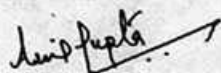


Looking toward tomorrow with fresh visions

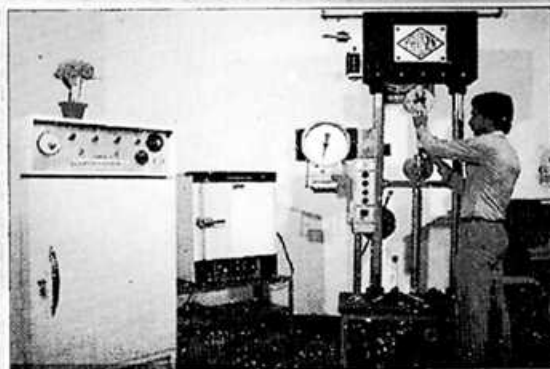
Universal HI-LIFE Polyester Cord V-Belts are the result of years of experience and practical exercise combining optimum strength and flexibility with marked resistance to wear.

Right belts for the job are produced by studying the performance under actual operating conditions. **Universal HI-LIFE** has been specially developed to cater to an ever increasing demand of quality conscious industries for higher and higher standards of working performance. Thus, this premium quality V-Belt that conforms to IS:2494 and International Specifications DIN 7753, has fostered many engineers and designers by providing answers to troublesome drive problems.

Pulleys and couplings that are properly machined for easy installation.



Anil Gupta
President



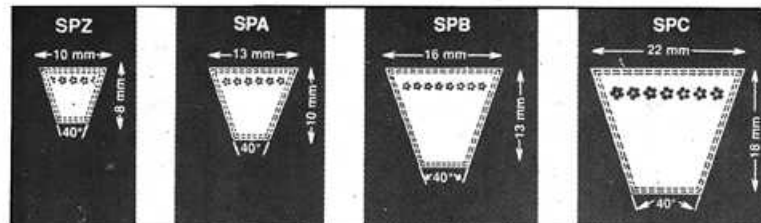
In-house evaluation of Finished Belt on Tensile Testing Machine in the Lab.

VEE - BELTS

Vee Belts are used for motor to pulley power transmission in threshers, harvester combines, automobiles, rice mills, flour mills, textiles, sugar, fertilizer, cement, coal, thermal power plants, paper mills, ceramic industries, and other industrial applications and "Universal" offers polyester cord v-belts combining optimum strength and flexibility with marked resistance to wear.

RANGE OF SECTION & SIZES (Conforming to IS : 2494, DIN 7753 and BS 3790)

SPACE SAVER WEDGE BELTS



Range of Nominal Inside Length

mm	mm	mm	mm
630-3550	800-4500	1250-12000	2000-12000

Section	Belt Pitch Length Exceeds Inside Length By (mm)	Pulley Outside Diameter Exceeds Pitch Diameter By (mm)
A	36	6.6
B	43	8.4
C	56	11.4
D	79	16.2
E	92	19.3
SPZ	-	4.0
SPA	-	6.0
SPB	-	7.0
SPC	-	9.6

DRIVE DESIGN FORMULAE

$$L = 2C + 1.57(D + d) + \frac{(D-d)^2}{4C}$$

where
 L = Belt Pitch Length, mm
 C = Centre Distance, mm
 D = Pitch dia. of large pulley, mm
 d = Pitch dia. of small pulley, mm
 R = Power Rating per belt, KW
 F_L = Belt Length Correction Factor
 F_c = Arc of contact correction Factor
 F_s = Service Factor
 P = Drive Power in KW.

INFORMATION TO BE SUPPLIED WITH ENQUIRY OR ORDER

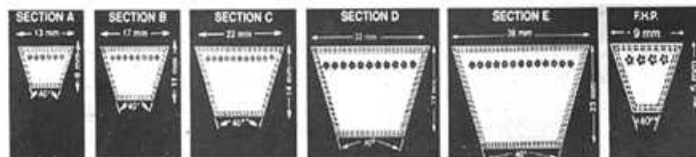
- (i) Section
- (ii) Size in inches or mm
- (iii) Quantity in nos.



Compound processing in mixing mill.

Universal Wedge Belts are capable of transmitting more than twice as much power as traditional Vee belts, hence utilized in space-saving, narrower pulleys, reduced overhung and increased bearing life.

CLASSICAL



Range of Nominal Inside Length

Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm
16-180	406-4572	24-360	610-9144	36-600	916-15240	75-600	1905-15240	159-600	4013-15240

Timing Belts are offered in various types viz., 'XL', 'L', 'H', 'XH', 'XXH'.

Table 2 RECOMMENDED PULLEY PITCH DIAMETERS

V-Belt Section	Permissible Min. Pitch Diameter mm	Pulley Pitch Diameter inch	Recommended Min. Pulley Pitch Diameter mm	Pulley Pitch Diameter inch
A	75	3	95	3.8
B	125	5	145	5.8
C	200	8	225	9
D	315	12.6	350	14
E	500	20	550	22
SPZ	-	-	63	2.5
SPA	-	-	90	3.6
SPB	-	-	160	6.4
SPC	-	-	224	9.0

Selecting a V-Belt Drive

Designing a V-belt drive basically includes factors like belt speed, H.P. rating, Service factor, sheave diameters and Area of contact with small sheaves.

Step 1 Determine Speed Ratio

Calculate the *Speed Ratio* by dividing the *revolutions per minute of the faster shaft (driving)* by the *rev/min of the slower shaft (driven)*. alternatively, *pitch diameter of larger pulley* divided by the *pitch dia of smaller pulley* will give speed ratio. Hence,

$$\text{Speed Ratio} = \frac{\text{RPM of faster shaft}}{\text{RPM of slower shaft}}$$

$$= \frac{\text{Pitch Diameter of Larger pulley}}{\text{Pitch Diameter of Smaller Pulley}}$$

Step 2 Choose Belt Section

Please select belt section most suitable for application from *Table 1*.

Step 3 Correct H.P. for Service Factor

This is essentially finding the *design power* i.e., the motor or prime mover power in H.P. or KW multiplied by the service factor for appropriate type of service taking into account the operational hours per day, for which please refer *Table 4*. Hence,

$$\text{Design Power} = \text{Prime Mover Power} \times \text{Service Factor}$$

Step 4 Choose Sheave or Pulley Diameter

Please select right *pulley pitch diameters* from *Table 2* as the recommended pulley pitch diameters are capable of transmitting the design power at given speed.

Step 5 Calculate Belt Pitch Length

The *pitch lengths* of belts corresponding to given pulley diameters and center distances may please be obtained from the following formula :

$$L = 2C + 1.57(D + d) + \frac{(D-d)^2}{4C}$$

(in mm)

Where, C = Centre distance (mm)

D = pitch diameter of larger pulley (mm)

d = pitch diameter of smaller pulley (mm)

The inside length of belt, generally marked in inches as a practice, may then be calculated selecting the nearest size in the range taking into account difference between belt pitch length and inside length.

Step 6 Calculate Centre Distance

Following formula will give centre distance :

$$C = A + \sqrt{A^2 - B}$$

where, $A = \frac{L}{4} - 0.3925(D + d)$

$$B = \frac{(D - d)^2}{8}$$

Illustration

Design a proper V-belt drive to operate the countershaft of a belt conveyor at 200 R.P.M. from a squirrel cage high torque motor, rated 5 H.P. (3.73 KW) at 960 R.P.M. The centre distance is to be approximately 500 m. Operating hours shall be 20 hours per day.

$$(i) \quad \text{Speed Ratio} = \frac{960 \text{ R.P.M.}}{200 \text{ R.P.M.}} = 4.8$$

(ii) *Table 1* indicates that V-belt of either section 'A' or 'B' be used. We still use 'B' Section belts for the application as the speed ratio is rather large.

$$(iii) \quad \text{Design power} = 5 \text{ H.P.} \times 1.3 = 6.5 \text{ H.P.}$$

$$\text{or} \Rightarrow 3.73 \text{ KW} \times 1.3 = 4.85 \text{ KW}$$

(Value 1.3 as service factor being taken from *Table 4* taking into account the operational hours/day for high torque motor).

(iv) From *Table 2*, we pick an average size of 145mm (5.8") pulley dia sheave for the driver.

With a speed ratio of 4.8, we must then use a 696mm pulley dia driven sheave. (145mm x 4.8)

$$(v) \quad L = 2 \times 500 + 1.57(696 + 145) + \frac{(696 - 145)^2}{4 \times 500}$$

$$= 1000 + 1320.37 +$$

$$= 1000 + 1320.27 + 151.80$$

$$= 2472.17$$

$$= \text{say } 2472 \text{ mm}$$

Select the nearest belt size with a pitch length of 2472 mm. The nearest stock size is B96 with *pitch length of 2482 mm* (B96 implies 96" = 2438.4 mm inside length and pitch length of section B exceeds inside length by 43 mm meaning belt pitch length of 2481.4 say 2482 mm i.e. 2438.4 + 43).

Section	Belt Pitch Length exceeds Inside Length by (mm)
A	36
B	43
C	56
D	79
E	92

$$(vi) \quad A = \frac{2482}{4} - 0.3925(696 + 145)$$

$$= 620.5 - 330.09 = 290.41$$

$$B = \frac{(696 - 145)^2}{8}$$

$$= \frac{303601}{8} = 37950.12$$

Selecting a V-Belt Drive

C = centre distance (mm)

L = pitch length of belt (mm)

D = pitch diameter of larger pulley (mm)

d = pitch diameter of smaller pulley (mm)

Step 7 Determine Number of Belts Required

With belt speed ratio, section and diameter of smaller pulley are established :

- Ascertain *power rating per belt* from *Table 7* for 180° arc of contact between belt and smaller pulley.
- Determine *Corrected power rating per belt* for an arc of contact less than 180° by multiplying listed H.P. and proper correction factor as shown in *Table 5*.

Thus, the number of belts required can be calculated by *dividing the correct H.P. for service factor* i.e., the total H.P. to be transmitted by belts or the design power, whatever nomenclature be understood as in *Step 3* by *corrected power rating per belt* as in *Step 7*.

Illustration

$$\text{Hence } C = 290.41 + \sqrt{(290.41)^2 - 37950.12}$$

$$= 290.41 + 215.37$$

$$= 505.78$$

$$= \underline{506 \text{ mm (say)}}$$

(vii) The *power rating per belt* is 2.82 KW with smaller pulley pitch dia of 150 mm with motor RPM of 960. Interpolating for 145 mm dia pulley, power rating per belt comes out to 2.73 KW and with additional power per belt for speed ratio of 4.8, i.e. 0.30 KW from *Table 7*, the power rating per belt comes out to 3.03 KW (4 H.P.).

$$\text{The actual arc of contact} = 180^\circ - \frac{57.3(D - d)}{C}$$

$$= 180^\circ - \frac{57.3(696 - 145)}{506}$$

$$= 180^\circ - \frac{31572.3}{506} = 120^\circ$$

For actual arc of contact on smaller pulley of 120°, we find a correction factor of 0.82 from *Table 5*. Consequently, the 4 H.P. power rating for 180° arc of contact is reduced to 3.28 H.P. per belt for an arc of contact of 120°.

i.e. *Corrected Power per belt* = 4 H.P. x 0.82 = 3.28 H.P.

Thus, number of belt required

$$= \frac{\text{Correct H.P. for service factor or Design Power}}{\text{Corrected power per belt}}$$

$$= \frac{6.5 \text{ H.P.}}{3.28 \text{ H.P.}} = 1.98 \text{ say } 2 \text{ belts}$$

i.e. 2 Nos. V-belts of B96/2482.

BELT SPEED

The linear belt speed can be established as stated below :

Belt Speed, $V = (\text{Pitch Dia or Drive Sheave In Inches}) \times \text{R.P.M. of Prime Mover} \times 0.262$
(F.P.M., feet per minute) OR

$$V = \frac{\pi \times \text{Pitch Dia of Drive Sheave In mm} \times \text{R.P.M. of Prime Mover}}{60 \times 1000}$$

(m/s)

Now, in above illustration,

Pitch Dia of Drive Sheave = 5.8" or 145 mm; R.P.M. of Prime Mover = 960

Hence $V = 5.8 \times 960 \times 0.262 = 1458.8 \text{ feet per minute}$

$$\text{or } V = \frac{\pi \times 145 \times 960}{60 \times 1000} = \frac{3.14 \times 145 \times 960}{60000} = 7.28 \text{ m/s.}$$

Table 4 SERVICE FACTORS FOR TYPE OF DRIVEN MACHINES

To correct the horse power rating of the V-belt drive for the type of service on which is to be used, multiply the motor horse power transmitted by the power correction factor as given in the table, taking into account type of driven machine and the operational hours per day.

SPEED INCREASING DRIVES		TYPES OF PRIME MOVERS					
		Soft Starts			Heavy Starts		
For Speed Increasing drives, Multiply Fs with 1.00 for speed Ratio 1.00 to 1.24 1.05 for speed Ratio 1.25 to 1.74 1.11 for speed Ratio 1.75 to 2.49 1.18 for speed Ratio 2.50 to 3.49 1.25 for speed Ratio 3.50 and Over		Electric Motors (Normal Torque) : A.C. - Star-Delta Start D.C. - Shut wound I.C. Engines with 4 or more cylinder all prime movers fitted with centrifugal clutches, fluid or powder couplings			Electric Motors (High Torque) : A.C. Direct on-line start D.C. - Series and compound wound I.C. Engines with less than 4 cylinders Line shafts, clutches.		
Types of Driven Machines		Operational Hours per day			Operational Hours per day		
Light Duty	Agitators (Uniform density), Blowers, Exhausters, Centrifugal pumps and Compressors, Fans upto 7.5 kw and Belt conveyors (light duty).	Upto 10 h	Over 10 to 16 h	Over 16 h	Upto 10 h	Over 10 to 16 h	Over 16 h
Medium Duty	Agitators and Mixers (Variable density), Blowers, Exhausters and fans and Dough mixers over 7.5 kw, positive displacement rotary pumps and compressors. Belt conveyors (Not uniformly loaded), Generators, line-shafts, Laundry machinery, Machine-tools, punches, presses and shears, Printing machinery, Revolving and Vibrating screens.	1.0	1.1	1.2	1.1	1.2	1.3
Heavy Duty	Brick machinery, Bucket elevators, Exciters, Reciprocating compressors and pumps, Conveyors (drag-pan-screw), Hammer mills, Paper mill beaters, Pulverizers, Saw mill and Wood working machinery, Textile machinery and Rubber machinery.	1.1	1.2	1.3	1.2	1.3	1.4
Extra Heavy Duty	Crushers (gyratory-jaw-roll), Mills (Ball-rod-tube), hoists, Rubber (calenders, extruders mills).	1.2	1.3	1.4	1.4	1.5	1.6
		1.3	1.4	1.5	1.5	1.6	1.8

Table 5 ARC OF CONTACT CORRECTION FACTORS

D-d C	Factor Fc	Arc of contact on smaller pulley, degrees	D-d C	Factor Fc	Arc of contact on smaller pulley, degrees	D-d C	Factor Fc	Arc of contact on smaller pulley, degrees
0.00	1.00	180	0.50	0.93	151	1.00	0.82	120
0.05	0.99	177	0.55	0.92	148	1.05	0.81	117
0.10	0.99	174	0.60	0.91	145	1.10	0.80	113
0.15	0.98	171	0.65	0.90	142	1.15	0.78	110
0.20	0.97	169	0.70	0.89	139	1.20	0.77	106
0.25	0.97	166	0.75	0.88	136	1.25	0.75	103
0.30	0.96	163	0.80	0.87	133	1.30	0.73	99
0.35	0.95	160	0.85	0.86	130	1.35	0.72	95
0.40	0.94	157	0.90	0.85	127	1.40	0.70	91
0.45	0.93	154	0.95	0.83	123	1.45	0.68	87

Arc of contact below 120° should not please be used unless complete drive details are submitted to HIC International Co. Inc., New Delhi for confirmation.

Table 6 CORRECTION FACTORS FOR BELT LENGTH

Factor	Belt Length, mm								
	SPZ	A	SPA	B	SPB	C	SPC	D	E
0.80	-	610	-	889	-	1295	-	-	-
0.81	-	660	-	911	-	1324	-	-	-
0.82	-	711	-	933	-	1353	-	-	-
0.83	630	762	800	955	-	1382	-	-	-
0.84	-	813	850	977	-	1411	-	-	-
0.85	710	864	900	1000	-	1440	-	-	-
0.86	-	915	950	1022	1250	1727	-	-	-
0.87	800	966	1000	1044	1300	1756	2000	3048	-
0.88	-	1017	1050	1067	1350	1785	2050	3098	-
0.89	900	1068	1100	1089	1400	1814	2100	3148	-
0.90	-	1119	1150	1111	1450	1843	2150	3198	-
0.91	-	1170	1200	1133	1500	1872	2200	3248	-
0.92	1000	1221	1250	1155	1550	1901	2250	3298	-
0.93	-	1272	1300	1177	1600	1930	2300	3348	-
0.94	1140	1323	1350	1199	1650	1959	2350	3398	-
0.95	-	1374	1400	1221	1700	1988	2400	3448	-
0.96	1250	1425	1450	1243	1750	2017	2450	3498	-
0.97	-	1476	1500	1265	1800	2046	2500	3548	-
0.98	1400	1527	1550	1287	1850	2075	2550	3598	-
0.99	-	1578	1600	1309	1900	2104	2600	3648	-
1.00	1600	1629	1650	1331	1950	2133	2650	3698	-
1.01	-	1680	1700	1353	2000	2162	2700	3748	-
1.02	1800	1740	1750	1375	2050	2191	2750	3798	-
1.03	-	1791	1800	1397	2100	2220	2800	3848	-
1.04	2000	1852	1850	1419	2150	2249	2850	3898	-
1.05	-	1903	1900	1441	2200	2278	2900	3948	-
1.06	2240	1964	1950	1463	2250	2307	2950	3998	-
1.07	-	2015	2000	1485	2300	2336	3000	4048	-
1.08	2500	2076	2050	1507	2350	2365	3050	4098	-
1.09	-	2127	2100	1529	2400	2394	3100	4148	-
1.10	2800	2188	2150	1551	2450	2423	3150	4198	-
1.11	-	2239	2200	1573	2500	2452	3200	4248	-
1.12	3150	2240	2250	1595	2550	2481	3250	4298	-
1.13	-	2291	2300	1617	2600	2510	3300	4348	-
1.14	-	2342	2350	1639	2650	2539	3350	4398	-
1.15	3550	2343	2400	1661	2700	2568	3400	4448	-
1.16	-	2394	2450	1683	2750	2597	3450	4498	-
1.17	-	2445	2500	1705	2800	2626	3500	4548	-
1.18	-	2496	2550	1727	2850	2655	3550	4598	-
1.19	-	2547	2600	1749	2900	2684	3600	4648	-
1.20	-	2598	2650	1771	2950	2713	3650	4698	-
1.21	-	2649	2700	1793	3000	2742	3700	4748	-
1.22	-	2700	2750	1815	3050	2771	3750	4798	-
1.23	-	2751	2800	1837	3100	2800	3800	4848	-
1.24	-	2802	2850	1859	3150	2829	3850	4898	-

Table 7 (R) POWER RATING (KW) PER BELT FOR SMALL PULLEY PITCH DIAMETER

RPM of smaller pulley	Smaller pulley pitch diameter, mm																			
	67	71	75	80	85	90	95	100	106	112	118	125	132	140	150	160	170	180	190	200
SPZ	0.56	0.65	0.76	0.84	0.97	1.08	1.19	1.30	1.46	1.57	1.73	1.87	2.03	2.18	2.38	2.58	2.83	3.12	3.46	3.84
	0.70	0.83	0.95	1.08	1.24	1.40	1.57	1.73	1.89	2.07	2.24	2.43	2.65	2.86	3.08	3.34	3.61	3.91	4.24	4.61
	0.97	1.13	1.35	1.51	1.73	1.94	2.16	2.43	2.61	2.88	3.14	3.40	3.73	4.00	4.34	4.71	5.09	5.50	5.94	6.41
	1.57	1.89	2.21	2.54	2.97	3.40	3.78	4.21	4.59	5.02	5.51	5.94	6.48	6.99	7.56	8.15	8.78	9.44	10.14	10.87
A	0.67	0.75	0.83	0.91	0.99	1.09	1.18	1.28	1.39	1.50	1.62	1.73	1.87	2.03	2.18	2.38	2.58	2.83	3.12	3.46
	0.84	0.95	1.05	1.16	1.25	1.39	1.50	1.62	1.77	1.91	2.06	2.21	2.38	2.58	2.83	3.12	3.46	3.84	4.24	4.61
	1.14	1.28	1.43	1.59	1.73	1.91	2.08	2.26	2.46	2.66	2.88	3.12	3.40	3.73	4.00	4.34	4.71	5.09	5.50	5.94
	1.83	2.10	2.35	2.60	2.84	3.10	3.39	3.61	3.95	4.25	4.58	4.94	5.34	5.78	6.25	6.75	7.28	7.84	8.44	9.07
B	0.78	0.86	0.94	1.02	1.10	1.18	1.26	1.34	1.42	1.50	1.58	1.66	1.74	1.82	1.90	1.98	2.06	2.14	2.22	2.30
	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	2.00	2.10	2.20	2.30	2.40	2.50	2.60	2.70	2.80	2.90
	1.28	1.40	1.52	1.64	1.76	1.88	2.00	2.12	2.24	2.36	2.48	2.60	2.72	2.84	2.96	3.08	3.20	3.32	3.44	3.56
	1.96	2.16	2.36	2.56	2.76	2.96	3.16	3.36	3.56	3.76	3.96	4.16	4.36	4.56	4.76	4.96	5.16	5.36	5.56	5.76
C	0.89	0.99	1.09	1.19	1.29	1.39	1.49	1.59	1.69	1.79	1.89	1.99	2.09	2.19	2.29	2.39	2.49	2.59	2.69	2.79
	1.16	1.28	1.40	1.52	1.64	1.76	1.88	2.00	2.12	2.24	2.36	2.48	2.60	2.72	2.84	2.96	3.08	3.20	3.32	3.44
	1.44	1.60	1.76	1.92	2.08	2.24	2.40	2.56	2.72	2.88	3.04	3.20	3.36	3.52	3.68	3.84	4.00	4.16	4.32	4.48
	2.22	2.46	2.75	3.10	3.44	3.78	4.12	4.45	4.75	5.05	5.35	5.65	5.95	6.25	6.55	6.85	7.15	7.45	7.75	8.05
D	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	2.00	2.10	2.20	2.30	2.40	2.50	2.60	2.70	2.80	2.90
	1.28	1.40	1.52	1.64	1.76	1.88	2.00	2.12	2.24	2.36	2.48	2.60	2.72	2.84	2.96	3.08	3.20	3.32	3.44	3.56
	1.56	1.72	1.88	2.04	2.20	2.36	2.52	2.68	2.84	3.00	3.16	3.32	3.48	3.64	3.80	3.96	4.12	4.28	4.44	4.60
	2.30	2.58	2.86	3.14	3.42	3.70	3.98	4.26	4.54	4.82	5.10	5.38	5.66	5.94	6.22	6.50	6.78	7.06	7.34	7.62
E	1.16	1.28	1.40	1.52	1.64	1.76	1.88	2.00	2.12	2.24	2.36	2.48	2.60	2.72	2.84	2.96	3.08	3.20	3.32	3.44
	1.44	1.60	1.76	1.92	2.08	2.24	2.40	2.56	2.72	2.88	3.04	3.20	3.36	3.52	3.68	3.84	4.00	4.16	4.32	4.48
	1.72	1.92	2.12	2.32	2.52	2.72	2.92	3.12	3.32	3.52	3.72	3.92	4.12	4.32	4.52	4.72	4.92	5.12	5.32	5.52
	2.50	2.82	3.14	3.46	3.78	4.10	4.42	4.74	5.06	5.38	5.70	6.02	6.34	6.66	6.98	7.30	7.62	7.94	8.26	8.58

$$\text{Belt Speed (feet per minute)} = \left[\frac{\text{Pitch Diameter of Drive Sheave in Inches}}{\text{Pitch Diameter of Prime Mover}} \right] \times \text{R.P.M. of Prime Mover} \times 0.262$$