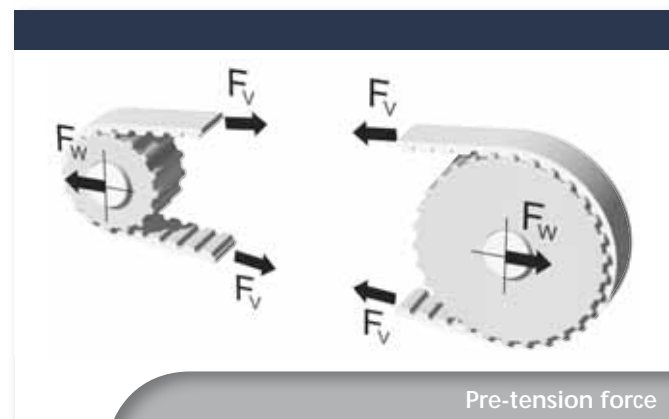## Pre-tension force

Pre-tension is intended to guarantee a minimum tensioning force at the slack span side to ensure smooth tooth meshing into the driven pulley.

Generally, the pre-tension should only be set as high as necessary. The necessary pretension force of the spans F_V depends on the max. circumferential force F_U, the belt length L_B (number of teeth z_B) and the drive configuration.

Pre-tension force

The recommendations shown in the table refer to the pre-tension force setting per span.

Drive configuration		Pre-tension force of each individual span
Two-shaft drive	$Z_B < 60$	$F_V = 1/3\ F_U$
	$60 \le Z_B < 150$	$F_V = 1/2\ F_U$
	$Z_B > 150$	$F_V = 2/3\ F_U$
Multiple-shaft drive	$l_{Load\ span} \le l_{Slack\ span}$	$F_V = F_U$
	$l_{Load\ span} > l_{Slack\ span}$	$F_V > F_U$
Linear drive		$F_V \ge F_U$

In every case, the tension cord strength is the top limit of the span load. Take into consideration that especially with multiple-shaft and linear drives, an addition of the pre-tension force and the circumferencial force in relation to the load span force is to be expected.

Influence variables

Stiffness of the belt
Friction forces created by the interaction of the tooth mesh (especially at the slack span) intensify the span forces, which in turn increase the degree of elongation. This influence may lead to the slack span tooth mesh butting against the driven pulley, thereby causing the belt to jump.
Elongation being directly depending on the belt stiffness, the high stiffness of the steel cord tension members permits a comparably low pre-tension.

Circumferential force
The circumferential force acts in proportion to the elongation of the load span, i.e. excessive slackening of the slack span can be counteracted by a pre-tension matched to the circumferential force.

Belt length
Belt elongation resulting from the effect of the circumferential force and the friction forces is also approximately in proportion to the belt length. Therefore, the tendency of running up or jumping is considerably influenced by the belt length. Even under high circumferential forces with the resulting friction forces, a very short timing belt will elongate to only a small degree, so that even when subject to low pre-tension forces there will be no danger of running up or jumping of teeth. On the contrary, with short timing belts circumferential deviations of the pulleys could cause heavy pre-tension fluctuations and, as a result, extreme peak values.

Proportion of the span lengths
Especially with multiple-shaft drives the load span is often markedly longer than the slack span side. For this reason, a slight elongation of the load span results in a very unfavourable slack on the span side. Therefore, the pre-tension force of spans of such gearings should be higher than the circumferencial force.

Precise transmission of movement
There is a high transmission accuracy possible in the reverse operation with BRECO® and BRECOFLEX® timing belts, when the span pre-tension forces are selected in the same size of the circumferencial force.

Consequences of faulty pre-tension setting:

Too low pre-tension
- The teeth of the slack span side run up on or override the teeth of the driven pulley
- Wear on the faces caused by the friction force during meshing
- Forced breakage by excessive elongation due to full overriding

Excessive pre-tension
- High bearing load of the shafts
- Reduction of the transmissionable power
- Wear and tear at the belt tooth

General information

Design
- In the transmission configuration, design at least one adjustable axis, plan one adjustable tension roller (not spring-loaded) for fix centre distances
- The bearing has to be absolutely rigid
- Note the importance of a parallel run and flush alignment of the synchronising pulleys

Transport/storing
- Upon receipt, unpack the timing belt immediately and store in circular position in a dry place at room temperature
- Do not bend

Measuring with frequency measuring meter

The intrinsic frequency of a vibrating belt span can be measured by means of various Mulco belt tension measuring meters. The pre-tension force of the span can be calculated from the measured intrinsic frequency:

$$F_V = 4 \cdot m \cdot l_T^2 \cdot f^2$$

The corresponding intrinsic frequency can be calculated, if the pre-tension is preset:

$$f = \sqrt{\frac{F_V}{4 \cdot m \cdot l_T^2}}$$

f: Frequency of the variations in hertz:
m: Mass of the belt per meter length in kg/m
l: Drum span length subject to vibration in m
FV: Span force in N

Please contact our distribution partner for the various measuring meters. (e.g. BRECO® TSM alpha 1)

Mounting
- Fit timing belts on the pulleys when slack without exerting any force
- Exert no force when fitting with fix centre distances if necessary, fit together with synchronising pulleys
- Apply pre-tensioning force according to the chapter „Pre-tension"
- Secure adjustable axis against sliding
- Do not clamp the timing belt between the flanges

Operation
- Protect the drives against dust, dirt, hot surrounding media as well as acids and lyes
- Take into consideration the ambient temperatures (see characteristics of polyurethane timing belts)