SPRING LOADED V-BELT TENSIOMETER

V-BELT TENSIONING

This document examines the formula method when using a spring loaded tensiometer. Carlisle also offers several other tools to help tension belts properly. The Carlisle Frequency-Finder allows simple, fast and reliable tensioning on virtually any type of belt. It works on the principle of forced vibration. Carlisle's Tension-Finder is a simple, easy and accurate tool to assure proper tensioning of individual belts or V-Bands. The Tension-Finder should not be used with aramid or glass cord belts.

V-BELT TENSIONING

INTRODUCTION

Because V-belts operate on the friction principle, multiplied by the mechanical advantage of the wedging principle, proper tensioning of v-belts is the single most important factor necessary for long, satisfactory operation. Too little tension will result in slippage, causing rapid belt and sheave wear, and loss of productivity. Too much tension can result in excessive stress on belts, bearings, and shafts and reduced efficiency.

However, there is still a wide range of tension within which a drive will operate satisfactorily. The intent is to find this proper range for any V-belt drive.

IMPORTANT

Although the values in the Average Tensioning Values Table included in this brochure can be used satisfactorily for most V-belt drives, they are based on drives which are designed using recommended procedures and ratings in the Carlisle Engineering Guide for Industrial V-Belt Drives (102161). They DO NOT, for example, consider drives originally designed for wrapped type belts, which are later upgraded to the premium Power-Wedge® Cog-Belt® (3VX, 5VX, 8VX) belts or Gold Ribbon™ Cog-Belt® (AX, BX, CX, DX) belts. In these cases, where known, the values for the wrapped type Super Power-Wedge® (3V, 5V, 8V) belts or Super Blue Ribbon® (AP, BP, CP, DP) belts should be used. For more precise tension values, Carlisle recommends that the "Formula Method" of tensioning described in the Engineering Guide for Industrial V-Belt Drives be used. **Failure to observe the limitations of the Average Tensioning Values Table may result in excessive loads on bearings and/or shafts.**

GENERAL METHOD

A few simple rules should be followed to satisfy most drive requirements:

1. For installation, reduce the center distance so the belts may be placed in the sheave grooves without force. Arrange the belts so that both the top and bottom spans have about the same amount of sag. Apply tension to the belts by increasing the center distance until the belts are snug and have a live, springy action when struck with the hand.

2. Operate the drive a few minutes to seat the belts in the sheave grooves. Observe the operation of the drive under its highest load condition (usually starting). A slight bowing of the slack side of the drive indicates adequate tension. If the slack side remains taut during the peak load, the drive is too tight.

3. Check the tension on a new drive several times during the first 24 hours of operation, by observing the slack side span.

4. Keep the drive free of foreign material which might cause slippage or damage to the belt and sheave surfaces.

5. If a V-belt slips, it is too loose. Increase the tension by increasing the center distance. Never apply belt dressing, as this will damage the belt and cause early failure.

V-BELT TENSIONING

(Continued)

Strand Deflection — Formula Method

This method is based on the fact that the force required to deflect a given span length by a given amount is related to the tension in the belt. (Note: If the drive uses banded V-belts, use "Belt Elongation Method." See page 10.

Step 1. Install the belts per rules 1 and 2 of the "General Method" discussed previously. Measure span length (t) in inches as shown in Figure 26, or calculate as follows:

$$t = \sqrt{C^2 - \left(\frac{D-d}{2}\right)^2}$$

Where:
t = span length, in inches
C = center distance, in inches
D = large sheave pitch diameter, in inches
d = small sheave pitch diameter, in inches

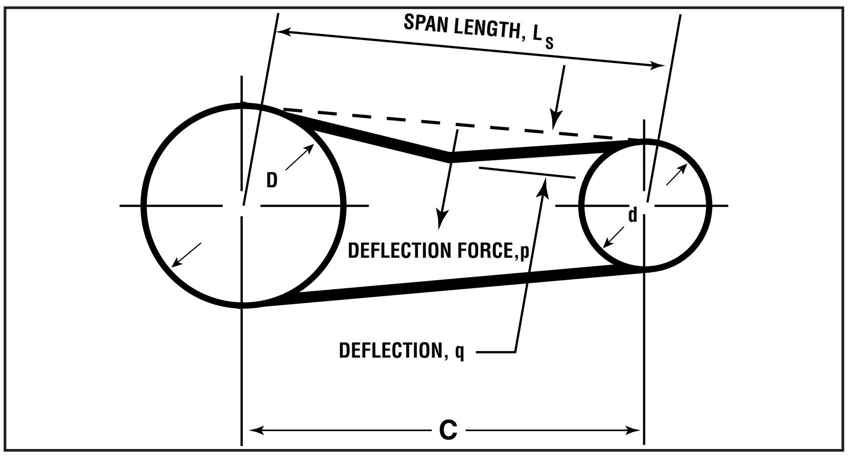

Figure 26 — BELT DEFLECTION DIAGRAM

Step 2. Calculate the deflection distance by: t/64 = deflection. Note from Figure 26 that the deflection distance is always 1/64″ per inch of span length (for example, a 32″ span length would require a deflection of 32/64 or 1/2 inch).

Step 3. Calculate the static strand tension (T_s) per belt by the following formula:

$$T_s = \frac{\text{Design HP x K}}{\text{Q x S}} + T_c$$

Where: K = value from Table 29 depending on value of $\frac{D - d}{C}$

Q = number of belts/ribs on drive
S = belt speed, feet per minute / 1000
T_c = add-on tension allowance for centrifugal force, from Table 31 on page 7.

Note: The value of T_s is for an individual V-belt. If a banded V-belt is used, refer to "Elongation Method."

Step 4. Calculate the recommended minimum and maximum deflection forces (P), in pounds:

$$P_{min} = \frac{T_s + Y}{16} \qquad P_{max} = \frac{(1.5 \times T_s) + Y}{16}$$

Where:
T_s = Static strand tension (from Step 3)
Y = Constant from Table 30 on page 5.

Table 29 Factors Table

Arc of Contact (degrees)	(D-d)/C	A	B	H	K	M	N (C_q)	O
180	0.000	—	1.000	2.000	24.750	1.000	1.00	0.75
179	0.017	57.297	1.000	2.000	24.843	1.000	1.00	0.75
178	0.035	28.649	1.000	2.000	24.937	1.000	1.00	0.76
177	0.052	19.101	1.000	1.999	25.032	1.000	0.99	0.76
176	0.070	14.327	0.999	1.999	25.129	0.999	0.99	0.76
175	0.087	11.463	0.999	1.998	25.227	0.999	0.99	0.76
174	0.105	9.554	0.998	1.997	25.326	0.999	0.99	0.77
173	0.122	8.190	0.998	1.996	25.427	0.998	0.98	0.77
172	0.140	7.168	0.997	1.995	25.529	0.998	0.98	0.77
171	0.157	6.373	0.996	1.994	25.632	0.997	0.9	0.77
170	0.174	5.737	0.996	1.992	25.737	0.996	0.98	0.77
169	0.192	5.217	0.995	1.991	25.844	0.995	0.97	0.78
168	0.209	4.783	0.994	1.989	25.952	0.995	0.97	0.78
167	0.226	4.417	0.993	1.987	26.061	0.994	0.97	0.78
166	0.244	4.103	0.992	1.985	26.172	0.993	0.97	0.78
165	0.261	3.831	0.991	1.983	26.285	0.992	0.96	0.79
164	0.278	3.593	0.990	1.981	26.399	0.990	0.96	0.79
163	0.296	3.383	0.988	1.978	26.515	0.989	0.96	0.79
162	0.313	3.196	0.987	1.975	26.633	0.988	0.96	0.79
161	0.330	3.029	0.986	1.973	26.752	0.987	0.95	0.80
160	0.347	2.879	0.984	1.970	26.873	0.985	0.95	0.80
159	0.364	2.744	0.983	1.967	26.996	0.984	0.95	0.80
158	0.382	2.620	0.981	1.963	27.120	0.982	0.95	0.80
157	0.399	2.508	0.979	1.960	27.247	0.980	0.94	0.81
156	0.416	2.405	0.977	1.956	27.375	0.979	0.94	0.81
155	0.433	2.310	0.975	1.953	27.505	0.977	0.94	0.81
154	0.450	2.223	0.973	1.949	27.638	0.975	0.93	0.81
153	0.467	2.142	0.971	1.945	27.772	0.973	0.93	0.81
152	0.484	2.067	0.969	1.941	27.908	0.971	0.93	0.82
151	0.501	1.997	0.967	1.936	28.046	0.969	0.93	0.82
150	0.518	1.932	0.965	1.932	28.187	0.967	0.92	0.82
149	0.534	1.871	0.962	0.927	28.329	0.965	0.92	0.82
148	0.551	1.814	0.960	1.923	28.474	0.963	0.92	0.83
147	0.568	1.760	0.957	1.918	28.621	0.961	0.91	0.83
146	0.585	1.710	0.954	1.913	28.771	0.959	0.91	0.83
145	0.601	1.663	0.952	1.907	28.922	0.956	0.91	0.83
144	0.618	1.618	0.949	1.902	29.076	0.954	0.91	0.83
143	0.635	1.576	0.946	1.897	29.233	0.952	0.90	0.84
142	0.651	1.536	0.943	1.891	29.392	0.949	0.90	0.84
141	0.668	1.498	0.940	1.885	29.553	0.947	0.90	0.84
Arc of Contact (degrees)	(D-d)/C	A	B	H	K	M	N (C_q)	O
140	0.684	1.462	0.936	1.879	29.718	0.944	0.89	0.84
139	0.700	1.428	0.933	1.873	29.884	0.942	0.89	0.84
138	0.717	1.395	0.930	1.867	30.054	0.939	0.89	0.85
137	0.733	1.364	0.926	1.861	30.226	0.936	0.88	0.85
136	0.749	1.335	0.922	1.854	30.402	0.934	0.88	0.85
135	0.765	1.307	0.919	1.848	30.580	0.931	0.88	0.85
134	0.781	1.280	0.915	1.841	30.761	0.928	0.87	0.85
133	0.797	1.254	0.911	1.834	30.945	0.925	0.87	0.86
132	0.813	1.229	0.907	1.827	31.132	0.923	0.87	0.86
131	0.829	1.206	0.903	1.820	31.323	0.920	0.86	0.86
130	0.845	1.183	0.898	1.813	31.516	0.917	0.86	0.86
129	0.861	1.161	0.894	1.805	31.713	0.914	0.86	0.86
128	0.877	1.141	0.889	1.798	31.914	0.911	0.85	0.85
127	0.892	1.121	0.885	1.790	32.118	0.908	0.85	0.85
126	0.908	1.101	0.880	1.782	32.325	0.905	0.84	0.84
125	0.939	1.065	0.870	1.766	32.752	0.899	0.84	0.84
123	0.954	1.048	0.864	1.758	32.970	0.896	0.83	0.83
122	0.970	1.031	0.859	1.749	33.193	0.893	0.83	0.83
121	0.985	1.015	0.853	1.741	33.420	0.890	0.83	0.83
120	1.000	1.000	0.847	1.732	33.651	0.887	0.82	0.82
119	1.015	0.985	0.841	1.723	33.886	0.884	0.82	0.82
118	1.030	0.971	0.835	1.714	34.126	0.880	0.81	0.81
117	1.045	0.957	0.829	1.705	34.370	0.877	0.81	0.81
116	1.060	0.944	0.822	1.696	34.618	0.874	0.81	0.81
115	1.075	0.931	0.815	1.687	34.871	0.871	0.80	0.80
114	1.089	0.918	0.808	1.677	35.130	0.868	0.80	0.80
113	1.104	0.906	0.801	1.668	35.393	0.865	0.79	0.79
112	1.118	0.894	0.793	1.658	35.661	0.861	0.79	0.79
111	1.133	0.883	0.785	1.648	35.934	0.858	0.79	0.79
110	1.147	0.872	0.776	1.638	36.213	0.855	0.78	0.78
109	1.161	0.861	0.767	1.628	36.497	0.852	0.78	0.78
108	1.176	0.851	0.757	1.618	36.787	0.849	0.77	0.77
107	1.190	0.841	0.747	1.608	37.083	0.845	0.77	0.77
106	1.204	0.831	0.736	1.597	37.385	0.842	0.77	0.77
105	1.218	0.821	0.724	1.587	37.693	0.839	0.76	0.76
104	1.231	0.812	0.710	1.576	38.008	0.836	0.76	0.76
103	1.245	0.803	0.694	1.565	38.328	0.833	0.75	0.75
102	1.259	0.795	0.675	1.554	38.656	0.830	0.75	0.75
101	1.272	0.786	0.644	1.543	38.991	0.826	0.74	0.74

V-BELT TENSIONING (Continued)

TABLE 30 - FACTORS C_c & Y

BELT CROSS SECTION	Cc SINGLE BELTS	Cc BANDED BELTS	Y
A	0.72	-	6.00
AP	0.72	0.86	5.00
AX	0.68	0.81	6.00
B	0.99	-	9.00
BP	1.09	1.36	8.00
BX	0.95	1.17	9.00
C	2.09	-	18.00
CP	1.84	2.24	18.00
CX	1.69	-	19.00
DP	3.65	4.19	28.00
DX	3.83	4.78	40.00
3VX	0.55	0.47	4.00
5VX/5V	1.25	1.32	11.00
8V	2.95	3.46	25.00
8VX	2.95	3.46	30.00

NOTE: For drives using only one belt, and at least one shaft is free to turn, use the following for the deflection forces (P):

$$P_{min} = \frac{T_s + \frac{t}{L}r}{16} \qquad P_{max} = \frac{(1.5xT_s) + \frac{t}{L}Y}{16}$$

Where: t = span length, inches (from step 1)
L = belt pitch length, inches
Y = constant from Table 30 above

STEP 5

Tension the V-belts by this procedure:

a) Using a Carlisle Tensiometer (part no. 102761), or other suitable spring scale, apply force to ONE belt of the drive, perpendicular to the span at its mid-point, as shown in figure 27. See Page 13 for the Tensiometer instructions.

b) Measure the deflecting force being applied when the belt has been deflected the distance calculated in Step 2 (use an adjacent belt as reference point; on single belt drives, use straight edge or taut string across sheaves). The measured force should be between the values of P_{min} and P_{max} calculated in Step 4. If the measured force is outside these values, adjust center distance to increase or reduce tension, and repeat above procedure. On multiple belt drives an average of readings on each belt is recommended.

NOTE: If new belts are being installed for the first time, it is permissible to tension as much as 1.33 x P_{max} to allow for initial stretch and seating in the grooves.

STEP 6

During the first 24 hours of operation, it is advisable to repeat the procedure in Step 5 at least once.

Example of Determining Tension by Formula Method

Given drive parameters:
Driven HP = 25
Driver = 6 groove, C section, 10.0" p.d. (@ 1750 RPM)
Driven = 6 groove, C section, 30.0" p.d.
Belts = 6 CP162 Super Blue Ribbon
Center Distance = 50.0"

STEP 1

Measure span length (t), or calculate as:

$$t = \sqrt{C^2 - \left(\frac{D-d}{2}\right)^2} =$$

$$t = \sqrt{(50)^2 - \left(\frac{30-10}{2}\right)^2} = 49.0"$$

STEP 2

Calculate deflection distance: t = **49/64"**

STEP 3

To find Static Strand Tension (Ts), first calculate:

$$S\ (\text{fpm}/1000) = \frac{10 \times 1750 \times .262}{1000} = \mathbf{4.585}$$

$$\frac{D-d}{C} = \frac{30-10}{50} = \mathbf{0.4}$$

and find factor K from Table 29 on Page 4.
K = 27.257 (interpolating)

$$T_s = \frac{\text{Design Horsepower} \times K}{Q \times S} + T_c \quad \text{(from Table 31)} \quad = \frac{125 \times 27.257}{6 \times 4.585} + 20.8 = \mathbf{144.7\ lbs.}$$

V-BELT TENSIONING (Continued)

STEP 4

Calculate minimum and maximum deflection forces:

$$\text{Pmin} = \frac{T_s + Y}{16} = \frac{144.7 + 16}{16} = \textbf{10 lbs.}$$

$$\text{Pmax} = \frac{(1.5 \times T_s) + Y}{16} = \frac{217.1 + 16}{16} = \textbf{14.6 lbs.}$$

STEP 5

Belts are tensioned at deflection distance of 49/64" until force readings are between 10 and 15 lbs. If belts are new, between 15 and 20 lbs.)

ALTERNATE FORMULA FOR FINDING STRAND TENSION (T_s):

$$T_s = 16.5 \left(\frac{2.5 - N}{N}\right) \left(\frac{\text{Design HP}}{Q \times S}\right) + \frac{C_c \times S^2}{2}$$

Where: N = Arc Correction Factor, Table 29
Q = Number of belts on drive
Cc = Centrifugal constant from Table 30
S = Belt speed, feet per minute/1000

TABLE 31 - Tc CENTRIFUGAL TENSION ADD-ON VALUES FOR CALCULATING STATIC STRAND TENSION (Ts) OF INDIVIDUAL V-BELTS. (FOR BANDED BELTS SEE TABLE 32)

S fpm 1000	POWER-WEDGE COG-BELT			SUPER POWER WEDGE		SUPER BLUE RIBBON				GOLD RIBBON COG & SUPER II			
	3VX	5VX	8VX	5V	8V	AP	BP	CP	DP	AX A	BX B	CX C	DX D
0.50	0.05	0.13	0.44	0.15	0.41	0.08	0.13	0.25	0.47	0.08	0.13	0.22	0.50
0.75	0.11	0.30	0.98	0.34	0.92	0.19	0.30	0.56	1.05	0.17	0.28	0.50	1.12
1.00	0.19	0.54	1.74	0.61	1.64	0.33	0.54	0.99	1.87	0.31	0.50	0.89	1.98
1.25	0.30	0.84	2.72	0.96	2.56	0.52	0.84	1.54	2.92	0.48	0.78	1.39	3.10
1.50	0.44	1.21	3.92	1.38	3.69	0.75	1.21	2.22	4.20	0.69	1.13	2.00	4.46
1.75	0.59	1.65	5.34	1.88	5.02	1.02	1.65	3.03	5.72	0.94	1.53	2.72	6.08
2.00	0.78	2.16	6.97	2.45	6.56	1.33	2.16	3.95	7.47	1.23	2.00	3.55	7.94
2.25	0.98	2.73	8.82	3.10	8.30	1.68	2.73	5.00	9.46	1.55	2.53	4.50	10.05
2.50	1.21	3.37	10.89	3.83	10.24	2.08	3.37	6.17	11.67	1.91	3.13	5.55	12.40
2.75	1.47	4.08	13.18	4.63	12.40	2.51	4.08	7.47	14.12	2.32	3.78	6.72	15.01
3.00	1.75	4.85	15.68	5.51	14.75	2.99	4.85	8.89	16.81	2.76	4.50	8.00	17.86
3.25	2.05	5.70	18.41	6.47	17.31	3.51	5.70	10.43	19.73	3.23	5.29	9.39	20.96
3.50	2.38	6.61	21.35	7.50	20.08	4.07	6.61	12.10	22.88	3.75	6.13	10.89	24.31
3.75	2.73	7.58	24.51	8.61	23.05	4.67	7.58	13.89	26.27	4.31	7.04	12.50	27.90
4.00	3.11	8.63	27.88	9.80	26.23	5.31	8.63	15.80	29.88	4.90	8.01	14.22	31.75
4.25	3.51	9.74	31.48	11.06	29.61	6.00	9.74	17.84	33.74	5.53	9.04	16.05	35.84
4.50	3.93	10.92	35.29	12.40	33.19	6.73	10.92	20.00	37.82	6.20	10.13	17.99	40.18
4.75	4.38	12.17	39.32	13.82	36.98	7.49	12.17	22.29	42.14	6.91	11.29	20.05	44.77
5.00	4.85	13.48	43.57	15.31	40.98	8.30	13.48	24.69	46.69	7.66	12.51	22.21	49.61
5.25	5.35	14.86	48.03	16.88	45.18	9.15	14.86	27.23	51.48	8.44	13.79	24.49	54.69
5.50	5.87	16.31	52.72	18.53	49.58	10.05	16.31	29.88	56.50	9.26	15.14	26.88	60.02
5.75	6.42	17.83	57.62	20.25	54.19	10.98	17.83	32.66	61.75	10.13	16.54	29.38	65.60
6.00	6.99	19.41	62.74	22.05	59.01	11.96	19.41	35.56	67.24	11.03	18.01	31.99	71.43
6.25	7.58	21.06	68.07	23.93	64.03	12.97	21.06	38.59	72.96	11.96	19.55	34.71	77.51
6.50	8.20	22.78	73.63	25.88	69.25	14.03	22.78	41.73	78.91	12.94	21.14	37.54	83.83
6.75	8.84	24.57	79.40	27.91	74.68	15.13	24.57	45.01	85.10	13.95	22.80	40.49	90.41
7.00	9.51	26.42	85.39	30.01	80.32	16.27	26.42	48.40	91.52	15.01	24.52	43.54	97.23

NOTE: When value of S is greater than 6.00, special sheaves and/or dynamic balancing may be necessary. See the Carlisle V-Belt Drive Design catalog (102161)

V-BELT TENSIONING (Continued)

TABLE 32 - Tc CENTRIFUGAL TENSION ADD-ON VALUES FOR CALCULATING STATIC STRAND TENSION (Ts) OF BANDED V-BELTS. (FOR INDIVIDUAL V-BELTS SEE TABLE 31)

S fpm / 1000	Wedge-Band			Super Vee-Band			Gold Ribbon Cog-Band		
	R3V	R5V	R8V	RBP	RCP	RDP	RBX	RCX	RDX
0.50	0.06	0.16	0.47	0.17	0.29	0.54	0.16	0.26	0.57
0.75	0.14	0.37	1.07	0.39	0.66	1.21	0.36	0.59	1.28
1.00	0.25	1.03	2.97	1.08	1.82	3.35	1.00	1.64	3.56
1.25	0.40	1.03	2.97	1.08	1.82	3.35	1.00	1.64	3.56
1.50	0.57	1.48	4.27	1.55	2.62	4.82	1.44	2.36	5.12
1.75	0.78	2.02	5.81	2.11	3.57	6.57	1.96	3.21	6.97
2.00	1.02	2.64	7.59	2.76	4.66	8.58	2.55	4.19	9.11
2.25	1.29	3.34	9.61	3.49	5.90	10.85	3.23	5.31	11.53
2.50	1.59	4.12	11.86	4.31	7.28	13.40	3.99	6.55	14.23
2.75	1.92	4.99	14.35	5.22	8.81	16.21	4.83	7.93	17.22
3.00	2.29	5.94	17.08	6.21	10.48	19.29	5.75	9.43	20.50
3.25	2.69	6.97	20.05	7.29	12.30	22.64	6.74	11.07	24.06
3.50	3.12	8.08	23.25	8.45	14.27	26.26	7.82	12.84	27.90
3.75	3.58	9.28	26.69	9.71	16.38	30.15	8.98	14.74	32.03
4.00	4.07	10.56	30.37	11.04	18.63	34.30	10.21	16.77	36.44
4.25	4.60	11.92	34.28	12.47	21.04	38.72	11.53	18.93	41.14
4.50	5.15	13.36	38.43	13.98	23.58	43.41	12.93	21.23	46.12
4.75	5.74	14.89	42.82	15.57	26.28	48.37	14.40	23.65	51.39
5.00	6.36	16.50	47.45	17.25	29.12	53.60	15.96	26.20	56.94
5.25	7.01	18.19	52.31	19.02	32.10	59.09	17.69	28.89	62.77
5.50	7.70	19.96	57.41	20.88	35.23	64.85	19.31	31.71	68.90
5.75	8.41	21.82	62.75	22.82	38.51	70.88	21.11	34.66	75.30
6.00	9.16	23.76	68.33	24.85	41.93	77.18	22.98	37.73	81.99
6.25	9.94	25.78	74.14	26.96	45.49	83.74	24.94	40.94	88.97
6.50	10.75	27.88	80.19	29.16	49.21	90.58	26.97	44.29	96.23
6.75	11.60	30.07	86.47	31.45	53.06	97.68	29.09	47.76	103.77
7.00	12.47	32.34	93.00	33.82	57.07	105.05	31.28	51.36	111.60

NOTE

When value of S is greater than 6.00, special sheaves and/or dynamic balancing may be necessary - see the Carlisle V Belt Drive design catalog 102161

AVERAGE TENSIONING TABLES

Although the Formula Method is recommended for the most accurate means of determining V-Belt tension, Table 33 may be used satisfactorily for most drives. However, these values are based on drives which are designed using recommended procedures and ratings in this catalog for the belt types and cross-sections indicated in the tables. They do NOT, for example, consider drives originally designed for wrapped-type belts, which are later upgraded to the premium Power-Wedge Cog-Belt or Gold Ribbon Cog-Belt. In these cases, where known, the values for the wrapped-type Super Power-Wedge or Super Blue Ribbon should be used.

Failure to observe these limitations of the tables may result in excessive loads on bearings and/or shafts.

V-BELT TENSIONING (Continued)

TABLE 33 AVERAGE TENSIONING VALUES (RECOMMENDED MINIMUM FORCE PER BELT)

V-Belt Type	V-Belt Section	Small Sheave Speed Range	Small Sheave Diameter	Deflection Force for Drive Speed Ratio (lbs.) 1.00	1.5	2.0	4.0 & over
Super II / Super Blue Ribbon	A AP	1800-3600	3.0	2.0	2.3	2.4	3.3
		1800-3600	4.0	2.6	2.8	3.0	3.3
		1800-3600	5.0	3.0	3.3	3.4	3.7
		1800-3600	7.0	3.5	3.7	3.8	4.3
	B BP	1200-1800	4.6	3.7	4.3	4.5	5.0
		1200-1800	5.0	4.1	4.6	4.8	5.6
		1200-1800	6.0	4.8	5.3	5.5	6.3
		1200-1800	8.0	5.7	6.2	6.4	7.2
	C CP	900-1800	7.0	6.5	7.0	8.0	9.0
		900-1800	9.0	8.0	9.0	10.0	11.0
		900-1800	12.0	10.0	11.0	12.0	13.0
		700-1500	16.0	12.0	13.0	13.0	14.0
	DP	900-1500	12.0	13.0	15.0	16.0	17.0
		900-1500	15.0	16.0	18.0	19.0	21.0
		700-1200	18.0	19.0	21.0	22.0	24.0
		700-1200	22.0	22.0	23.0	24.0	26.0
Gold Ribbon Cog-Belt	AX	1800-3600	3.0	2.5	2.8	3.0	3.3
		1800-3600	4.0	3.3	3.6	3.8	4.2
		1800-3600	5.0	3.7	4.1	4.3	4.6
		1800-3600	7.0	4.3	4.6	4.8	5.3
	BX	1200-1800	4.6	5.2	5.8	6.0	6.9
		1200-1800	5.0	5.4	6.0	6.3	7.1
		1200-1800	6.0	6.0	6.4	6.7	7.7
		1200-1800	8.0	6.6	7.1	7.5	8.2
	CX	900-1800	7.0	10.0	11.0	12.0	13.0
		900-1800	9.0	11.0	12.0	13.0	14.0
		900-1800	12.0	12.0	13.0	13.0	14.0
		700-1500	16.0	13.0	14.0	14.0	15.0
	DX	900-1500	12.0	16.0	18.0	19.0	20.0
		900-1500	15.0	19.0	21.0	22.0	24.0
		700-1200	18.0	22.0	24.0	25.0	27.0
		700-1200	22.0	25.0	27.0	28.0	30.0
Power-Wedge Cog-Belt	3VX	1200-3600	2.2	2.2	2.5	2.7	3.0
		1200-3600	2.5	2.6	2.9	3.1	3.6
		1200-3600	3.0	3.1	3.5	3.7	4.2
		1200-3600	4.1	3.9	4.3	4.5	5.1
		1200-3600	5.3	4.6	4.9	5.1	5.7
		1200-3600	6.9	5.0	5.4	5.6	6.2
	5VX	1200-3600	4.4	6.5	7.5	8.0	9.0
		1200-3600	5.2	8.0	9.0	9.5	10.0
		1200-3600	6.3	9.5	10.0	11.0	12.0
		1200-3600	7.1	10.0	11.0	12.0	13.0
		900-1800	9.0	12.0	13.0	14.0	15.0
		900-1800	14.0	14.0	15.0	16.0	17.0
	8VX	900-1800	12.5	18.0	21.0	23.0	25.0
		900-1800	14.0	21.0	23.0	24.0	28.0
		700-1500	17.0	24.0	26.0	28.0	30.0
		700-1200	21.2	28.0	30.0	32.0	34.0
		400-1000	24.8	31.0	32.0	34.0	36.0
Super Power-Wedge	5V	900-1800	7.1	8.5	9.5	10.0	11.0
		900-1800	9.0	10.0	11.0	12.0	13.0
		900-1800	14.0	12.0	13.0	14.0	15.0
		700-1200	21.2	14.0	15.0	16.0	17.0
	8V	900-1800	12.5	18.0	21.0	23.0	25.0
		900-1800	14.0	21.0	23.0	24.0	28.0
		700-1500	17.0	24.0	26.0	28.0	30.0
		700-1200	21.2	28.0	30.0	32.0	34.0
		400-1000	24.8	31.0	32.0	34.0	36.0

USE OF TABLES
(NOTE: For banded V-Belts, Use the Elongation Method)

STEP 1
Install the belts per rules 1 and 2 of the "General Method" discussed previously. Measure span length (t) in inches, or calculate per "Formula Method".

STEP 2
Calculate the deflection distance by t/64 = deflection.

STEP 3
Depending on the belt type and cross section, and the small sheave diameter and speed, locate the Minimum Deflection Force (Pmin) in the appropriate drive ratio column of Table 33 on Page 9. For intermediate diameters or ratios, use interpolation.

Maximum Deflection Force = 1.5 x minimum (for new belts, 2.0 x Minimum can be used.)

STEP 4
Tension belts per Steps 5 & 6 of "Formula Method". When using Carlisle Tensiometer (part no. 102761) see instructions on page 13.

ELONGATION METHOD
This method is recommended for tensioning Super Vee-Band, Wedge-Band and Gold Ribbon Cog-Band drives where larger deflection forces make the use of other methods impractical.

Because belt elongation is related to the tension causing it, tape-measured lengths, both slack and tight, can be used to obtain proper Vee-Band tension.

VEE-BAND INSTALLATION AND TENSIONING PROCEDURE

STEP 1
Check sheaves to make sure they are properly aligned and that the grooves are not excessively worn (they should not be dished out more than 1/64").

STEP 2
Decrease the center distance until the Vee-Band(s) can be easily slipped into the sheave grooves. Forcing the belts on can damage the load-carrying cords and cause premature failure.

STEP 3
With the Vee-Band(s) still on the drive at no tension,tape their outside circumference (slack O.C.).

NOTE: If you are tensioning a used belt, decrease the center distance until there is no tension on it; then tape the outside circumference.

V-BELT TENSIONING (Continued)

STEP 4

Find the required static tension (Ts) per individual strand (rib) using the formula:

$$Ts = \frac{\text{Design HP x K}}{\text{Q x S}} + T_c$$

Where: K = value from table 29 (page 4) depending on $\frac{D-d}{C}$

Q = number of belts
S = belt speed, fpm/1000
Tc = add-on tension allowance for centrifugal force (See Table 32 page 8)

STEP 5

Find a range of recommended Static Strand Tensions:
Lower value = Ts (from Step 4)
Upper value = 1.5 x Ts

STEP 6

Calculate minimum and maximum elongation band lengths for use in tensioning drive:
a. From table 34, find length multipliers corresponding to the lower and upper values of Ts in Step 5.
b. Multiply the slack O.C. found in Step 3 by the multipliers to find the minimum and maximum elongated band lengths.

STEP 7

Increase the drive center distance until a tape measurement of the band(s) O.C. is between the two values calculated for elongated band lengths in Step 6(b).

STEP 8

Re-tension as required. A new Vee-Band may lose tension rapidly during the run-in period and will probably need re-tensioning. A Vee-Band that has been on a drive for some time may also require re-tensioning due to tension decay from normal use and wear.

V-BELT TENSIONING (Continued)

TABLE 34 BELT LENGTH MULTIPLIERS FOR TENSIONING BANDED V-BELTS BY THE ELONGATION METHOD

Ts	Wedge-Band					Super Vee-Band					Gold Label Cog-Band			
Per	R3VX	R5V		R8V		RBP		RCP		RDP	RBX	RCX	RCX	RDX
Strand (lbs.)	All	R5XV	R5V	R8VX	R8V	RBP144 & under	over RBP144	RCP144 & under	over RCP144	All	All	up thru RBX210	over CX210	All
10	1.0012	1.0007	1.0006	1.0003	1.0007	1.0006	1.0007	1.0005	1.0007	1.0004	1.0006	1.0005	1.0008	1.0007
12	1.0014	1.0009	1.0008	1.0004	1.0009	1.0008	1.0009	1.0006	1.0008	1.0005	1.0008	1.0006	1.0008	1.0008
14	1.0016	1.0010	1.0009	1.0004	1.0010	1.0009	1.0011	1.0007	1.0009	1.0006	1.0009	1.0007	1.0011	1.0010
16	1.0019	1.0011	1.0010	1.0005	1.0011	1.0010	1.0012	1.0008	1.0011	1.0007	1.0010	1.0008	1.0012	1.0011
18	1.0021	1.0013	1.0012	1.0005	1.0013	1.0012	1.0014	1.0009	1.0012	1.0008	1.0012	1.0009	1.0014	1.0012
20	1.0023	1.0014	1.0013	1.0006	1.0014	1.0013	1.0016	1.0010	1.0013	1.0009	1.0003	1.0010	1.0015	1.0014
24	1.0028	1.0017	1.0016	1.0007	1.0017	1.0016	1.0019	1.0012	1.0016	1.0010	1.0015	1.0012	1.0018	1.0017
32	1.0038	1.0023	1.0021	1.0009	1.0022	1.0021	1.0027	1.0016	1.0021	1.0014	1.0021	1.0015	1.0024	1.0022
36	1.0042	1.0026	1.0023	1.0011	1.0025	1.0024	1.0031	1.0018	1.0024	1.0016	1.0023	1.0017	1.0026	1.0024
40	1.0047	1.0029	1.0026	1.0012	1.0028	1.0026	1.0035	1.0020	1.0026	1.0017	1.0026	1.0019	1.0029	1.0027
45	1.0053	1.0032	1.0029	1.0013	1.0031	1.0030	1.0040	1.0023	1.0030	1.0019	1.0029	1.0022	1.0033	1.0030
50	1.0060	1.0036	1.0033	1.0015	1.0034	1.0033	1.0046	1.0025	1.0033	1.0022	1.0032	1.0024	1.0036	1.0033
55	1.0066	1.0039	1.0036	1.0016	1.0037	1.0036	1.0052	100.28	1.0036	1.0024	1.0036	1.0027	1.0039	1.0037
60	1.0072	1.0043	1.0039	1.0018	1.0040	1.0040	1.0058	1.0030	1.0039	1.0026	1.0039	1.0029	1.0043	1.0040
65	1.0079	1.0047	1.0043	1.0019	1.0044	1.0043	1.0064	1.0033	1.0043	1.0028	1.0042	1.0032	1.0046	1.0043
70	1.0085	1.0050	1.0046	1.0021	1.0047	1.0047	1.0071	1.0035	1.0046	1.0031	1.0046	1.0035	1.0049	1.0046
75	1.0092	1.0054	1.0049	1.0022	1.0050	1.0050	1.0077	1.0038	1.0049	1.0033	1.0049	1.0037	1.0053	1.0049
80	1.0098	1.0058	1.0053	1.0024	1.0053	1.0054	1.0084	1.0040	1.0052	1.0035	1.0052	1.0040	1.0056	1.0052
85	1.0105	1.0061	1.0056	1.0025	1.0056	1.0057	1.0092	1.0043	1.0055	1.0037	1.0056	1.0042	1.0059	1.0055
90	1.0111	1.0065	1.0060	1.0027	1.0059	1.0061	1.0099	1.0045	10..58	1.0040	1.0059	1.0045	1.0062	1.0058
95	1.0118	1.0069	1.0063	1.0028	1.0062	1.0065	1.0106	1.0048	1.0062	1.0042	1.0062	1.0048	1.0065	1.0060
100	1.0125	1.0072	1.0066	1.0030	1.0065	1.0068	1.0114	1.0050	1.0065	1.0044	1.0066	1.0050	1.0068	1.0063
120	1.0152	1.0087	1.0080	1.0035	1.0076	1.0083	1.0147	1.0061	1.0077	1.0053	1.0079	1.0061	1.0080	1.0074
140	1.0181	1.0102	1.0094	1.0041	1.0087	1.0098	1.0183	1.0071	1.0090	1.0063	1.0093	1.0072	1.0091	1.0085
160	1.0210	1.0117	1.0109	1.0047	1.0097	1.0113	1.0221	1.0082	1.0102	1.0072	1.0107	1.0083	1.0102	1.0095
180	1.0240	1.0133	1.0123	1.0053	1.0107	1.0129	1.0263	1.0092	1.0114	1.0082	1.0121	1.0094	1.0112	1.0104
200	1.0271	1.0148	1.0138	1.0059	1.0116	1.0145	1.0307	1.0103	1.0126	1.0092	1.0136	1.0106	1.0122	1.0114
240	10.336	1.0179	1.0168	1.0071	1.0134	1.078	1.0402	1.0125	1.0150	1.0112	1.0165	1.0129	1.0140	1.0131
280	1.0404	1.0211	1.0198	1.0083	1.0150	1.0213	1.0505	1.0149	1.0174	1.0132	1.0195	1.0154	1.0158	1.0146
320	1.0475	1.0243	1.0229	1.0095	1.0165	1.0249	-	1.0174	1.0198	1.0153	1.0225	10.179	1.0174	1.0161
360	1.0550	1.0276	1.0261	1.0106	1.0179	1.0286	-	1.0200	1.0222	1.0175	1.0256	1.0206	1.0190	1.0175
400	-	1.0309	1.0294	1.0118	1.0193	1.0325	-	1.0228	1.0246	1.0197	1.0288	1.0233	1.0206	1.0187
450	-	1.0351	1.0366	1.0133	1.0209	1.0375	-	1.0266	1.0277	10.226	1.0329	10.268	1.0226	1.0202
500	-	1.0394	1.0379	10.148	1.0224	1.0428	-	1.0307	1.0309	1.0255	1.0370	1.0304	1.0247	1.0217
550	-	1.0438	1.0423	1.0163	1.0240	1.0482	-	1.0352	1.0343	1.0285	1.0413	1.0342	1.0269	1,9231
600	-	1.0482	1.0468	1.0177	1.0256	1.0539	-	1.0401	1.0377	1.0316	1.0457	1.0381	1.0293	1.0246
650	-	1.0528	1.0513	1.0192	1.0273	-	-	1.0455	1.0414	1.0348	1.0501	1.0421	1.0320	1.0261
700	-	-	-	1.0207	1.0291	-	-	1.0514	1.0452	1.0381	-	1.0463	1.0350	1.0277
750	-	-	-	1.0222	1.0311	-	-	-	1.0493	1.0414	-	1.0506	1.0384	1.0294
800	-	-	-	1.0237	1.033	-	-	-	1.0536	1.0449	-	-	1.0423	1.0313
850	-	-	-	1.0251	1.0357	-	-	-	-	1.0484	-	-	1.0466	1.0334
900	-	-	-	1.0266	1.0384	-	-	-	-	1.0520	-	-	1.0516	1.0358
950	-	-	-	1.0281	.10414	-	-	-	-	-	-	-	-	1.0385
1000	-	-	-	1.0296	1.0448	-	-	-	-	-	-	-	-	1.0414

INSTRUCTIONS FOR USING THE SPRING LOADED V-BELT TENSIOMETER

Procedure for using the Carlisle V-Belt Tensiometer

1. Measure the span length of the drive. (See Figure 27).
Set the large "O" ring at 1/64″ for each inch of belt span. For example, set the large "O" ring 1/4″ for a span length of 16″, at 1/2″ for a span length of 32″, at 1″ for a span length of 64″ etc.

2. Set the small "O" ring at zero and press down the Carlisle Tensiometer at the center of the belt span (See Figure 28).

a. On a single belt drive, depress the Tensiometer until the large "O" ring is even with the bottom of a straight edge placed on the outside rims of the two sheaves.

b. On a multiple belt drive, depress the Tensiometer until the large "O" ring is even with the top of the next belt. Measure each belt in the drive. and take the average reading of all belt tensions.

3. Remove the Tensiometer, and observe that the small "O" ring has moved from its original setting at zero to the number of pounds required to deflect the belt.

4. Check this reading against the value of Pmin and Pmax calculated using the table of Average Tensioning (page 9).

$$t = \sqrt{C^2 - \left(\frac{D-d}{2}\right)^2} \qquad h = \frac{t}{64}$$

Where:
t = Span length, inches
C = Center distance, inches
D = Larger sheave diameter
d = Smaller sheave diameter, inches

*Deflection height h = 1/64 per inch of span

Part No.	Item
102761	AWI 1 single stem belt tension tester
105575	AWI 2 double stem belt tension tester
105576	AWI 3 triple stem belt tension tester

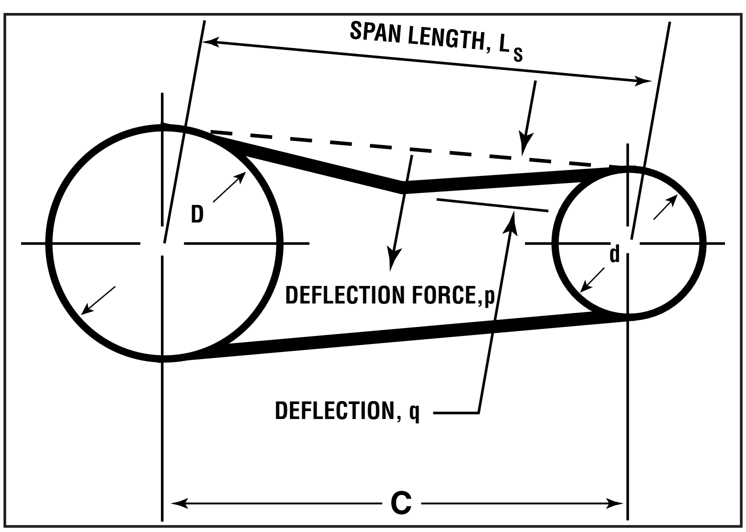

Figure 27 MEASURING DEFLECTION FORCE

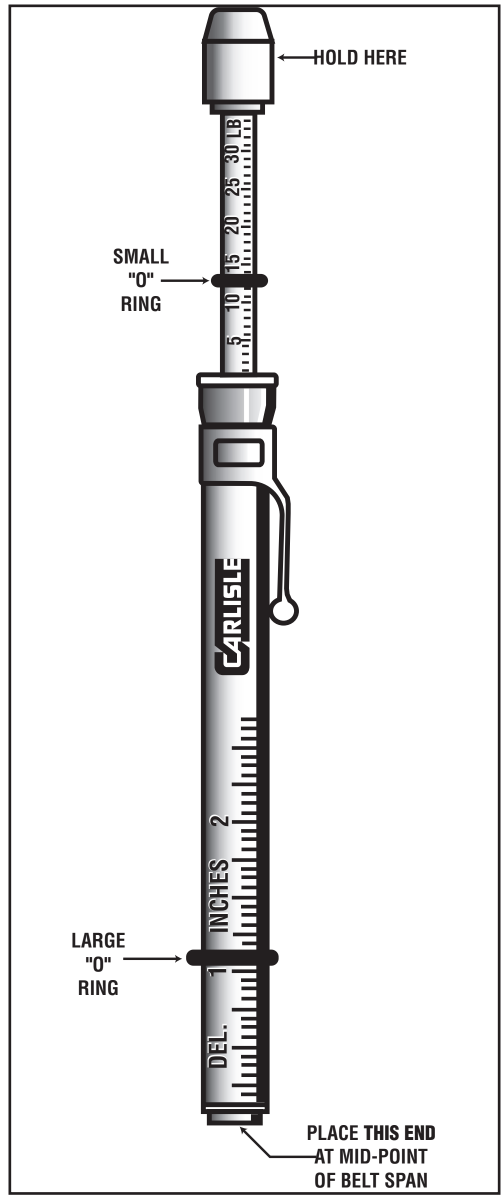

Figure 28 V-BELT TENSIOMETER (Part No. 102761)

Power Transmission Products, Inc.

Customer Service
Phone: (866) 773-2926

Canada Customer Service
Phone: (866) 797-2358

www.carlislebelts.com
info@carlislebelts.com