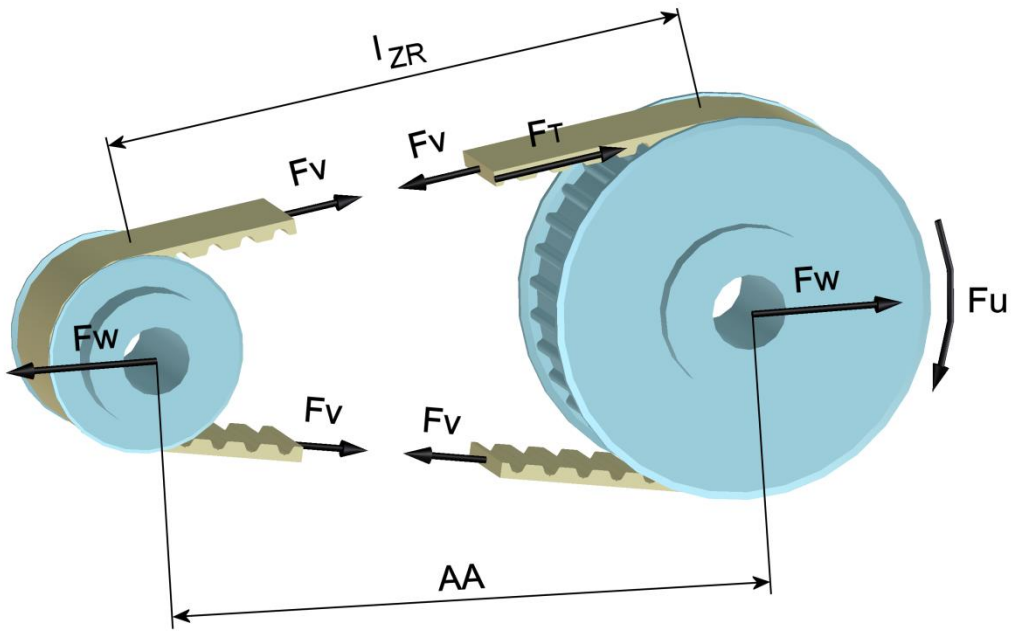
Deflection belt drive pretension (DBD)
Version: standard

General

Pretension is tasked with guaranteeing a minimum tension force in the slack strand in order to ensure smooth engagement in the driven disc. The configuration of the pretension should generally only be as large as necessary due to the fact that it acts as an additional load on the bearings. In this regard, the necessary pretension force F_V of the belt strands is dependent on the max. circumferential force F_U, the belt length L_B (or number of teeth Z_B) and the drive configuration. In the case of the belts in our deflection belt drives, a pretension force of F_V = 1/2 F_U is recommended by the manufacturer. The cable winch strength is the upper limit for the strand load in all cases.
The pretension force is measured via the frequency measurement performed on a 'beating' belt strand using a belt tensioning measurement device.

Cable winch strength and belt mass of our DBD standard versions:

- DBD1: 1260 N / 0.054 kg/m (16AT5) => Example: belt width 16 mm, toothing AT5
- DBD2: 2030 N / 0.085 kg/m (25AT5)
- DBD3: 2660 N / 0.109 kg/m (32AT5)
  4750 N / 0.202 kg/m (32AT10)



Centre distance	AA	[mm]
Strand force	F_T	[N]
Circumferential force	Fu	[N]

Pretension force	Fv	[N]
Shaft force	Fw	[N]
Toothed belt length (oscillating)	l_{ZR}	[mm]

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Calculation

AA	: Centre distance	[mm]	l_{gesZR}	: Toothed belt total length	[mm]
d_{0A}	: Effective diameter (of synchronising disc, driven)	[mm]	l_{ZR}	: Toothed belt length (oscillating)	[mm]
d_{0M}	: Effective diameter (of synchronising disc, motor)	[mm]	m_{ZR}	: Toothed belt mass	[kg/m]
f_{ZR}	: Pretension frequency	[Hz]	M_{Lin}	: Drive torque on linear unit	[Nm]
F_T	: Strand force	[N]	t_{ZR}	: Belt tooth pitch	[mm]
F_U	: Circumferential force (= F_T)	[N]	z_A	: Number of teeth (on synchronising disc, driven)	[ ]
F_V	: Pretension force	[N]	z_M	: Number of teeth (on synchronising disc, motor)	[ ]
F_{zul}	: Cable winch strength	[N]			

Type	DBD1 / AT5				DBD2 / AT5				
i	1:1	1.5:1	2:1	3:1	1:1	1:1	1.5:1	2:1	3:1
t_{ZR}	5				5				
l_{gesZR}	390	375	390	375	420	390	420	480	450
F_{zul}	1260				2030				
m_{ZR}	0.054				0.085				
z_A	36	36	48	48	36	30	36	60	60
z_M	36	24	24	16	36	30	24	30	20
AA	105	112	103	104	120	120	119	125	120

Type	DBD3 / AT5				DBD3 / AT10		
i	1:1	1.5:1	2:1	3:1	1:1	1.5:1	2:1
t_{ZR}	5				10		
l_{gesZR}	600	630	630	630	610	630	630
F_{zul}	2660				4750		
m_{ZR}	0.109				0.202		
z_A	44	60	72	72	22	30	36
z_M	44	40	36	24	22	20	18
AA	190	189	177	191	195	189	177

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Calculation/formulas

Determination of the circumferential force F_U

$$F_U = \frac{2 \cdot M_{Lin}}{d_{0A}} \qquad \text{with} \quad d_{0A} := \frac{z_A \cdot t_{ZR}}{\pi}$$

(F_U must be <= cable winch strength F_{zul} / 1.5.)

Calculation of pretension force F_V

$$F_V := F_U \cdot \frac{1}{2}$$

Calculation of oscillating belt length l_{ZR}

$$l_{ZR} := \sqrt{AA^2 - \left(\frac{d_{0A} - d_{0M}}{2}\right)^2} \quad \text{with} \quad d_{0A} := \frac{z_A \cdot t_{ZR}}{\pi} \quad \text{and} \quad d_{0M} := \frac{z_M \cdot t_{ZR}}{\pi}$$

Calculation of pretension frequency to be configured f_{ZR}

$$f_{ZR} = \sqrt{\frac{F_V}{4 \cdot m_{ZR} \cdot l_{ZR}^2}}$$

In order to measure the pretension frequency f_{ZR}, use a suitable tool (e.g. Allen key) to make the belt strand oscillate ('beat') and use a belt tensioning measurement device around the centre of the strand to determine the frequency.
(When measuring the frequency, the fastening screws of the motor must be tightened.)