

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

High Precision Drive Components



Works with all
belt types and
materials

E207

UNIVERSAL BELT TENSION METER - SM4

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The new SM4 Tension Meter is designed to measure the static tension of all belts (timing belts, flat belts, V-belts) in all belt materials, regardless of the tension member material.

The SM4 is more accurate and easier to use than force deflection or elongation methods.

Pre-Tension

The pre-tension F_v is determined by the maximum operating force F_u . The purpose of pre-tension is to allow both sides of the belt between the pulleys to run without sagging. It is important to recognize the difference between the loaded (taut) and unloaded (slack) side of a drive when power is applied. The tension increases in the loaded (taut) side and decreases proportionately in the slack side. The pre-tension is set correctly when the unloaded (slack) side of the belt always remains taut under the maximum operating load. Any sag or flap may indicate that the pre-tension is too low.

For recommended pre-tension see page 5


Advantages of Correct Pre-Tension

Correct pre-tension enhances the operation of any belt drive by:



- increasing service life
- improving reliability
- minimizing bearing load
- advancing positioning accuracy
- reducing noise level

Operating Instructions

Set-up

1. Insert battery at the back of the tension meter, connect it, and close the case.
2. Press . The red dot in the display will light up, indicating that the tension meter is operational.

Using the Tension Meter SM4

1. Make sure the belt drive is static (not in motion).
2. Hold the tension meter close to the static belt section to avoid any misreading due to hand movement.
3. Place the probe a few millimeters above or below the belt.
4. Tap the belt to generate vibration. At the same time press  and hold.
5. The red dot in the display lights up in response to the belt frequency. When a measurement is obtained, the device will beep and display the frequency of vibration in Hertz (the red dots do not represent commas).
6. If no reading is obtained, repeat steps 1 – 5.
7. To reset the display, release .

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Calculation

Use the SM4 to check and monitor belt pre-tension

Calculate the pre-tension F_v using the frequency f taken from the SM4:

$$F_v = \frac{K \cdot b \cdot L^2 \cdot f^2}{100}$$

F_v [in N]: pre-tension
 K: constant for each pitch (see table below)
 b [in mm]: belt width
 L [in m]: length of free vibrating belt span
 f [in Hz]: static belt frequency

Example: A 25 AT10 belt with a pulley center distance of $L = 0.8\text{m}$. If the measured frequency is 40Hz, it indicates that the belt is tensioned to:

$$F_v = \frac{2.5 \cdot 25 \cdot 0.8^2 \cdot 40^2}{100} = 640\text{N}$$

Use the SM4 to set the belt pre-tension

See page 5 for recommended pre-tension or duplicate the pre-tension of an existing identical system.

Calculate the required frequency value f as a function of the tension F_v :

$$f = \sqrt{\frac{100 \cdot F_v}{K \cdot b \cdot L^2}}$$

F_v [in N]: desired pre-tension
 K: constant for each pitch (see table below)
 b [in mm]: belt width
 L [in m]: length of free vibrating belt span
 f [in Hz]: static belt frequency

Example: A linear drive belt 50 ATL20 is to accelerate a load of 1500N. A pre-tension F_v of 1500N is presumed. The carriage is positioned at a distance $L = 1.0\text{m}$. The tensioning clamp should be tightened to allow a static belt frequency of:

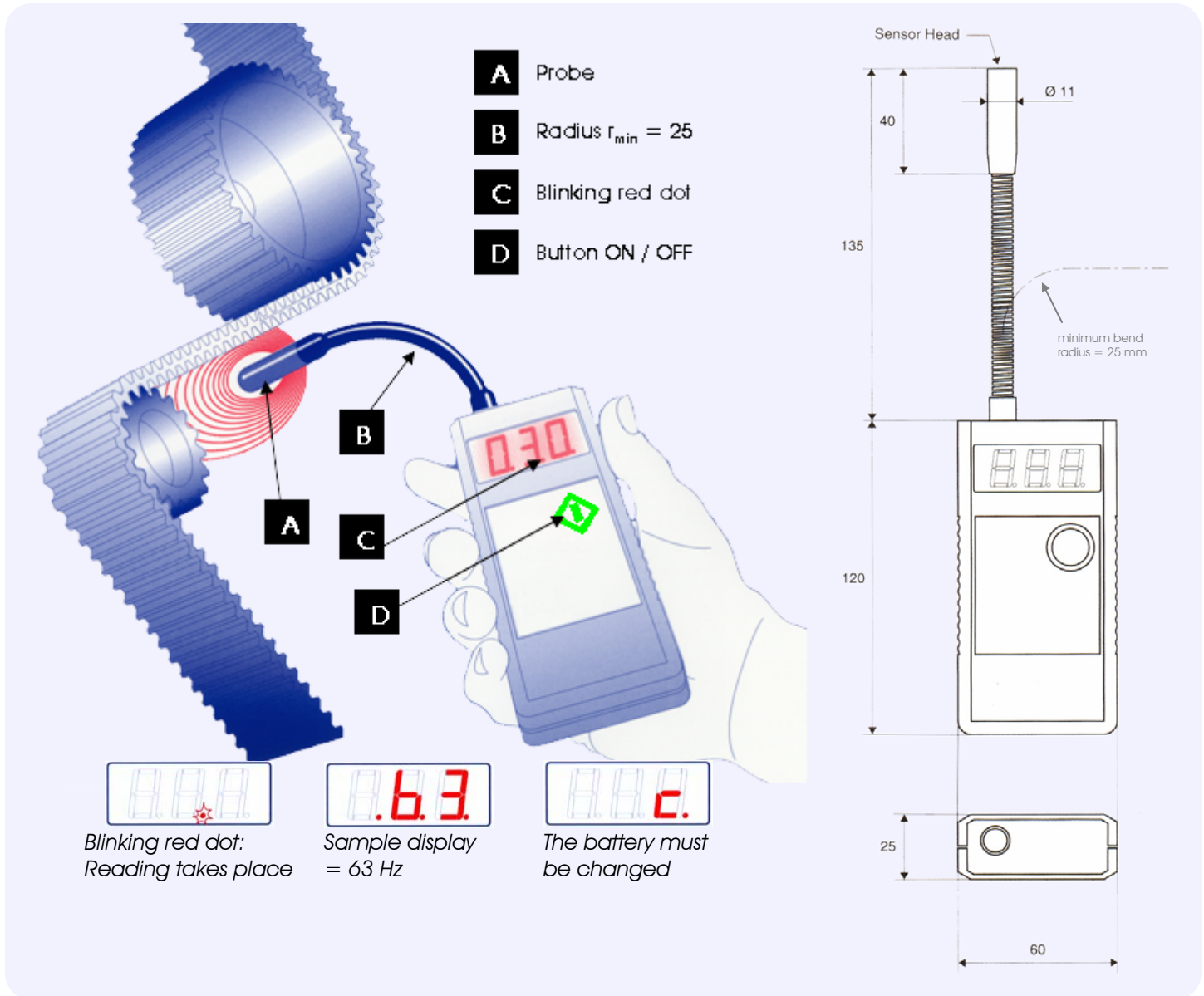
$$f = \sqrt{\frac{150000}{4.3 \cdot 50 \cdot 1.0^2}} = 26\text{Hz}$$

Table of Constant "K"

Belt Type	Single Sided	Double Sided - DL	Belt Type	Single Sided	Double Sided - DL
	Standard Steel Tension Member	Standard Steel Tension Member		Standard Steel Tension Member	Standard Steel Tension Member
T2	0.40	-	MXL	0.40	-
T2.5	0.42	-	XL (T1/5")	1.00	-
T5	0.90	1.20	L (T3/8")	1.50	-
T10	1.90	2.30	H (T1/2")	1.80	1.90
T20	3.00	4.00	XH (T7/8")	4.20	-
AT3	0.90	-	BAT10	2.50	-
AT5	1.35	1.40	BATK10	2.50	-
AT10	2.50	2.80	SFAT10	2.50	-
AT20	4.00	5.30	SFAT15	3.20	-
ATL5	1.45	-	SFAT20	4.00	-
ATL10	2.70	-	HTD 8M	2.35	-
ATL20	4.30	-	HTD 14M HF	4.15	-

For K values not listed in table, please contact BRECOflex CO., L.L.C. Applications Engineering

UNIVERSAL BELT TENSION METER – SM4



Remarks

- Accuracy is +/- 5%.
- Frequency Range is 6 – 350 Hz.
- It is recommended that several readings be taken in order to obtain an average for increased accuracy.
- The beep indicates when a reading is obtained and the frequency is displayed.
- No hand movement is permitted at low frequency.
- Change the battery when the letter "c" appears in the display.
- **Note:** the tension of ALL belt types and materials can be measured.

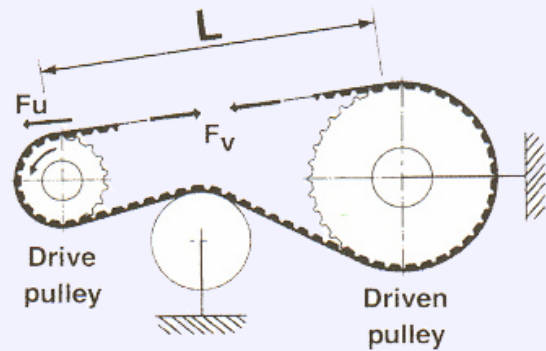
RECOMMENDED PRE-TENSION

The peripheral force (force transmitted through the belt) must be known to determine a recommended pre-tension. These recommendations are general and offered as a starting point. Adjustments may be necessary as determined by system performance.

F_v (pre-tension) as a function of F_u (peripheral force) – see the following tables:

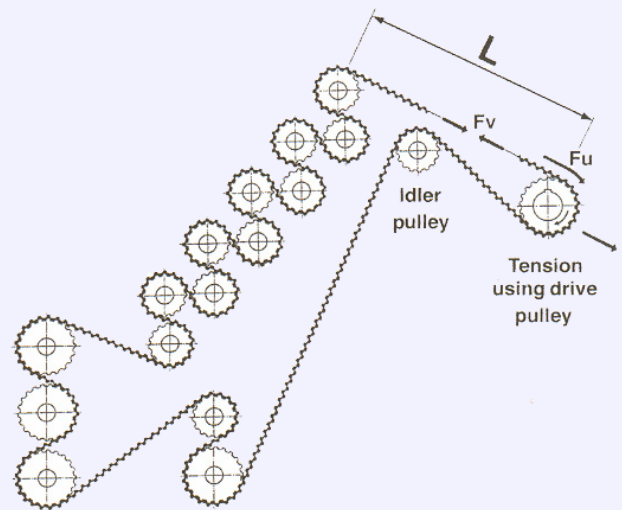
Two Pulley Drive:

Number of Teeth (Z_b) on the Belt	Static Tension F_v
$Z_b < 60$	$F_v = 1/3 F_u$
$60 \leq Z_b \leq 150$	$F_v = 1/2 F_u$
$150 \leq Z_b$	$F_v = 2/3 F_u$



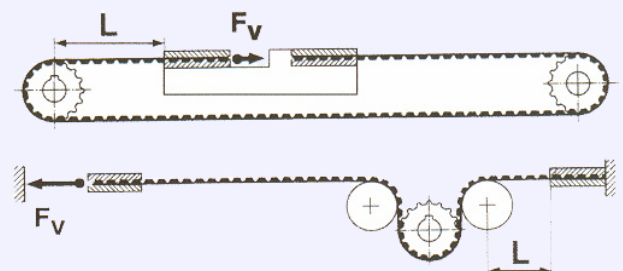
Multiple Pulley Drive:

Center Distance L	Static Tension F_v
Taut Side \leq Slack Side	$F_v = F_u$
Taut Side $>$ Slack Side	$F_v > F_u$



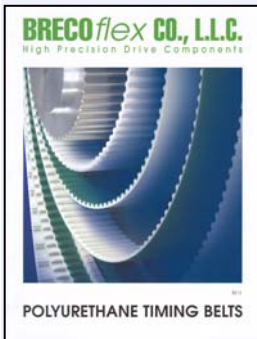
Linear Drive:

Center Distance L	Static Tension F_v
Any	$F_v = F_u$



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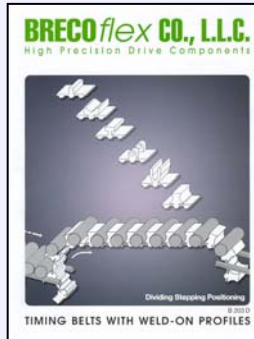
BRECOflex CO., L.L.C. PRODUCT CATALOGS



Polyurethane Timing Belts

Metric and English Pitches.

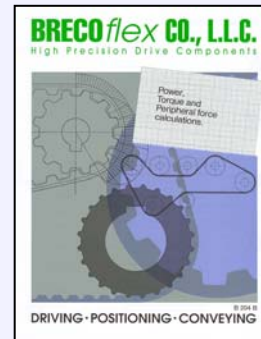
See BRECOflex catalog # B212



Polyurethane Timing Belts with Weld-on Profiles

Dividing, Stepping, Positioning.

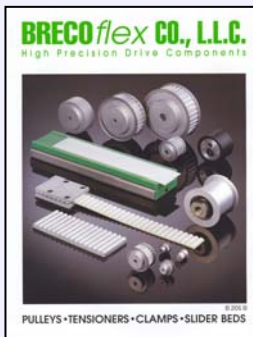
See BRECOflex catalog # B203



Calculations Driving, Positioning, Conveying

Power, Torque, and Peripheral Force calculations.

See BRECOflex catalog # B204



Accessory Items for Polyurethane Timing Belts

Pulleys, Tensioners, Clamps, Slider Beds.

See BRECOflex catalog # B205



Polyurethane Timing Belts ARC-POWER-BAT10

Circular "ARC" tooth shape.

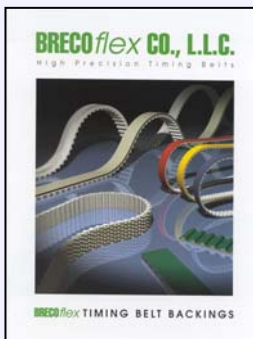
See BRECOflex catalog # B206



Tension Meter

Determine the correct static timing belt load. Improve performance, lifetime, positioning accuracy, bearing load, and noise level.

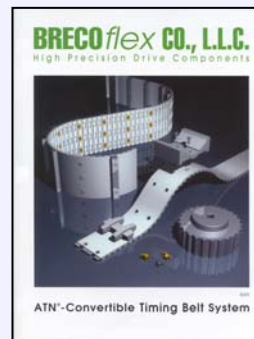
See BRECOflex catalog # B207



Timing Belt Backings

Polyurethane Timing Belts in Metric and English pitches with a wide range of cover materials.

See BRECOflex catalog # B208



ATN® – Convertible Timing Belt Systems

ATN technology allows the reconfiguration of profiled timing belts at the customer site.

See BRECOflex catalog # B209



ESBAND Truly Endless Woven Flat Belts

Wide variety of Polyurethane, Neoprene and Silicone state-of-the-art flat belts.

See BRECOflex catalog # B210

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