4. Spliced and welded construction

Minimum 50 TK10K13 spliced and welded length	900 mm, increasing by one tooth increments
Lead time for base belt	2 days

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Belt Cover Selection

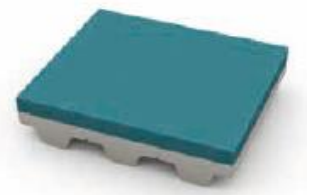
Cover	Material/ Hardness	Thickness	Temp. Range	Min. Pulley Dia.	Characteristics	
T-cover*	Clear polyurethane/85 Shore A	2 mm	-20°C to +80°C	80 mm	High abrasion resistance, medium friction	
PVC White Nub	White PVC/60 Shore A	1.5 mm	-10°C to +110°C	60 mm	Medium friction, textured surface	
SuperGrip Blue	Blue PVC/40 Shore A	4 mm	-15°C to +90°C	60 mm	High friction, textured surface	
Linatex	Red natural rubber/35 Shore A	3 mm	-40°C to +70°C	80 mm	Medium abrasion resistance, high friction with smooth surfaces	
PVC Blue	Blue PVC/65 Shore A	1 mm	-15°C to +90°C	30 mm	Medium abrasion resistance, very high friction with smooth surfaces	

Table 1. Back covers
*Minimum splice and weld length for belt with T-cover is 1250 mm.

The above covers are all excellent choices for robotics applications due to their abrasion resistance and their friction coefficients. The standard lead time for a base belt with a back cover is one week, with Linatex having a two week lead time due to the curing process. Lead time does **not** include shipping time. Please contact our Customer Service department at CS@brecoflex.com for all expedited requests.

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Timing Pulley Selection

Our high precision timing pulleys are made of 6061 aluminum and are CNC machined for perfect meshing with our timing belts. We have stock 55 mm wide TK10K13 pulleys in many tooth configurations from 20 to 60 teeth. The pulleys come with the K13 tracking groove centered on the pulley face and a pilot bore. Stock pulley lead time is 2 days. We can also offer pulleys bored to a finished size (additional cost and lead times apply).

Pricing Details

All pricing is in US dollars. Our belt pricing is based on the total length of the belt plus any cover options plus a welding charge. We are pleased to offer the following highly discounted pricing on these items for FIRST Robotics:

Base Belt	Price per meter
50 TK10K13/[belt length in mm] V	$26.80

+

Toothside Facing (optional)	Price adder per meter
PAZ	$2.67

+

Backing Material (optional)	Price adder per meter
T-cover	$8.04
PVC White Nub	$19.77
SuperGrip Blue	$14.13
Linatex	$29.12
PVC Blue	$16.26

+

Weld Charge	Per belt
No cover/With or without PAZ	$20.71
T-cover	$20.71
PVC White Nub	$48.66
SuperGrip Blue	$48.09
Linatex	$48.70
PVC Blue	$48.29

Example 1. *Belt pricing from the table above:*
50 TK10K13/2320 V PAZ
With a SuperGrip Blue back cover

Base Belt Price		PAZ Adder		Backing Adder		Price Per Meter		Belt Length in Meters		Belt Cost		Weld Charge		Total Price
$26.80	+	$2.67	+	$14.13	=	$43.60	x	2.32	=	$101.15	+	$48.09	=	$149.24

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Pulley pricing for our stock TK10K13 pulleys is shown below with the included FIRST Robotics discount applied:

Inventory Number	Pulley Description	Price
BP1505520A	AL 55 TK10K13-SE/20-0, 12 mm pilot bore	$20.26
BP1505524A	AL 55 TK10K13/24-0, 12 mm pilot bore	$23.40
BP1505525A	AL 55 TK10K13/25-0, 12 mm pilot bore	$23.51
BP1505527A	AL 55 TK10K13/27-0, 12 mm pilot bore	$28.13
BP1505530A	AL 55 TK13K13/30-0, 12 mm pilot bore	$30.76
BP1505532A	AL 55 TK10K13/32-0, 12 mm pilot bore	$32.26
BP1505536A	AL 55 TK10K13/36-0, 16 mm pilot bore	$36.71
BP1505540A	AL 55 TK10K13/40-0, 16 mm pilot bore	$42.75
BP1505548A	AL 55 TK10K13/48-0, 16 mm pilot bore	$56.42
BP1505560A	AL 55 TK10K13/60-0, 16 mm pilot bore	$70.93

Example 2. *Pulley part number AL 55 TK10K13/30-0, decoded:*

Material	Overall width	Pitch	Number of teeth	Flanges
AL (aluminum)	55 mm	TK10K13	30	0

Relevant Formulae for 1:1 System

Number of teeth = z
Pitch [mm] = t
Center to center distance [mm] = a
Pulley circumference [mm] = c

$$Pitch\ diameter:\ d_0 = \frac{z \times t}{\pi}$$
$$Circumference: c = z \times t$$
$$Belt\ length:\ L_B = 2 \times a + c$$

Example 3. *Determine if a 24 tooth pulley [BP1505524A] is acceptable for the belt in example 1.*
From Table 1, the minimum pulley diameter is 60 mm for the SuperGrip Blue cover. Solving for pitch diameter d_0:

$$d_0 = \frac{24 \times 10mm}{\pi} = 73.69mm > 60mm$$

Therefore, the 24 tooth pulley is acceptable for use.

Example 4. *Determine center to center distance with the belt in example 1 and the pulleys in example 2.*
The belt length is 2320 mm and the pulley has 24 teeth. Using the formula for belt length and solving for a:

$$a = \frac{L_B - c}{2} = \frac{2320mm - (24 \times 10mm)}{2} = 1040mm$$

Therefore, the CTC distance is 1040 mm.