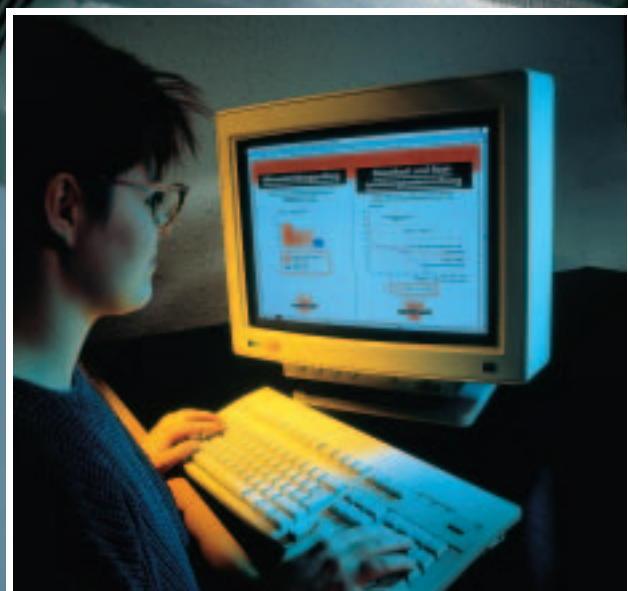




Power Transmission



Technical Manual

for Ribbed Belt Drives



Technical Manual for Ribbed Belt Drives

This manual incorporates all the important technical information and methods of calculation for drives and pulleys when using optibelt-RB Ribbed Belts. The Optibelt programme meets the requirements of DIN 7867, ISO 9982 and the USA Standard RMA/MPTA IP-26.

Our engineers will be pleased to advise on the use of this type of belt and to assist with any drive design.

This service, which utilises the most modern equipment, including computer controlled drive simulation, is available to all our customers free of charge.

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Product Description

Dimensions - Construction - Characteristics - Applications

Construction

Optibelt-RB Ribbed Belts consist of

- Belt top surface
- Tension cord
- Base compound

Parallel V-shaped ribs of a wear resistant polychloroprene compound form the base of the belt. The polyester tension cord, of high quality and extremely low stretch, is embedded in a rubber compound and extends across the entire width of the belt. The belt top surface with fabric laminates, the tension cord and the base compound are bonded together by vulcanisation.

Characteristics

The Optibelt-RB Ribbed Belt combines the high flexibility of the flat belt with the high power transmission capability of the traditional V-belt. Further advantages of this type of belt are the small sectional thickness and especially good frictional power transmission with minimal slip. Small pulley diameters, low stretch and extremely large speed ratios are additional benefits.

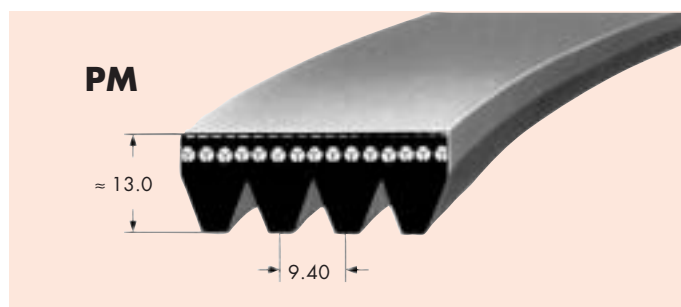
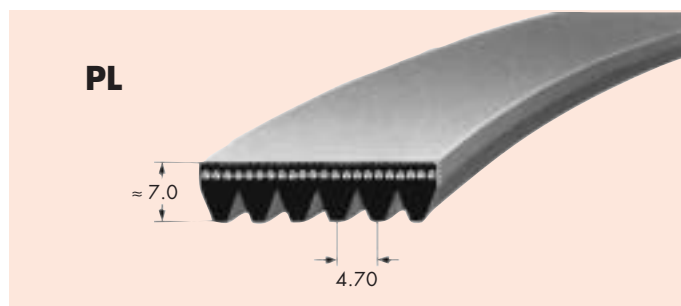
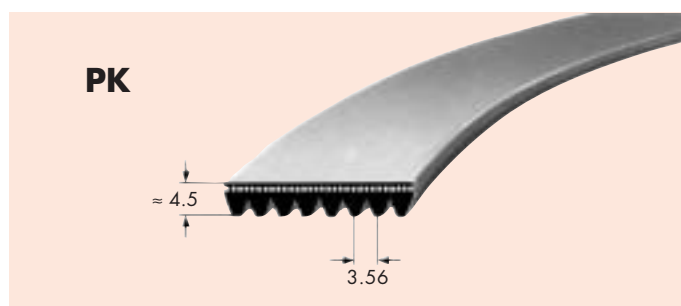
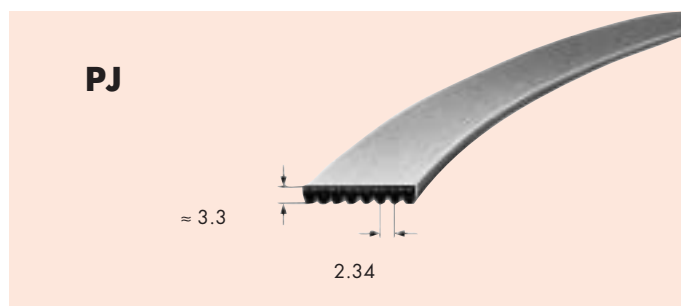
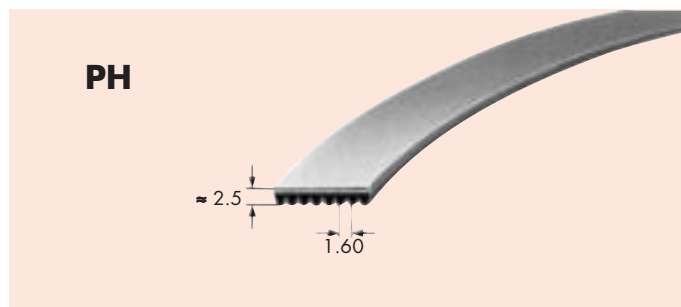
Since the ribs of the Optibelt-RB Ribbed Belt almost completely fill the pulley grooves, the resulting large contact area ensures a high degree of efficiency and a constant speed ratio. Belt turnover in the pulley is eliminated because of the single belt characteristic. Even at high speed the drive is quiet and vibration free. Due to the use of special materials, ribbed belts are resistant to most oils and will withstand high temperatures.

Only 5 sections are needed to cover a wide range of power transmission applications. The different sections are indicated by the letters PH, PJ, PK, PL and PM.

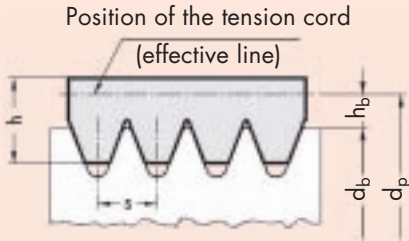
Applications

Whilst sections PJ, PL and PM are used on general purpose industrial machinery, section PH is preferred for domestic appliances. Section PK is mainly used in the automotive industry. Drives of this kind require special calculation methods and should be requested separately.

Standard Sections



Standard Range Ribbed Belts



$$d_p = d_b + 2 h_b$$

Section		PH	PJ	PK	PL	PM
Rib pitch	s (mm)	1.60	2.34	3.56	4.70	9.40
Belt thickness	≈ h (mm)	2.50	3.30	4.50	7.00	13.00
Belt speed	≈ v (m/s)	60	60	50	40	30
Min. pulley diameter	$d_{b \min}$ (mm)	13	20	45	75	180
Effective line variation	h_b	0.80	1.25	1.60	3.50	5.00

Section PH				Section PJ					
Effective length L_{es}		Effective length L_{es}		Effective length L_{es}		Effective length L_{es}		Effective length L_{es}	
(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)
698	27.5	1333	52.5	280	11.0	1150	45.3	1930	76.0
735	28.9	1371	54.0	330	13.0	1168	46.0	1956	77.0
762	30.0	1397	55.0	356	14.0	1194	47.0	1965	77.4
813	32.0	1439	56.7	362	14.3	1200	47.3	1981	78.0
858	33.8	1475	58.1	381	15.0	1222	48.1	1992	78.4
864	34.0	1600	63.0	406	16.0	1244	49.0	2083	82.0
886	34.9	1854	73.0	414	16.3	1262	49.7	2155	84.8
914	36.0	1895	74.6	432	17.0	1270	50.0	2210	87.0
955	37.6	1915	75.4	457	18.0	1285	50.6	2337	92.0
965	38.0	1930	76.0	483	19.0	1301	51.2	2489	98.0
975	38.4	1956	77.0	508	20.0	1309	51.5		
990	39.0	1992	78.4	559	22.0	1316	51.8		
1016	40.0	2083	82.0	584	23.0	1321	52.0		
1080	42.5	2155	84.8	610	24.0	1333	52.5		
1092	43.0			660	26.0	1355	53.4		
1096	43.1			711	28.0	1371	54.0		
1168	46.0			723	28.5	1397	55.0		
1194	47.0			762	30.0	1428	56.2		
1200	47.2			813	32.0	1439	56.7		
1222	48.1			836	32.9	1475	58.1		
1230	48.4			864	34.0	1549	61.0		
1244	49.0			914	36.0	1600	63.0		
1262	49.7			955	37.6	1651	65.0		
1270	50.0			965	38.0	1663	65.5		
1285	50.6			1016	40.0	1752	69.0		
1290	50.8			1092	43.0	1780	70.0		
1301	51.2			1105	43.5	1854	73.0		
1309	51.5			1110	43.7	1895	74.6		
1316	51.8			1123	44.2	1910	75.2		
1321	52.0			1130	44.5	1915	75.4		

Non standard lengths on request. Maximum number of ribs: Please contact our Applications Engineering Department.

Section PH is made to order



Power Transmission

Standard Range Ribbed Belts

Section PK						Section PL		Section PM	
Effective length L _{es}		Effective length L _{es}		Effective length L _{es}		Effective length L _{es}		Effective length L _{es}	
(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)
625	24.6	985	38.8	1600	63.0	954	37.5	2286	90.0
630	24.8	990	39.0	1610	63.4	991	39.0	2388	94.0
648	25.5	995	39.2	1655	65.2	1075	42.3	2515	99.0
675	26.6	1000	39.4	1725*	67.9	1194	47.0	2693	106.0
698	27.5	1005	39.6	1755	69.1	1270	50.0	2832	111.5
725	28.5	1010	39.8	1854*	73.0	1333	52.5	2921	115.0
735	28.9	1015	40.0	1885	74.2	1371	54.0	3010	118.5
763	30.0	1020	40.2	1900*	74.8	1397	55.0	3124	123.0
775	30.5	1025	40.4	1915	75.4	1422	56.0	3327	131.0
780	30.7	1045	41.1	1935	76.2	1562	61.5	3531	139.0
790	31.1	1065	41.9	1980	78.0	1613	63.5	3734	147.0
795	31.3	1080	42.5	1992*	78.4	1664	65.5	4089	161.0
800	31.5	1090	43.0	2040*	80.3	1715	67.5	4191	165.0
805	31.7	1100	43.3	2050	80.7	1764	69.5	4470	176.0
812	32.0	1110	43.7	2080	82.0	1803	71.0	4648	183.0
815	32.1	1120	44.1	2100	82.7	1841	72.5	5029	198.0
825	32.5	1125	44.3	2120	83.5	1943	76.5	5410	213.0
830	32.7	1140	44.9	2145	84.4	1981	78.0	6121	241.0
835	32.9	1150	45.3	2155*	84.8	2020	79.5	6883	271.0
841	33.1	1160*	45.7	2170	85.4	2070	81.5	7646	301.0
845	33.3	1165	45.9	2230*	87.8	2096	82.5	8408	331.0
850	33.5	1180	46.5			2134	84.0	9169	361.0
858	33.8	1190	46.8			2197	86.5	9931	391.0
865	34.0	1215	47.8			2235	88.0	10693	421.0
870	34.2	1230	48.4			2324	91.5	12217	481.0
872	34.3	1260	49.6			2362	93.0	13741	541.0
875	34.5	1270*	50.0			2476	97.5	15266	601.0
880*	34.6	1285*	50.6			2515	99.0		
884	34.8	1290	50.8			2705	106.5		
886	34.9	1301*	51.2			2743	108.0		
890	35.0	1325	52.2			2845	112.0		
905	35.6	1330	52.4			2895	114.0		
913	36.0	1345	53.0			2921	115.0		
920	36.2	1371*	54.0			2997	118.0		
925	36.4	1397*	55.0			3086	121.5		
930	36.6	1415	55.7			3124	123.0		
935	36.8	1420*	55.9			3289	129.5		
940	37.0	1439*	56.7			3327	131.0		
945	37.2	1450	57.1			3492	137.5		
950	37.4	1460	57.5			3696	145.5		
954	37.6	1475*	58.1			4051	159.5		
962	37.8	1520	59.8			4191	165.0		
966	38.0	1540*	60.6			4470	176.0		
970	38.2	1550*	61.0			4622	182.0		
975	38.4	1560	61.4			5029	198.0		
						5385	212.0		
						6096	240.0		

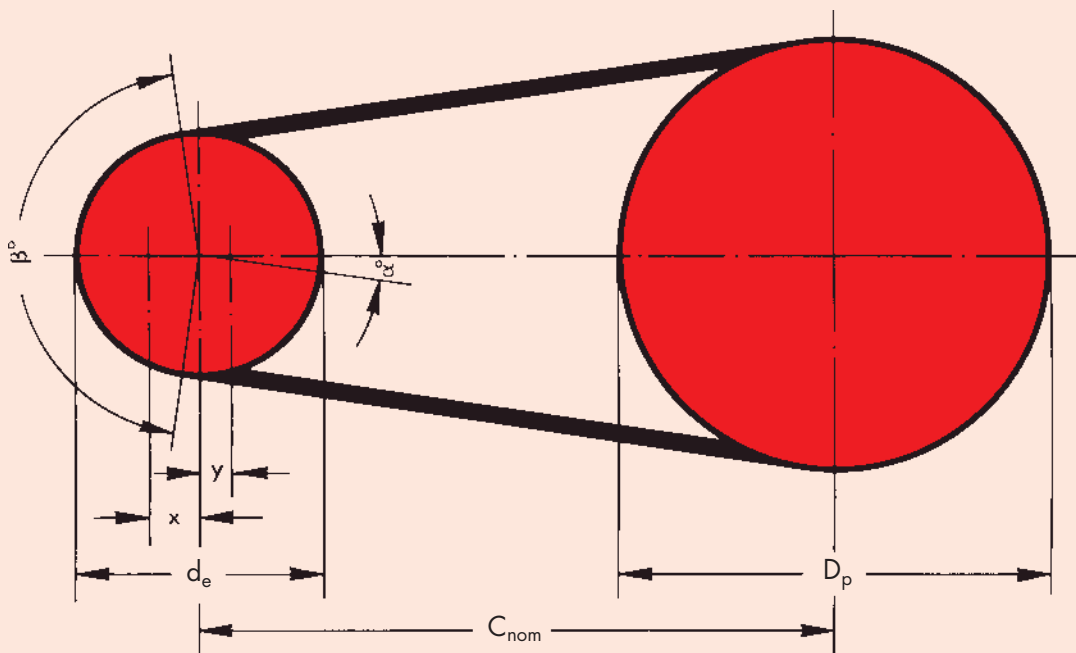
Non standard lengths on request. Maximum number of ribs: Please contact our Applications Engineering Department.

* non stock items

Drive Design

Abbreviations used in Formulae

h_b	= Effective line difference	(mm)	N	= Speed of larger pulley	(r.p.m.)
C	= Drive centre distance provisional	(mm)	n	= Speed of smaller pulley	(r.p.m.)
C_{nom}	= Drive centre distance actual	(mm)	n_1	= Speed of driver pulley	(r.p.m.)
$2c$	= Difference between effective and pitch diameter	(mm)	n_2	= Speed of driven pulley	(r.p.m.)
c_1	= Arc of contact correction factor		P	= Motor or normal running power	(kW)
c_2	= Drive service factor		P_B	= Design power	(kW)
c_3	= Belt length correction factor		P_N	= Power rating per rib	(kW)
D_e	= Effective diameter of larger pulley	(mm)	r	= Speed ratio	
d_e	= Effective diameter of smaller pulley	(mm)	S	= Drive span length	(mm)
d_{e1}	= Effective diameter of driver pulley	(mm)	S_a	= Static shaft loading	(N)
d_{e2}	= Effective diameter of driven pulley	(mm)	T	= Static belt tension per rib	(N)
D_p	= Pitch diameter of larger pulley	(mm)	v	= Belt speed	(m/s)
d_p	= Pitch diameter of smaller pulley	(mm)	x	= Minimum allowance above drive centre distance C_{nom} for belt stretch and wear	(mm)
E	= Belt deflection per 100 mm span length	(mm)	y	= Minimum allowance below drive centre distance C_{nom} for belt installation and tensioning	(mm)
E_a	= Belt deflection for a given span length	(mm)	z	= Number of ribs	
f	= Load used to set belt tension per rib	(N)	α	= Angle of belt run = $90^\circ - \frac{\beta}{2}$	(degrees)
k	= Constant for calculation of centrifugal force		β	= Arc of contact on smaller pulley	(degrees)
L_{es}	= Standard belt effective length	(mm)			
L_{eth}	= Calculated belt effective length	(mm)			





Drive Design

Optibelt Power Ratings P_N - Arc of Contact Correction Factor c_1

Optibelt power ratings P_N shown in tables 5 to 9 are based on internationally recognised formulae. These formulae contain material constants which must be used in accordance with the practices of the individual manufacturers. The P_N power rating formula is based on a specific tension ratio between the tight and slack sides of the belt. The power rating tables refer to the smallest loaded pulley in the drive. The belt power ratings from the tables are given for:

- the effective diameter of smaller pulley d_e
- the speed of smaller pulley n .
- the speed ratio r
- the arc of contact of the belt on smaller pulley $\beta = 180^\circ$
- the ideal belt length for the particular belt section.

From the given drive data the power rating per rib P_N can be found which must then be modified by application of the arc of contact and belt length correction factors c_1 and c_3 .

Intermediate values can be found by linear interpolation.

The arc of contact correction factor c_1 corrects the power rating P_N when the arc of contact of the belt around the smaller pulley d_e is smaller than $\beta = 180^\circ$.

Table 1

$D_e - d_e$ C_{nom}	$\beta \approx$	c_1
0	180°	1.00
0.05	177°	1.00
0.10	174°	1.00
0.15	171°	0.99
0.20	168°	0.99
0.25	165°	0.99
0.30	162°	0.99
0.35	160°	0.99
0.40	156°	0.98
0.45	153°	0.98
0.50	150°	0.98
0.55	147°	0.97
0.60	144°	0.97
0.65	141°	0.97
0.70	139°	0.96
0.75	136°	0.96
0.80	133°	0.95
0.85	130°	0.95
0.90	126°	0.94
0.95	123°	0.94
1.00	119°	0.93
1.05	115°	0.92
1.10	112°	0.92
1.15	109°	0.91
1.20	106°	0.90
1.25	103°	0.89
1.30	100°	0.89
1.35	96°	0.87
1.40	92°	0.86
1.45	88°	0.85
1.50	84°	0.83
1.55	80°	0.82
1.60	77°	0.80

Intermediate values should be found by linear interpolation!



Power Transmission

Drive Design

Belt Length Correction Factor c_3

The belt length correction factor c_3 takes into account the bending stresses in the particular belt section in relationship to a standard effective length.

This results in the following relationships:

ribbed belt length used > standard effective length $c_3 > 1.0$
ribbed belt length used = standard effective length $c_3 = 1.0$
ribbed belt length used < standard effective length $c_3 < 1.0$

$$c_3 = 1 + \frac{L_{es} - 0.09}{L_{eff}} - 1 \cdot 2.4$$

L_{es} – ribbed belt length used

L_{eff} = standard effective length

Table 2

Section PH				Section PJ			
Effective length L_{es} (mm)	c_3	Effective length L_{es} (mm)	c_3	Effective length L_{es} (mm)	c_3	Effective length L_{es} (mm)	c_3
698	0.96	1956	1.19	280	0.74	1309	1.05
735	0.97	1992	1.20	330	0.76	1316	1.05
762	0.98	2083	1.21	356	0.78	1321	1.05
813	1.00	2155	1.22	362	0.78	1333	1.05
858	1.01			381	0.79	1355	1.06
864	1.01			406	0.80	1371	1.06
886	1.01			414	0.81	1397	1.06
914	1.02			432	0.82	1428	1.07
955	1.03			457	0.83	1439	1.07
965	1.03			483	0.84	1475	1.08
975	1.03			508	0.85	1549	1.09
990	1.03			559	0.87	1600	1.10
1016	1.04			584	0.88	1651	1.10
1080	1.06			610	0.89	1663	1.10
1092	1.06			660	0.90	1752	1.12
1096	1.06			711	0.92	1780	1.12
1168	1.07			723	0.92	1854	1.13
1194	1.08			762	0.93	1895	1.13
1200	1.08			813	0.95	1910	1.14
1222	1.08			836	0.95	1915	1.14
1230	1.09			864	0.96	1930	1.14
1244	1.09			914	0.97	1956	1.14
1262	1.09			955	0.98	1965	1.14
1270	1.09			965	0.98	1981	1.14
1285	1.10			1016	1.00	1992	1.14
1290	1.10			1092	1.01	2083	1.16
1301	1.10			1105	1.01	2155	1.17
1309	1.10			1110	1.01	2210	1.17
1316	1.10			1123	1.02	2337	1.18
1321	1.10			1130	1.02	2489	1.20
1333	1.10			1150	1.02		
1371	1.11			1168	1.03		
1397	1.11			1194	1.03		
1439	1.12			1200	1.03		
1475	1.13			1222	1.04		
1600	1.15			1244	1.04		
1854	1.18			1262	1.04		
1895	1.18			1270	1.04		
1915	1.19			1285	1.05		
1930	1.19			1301	1.05		



Power Transmission

Drive Design

Belt Length Correction Factor c_3

Table 2

Section PK						Section PL				Section PM	
Effective length L_{es} (mm)	c_3	Effective length L_{es} (mm)	c_3	Effective length L_{es} (mm)	c_3	Effective length L_{es} (mm)	c_3	Effective length L_{es} (mm)	c_3	Effective length L_{es} (mm)	c_3
605	0.80	975	0.89	1550	0.99	954	0.83	4051	1.14	2286	0.87
625	0.81	985	0.89	1560	0.99	991	0.84	4191	1.15	2388	0.88
630	0.81	990	0.89	1570	1.00	1075	0.86	4470	1.16	2515	0.89
648	0.81	995	0.90	1600	1.00	1194	0.88	4622	1.17	2693	0.91
675	0.82	1000	0.90	1610	1.00	1270	0.89	5029	1.19	2832	0.92
698	0.82	1005	0.90	1655	1.01	1333	0.90	5385	1.21	2921	0.92
725	0.83	1010	0.90	1690	1.01	1371	0.91	6096	1.24	3010	0.93
735	0.83	1015	0.90	1725	1.02	1397	0.91			3124	0.94
763	0.84	1020	0.90	1755	1.02	1422	0.91			3327	0.95
775	0.85	1025	0.90	1854	1.03	1562	0.93			3531	0.96
780	0.85	1045	0.91	1885	1.03	1613	0.94			3734	0.98
790	0.85	1065	0.91	1900	1.04	1664	0.95			4089	1.00
795	0.85	1080	0.91	1915	1.04	1715	0.95			4191	1.00
800	0.85	1090	0.91	1935	1.04	1764	0.96			4470	1.01
805	0.85	1100	0.92	1980	1.05	1803	0.96			4648	1.02
812	0.85	1110	0.92	1992	1.05	1841	0.97			5029	1.04
815	0.85	1120	0.93	2030	1.05	1943	0.98			5410	1.06
825	0.86	1125	0.93	2040	1.05	1981	0.98			6121	1.08
830	0.86	1140	0.93	2050	1.05	2020	0.99			6883	1.11
835	0.86	1150	0.93	2080	1.06	2070	0.99			7646	1.13
841	0.86	1160	0.93	2100	1.06	2096	1.00			8408	1.16
845	0.87	1165	0.93	2120	1.06	2134	1.00			9169	1.18
850	0.87	1180	0.94	2145	1.06	2197	1.01			9931	1.19
858	0.87	1190	0.94	2155	1.07	2235	1.01			10693	1.21
865	0.87	1215	0.94	2170	1.07	2324	1.02			12217	1.24
870	0.87	1230	0.94	2230	1.07	2362	1.02			13741	1.27
872	0.87	1245	0.95			2476	1.03			15266	1.30
875	0.87	1260	0.95			2515	1.03				
880	0.87	1270	0.95			2705	1.05				
884	0.87	1285	0.95			2743	1.05				
886	0.87	1290	0.95			2845	1.06				
890	0.88	1301	0.96			2895	1.07				
905	0.88	1325	0.96			2921	1.07				
913	0.88	1330	0.96			2997	1.07				
920	0.88	1345	0.96			3086	1.08				
925	0.88	1371	0.96			3124	1.08				
930	0.89	1397	0.97			3289	1.09				
935	0.89	1415	0.97			3327	1.10				
940	0.89	1420	0.98			3492	1.11				
945	0.89	1439	0.98			3696	1.12				
950	0.89	1450	0.98								
954	0.89	1460	0.98								
962	0.89	1475	0.98								
966	0.89	1520	0.99								
970	0.89	1540	0.99								

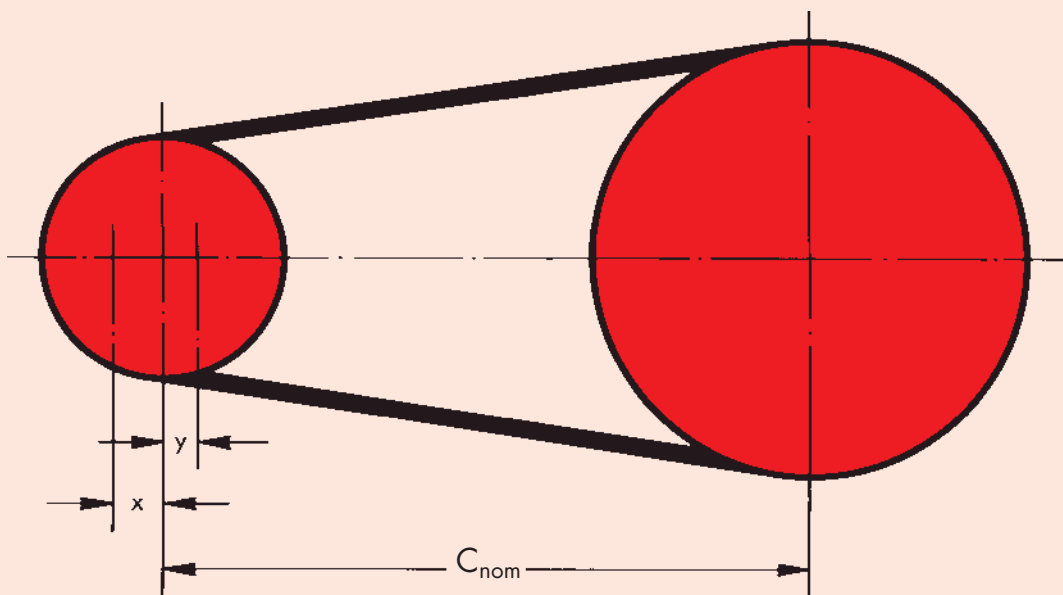
Non standard lengths on request.

Drive Design

Minimum Allowances x/y above and below Drive Centre Distance C_{nom}

Table 3

Effective length	Minimum allowance x (mm) for tensioning and retensioning	Minimum allowance y (mm) – for ease of fitting				
		Section PH	Section PJ	Section PK	Section PL	Section PM
≤ 500	10	10	10	—	—	—
$> 500 \leq 1000$	15	15	15	20	25	—
$> 1000 \leq 1500$	20	15	15	20	25	—
$> 1500 \leq 2000$	25	15	15	20	25	—
$> 2000 \leq 2500$	30	20	20	20	25	40
$> 2500 \leq 3000$	35	20	20	25	30	40
$> 3000 \leq 4000$	45	—	—	25	30	45
$> 4000 \leq 5000$	55	—	—	30	35	45
$> 5000 \leq 6000$	65	—	—	30	35	50
$> 6000 \leq 7500$	85	—	—	—	—	55
$> 7500 \leq 9000$	100	—	—	—	—	60
$> 9000 \leq 10\,500$	115	—	—	—	—	65
$> 10\,500 \leq 12\,000$	130	—	—	—	—	75
$> 12\,000 \leq 13\,500$	150	—	—	—	—	80
$> 13\,500 \leq 15\,266$	165	—	—	—	—	90



Drive Design

Drive Service Factor c_2

The drive service factor c_2 takes into account the length of time the drive is operational in a 24 hour period and the type of driver and driven units. It applies exclusively to two pulley drives and cannot be applied for other working conditions, such as drives with idler and guide pulleys. Pages 26 and 27 give the design bases for drives with more than two pulleys. Adverse operating conditions such as high ambient temperatures, high humidity, the use of an idler pulley, etc., are **not** considered due to the obvious difficulties in creating factor tables to cater for every eventuality. The Table given below should thus be regarded as a **guideline**. In special

cases e.g. high starting load (direct starting of fans), drives with high starting frequency, unusual shock loading, or the regular acceleration/ deceleration of mass, the load factor should be increased.

Typical value

Where the starting load is more than 1.8 times the standard running load, the minimum service factor c_2 should be determined by dividing the starting load factor by 1.5. Example: Starting load factor $M_A = 3.0$; c_2 selected 2.0. Where the application is especially problematical please consult our engineers.

Table 4

Types of Driven Machine		Types of Prime Mover					
		AC and three-phase motors with normal starting load (up to 1.8 times normal running load) e.g. synchronous and single-phase motors with auxiliary phase, three-phase motors with direct on-line start, star delta or commutator starter, DC shunt wound motors, internal combustion engines and turbines $n>600\text{ min}^{-1}$.			AC and three-phase motors with high starting load (more than 1.8 times normal running load) e.g. single phase motors with high starting torque, DC motors series and compound wound, internal combustion engines and turbines $n\leq 600\text{ min}^{-1}$.		
		Hours per day duty					
		10 and under	over 10 to 16	over 16	10 and under	over 10 to 16	over 16
Light duty	Agitators for liquids with uniform consistency, generators up to 0.05 kW, small conveyor belts for lightweight material, fans up to 0.05 kW, rotary pumps up to 0.05 kW	1.1	1.1	1.2	1.1	1.2	1.3
Light duty	Conveyor belts for lightweight material, fans from 0.06 to 0.1 kW, rotary pumps from 0.06 to 0.1 kW	1.1	1.2	1.3	1.2	1.3	1.4
Medium duty	Vibrating screens, mine fans, agitators for liquids with fluctuating consistency, compressors, screw presses, woodworking machinery, conveyor belts for heavy material, elevators, conveyor belts, fans above 0.8 kW, drills, milling machines, grinding machines, light lathes, bakery machinery, circular spinning frames, rotary pumps above 0.11 kW, laundry machinery	1.2	1.3	1.4	1.3	1.4	1.5
Heavy duty	Kneaders, mills, mixers, pumps, drying drums, general milling equipment, centrifuges, agitators for plastic materials with fluctuating consistency, bucket conveyors, centrifugal fans, parallel planing machines, weaving looms	1.3	1.4	1.5	1.4	1.5	1.6
Heavy duty	Paper making machinery, plate conveyors, slag mills, calenders, drilling rigs, heavy duty lathes, punches, shears, draw benches, piston pumps up to 2 cylinder	1.4	1.5	1.6	1.5	1.7	1.8
Extra heavy duty	Dredgers, heavy duty grinders, rolling mills, mixers, sawmills, calenders	1.6	1.7	1.8	1.6	1.8	2.0

Drive Design

A Guide to Selecting Ribbed Belt Sections

By using the following diagram and considering economy and size it is possible to determine the best Ribbed Belt section. Optimum utilisation of power and efficiency is achieved by the selection of the largest possible pulley diameter in relation to the section used. The limits to the permissible circumferential speeds must be observed.

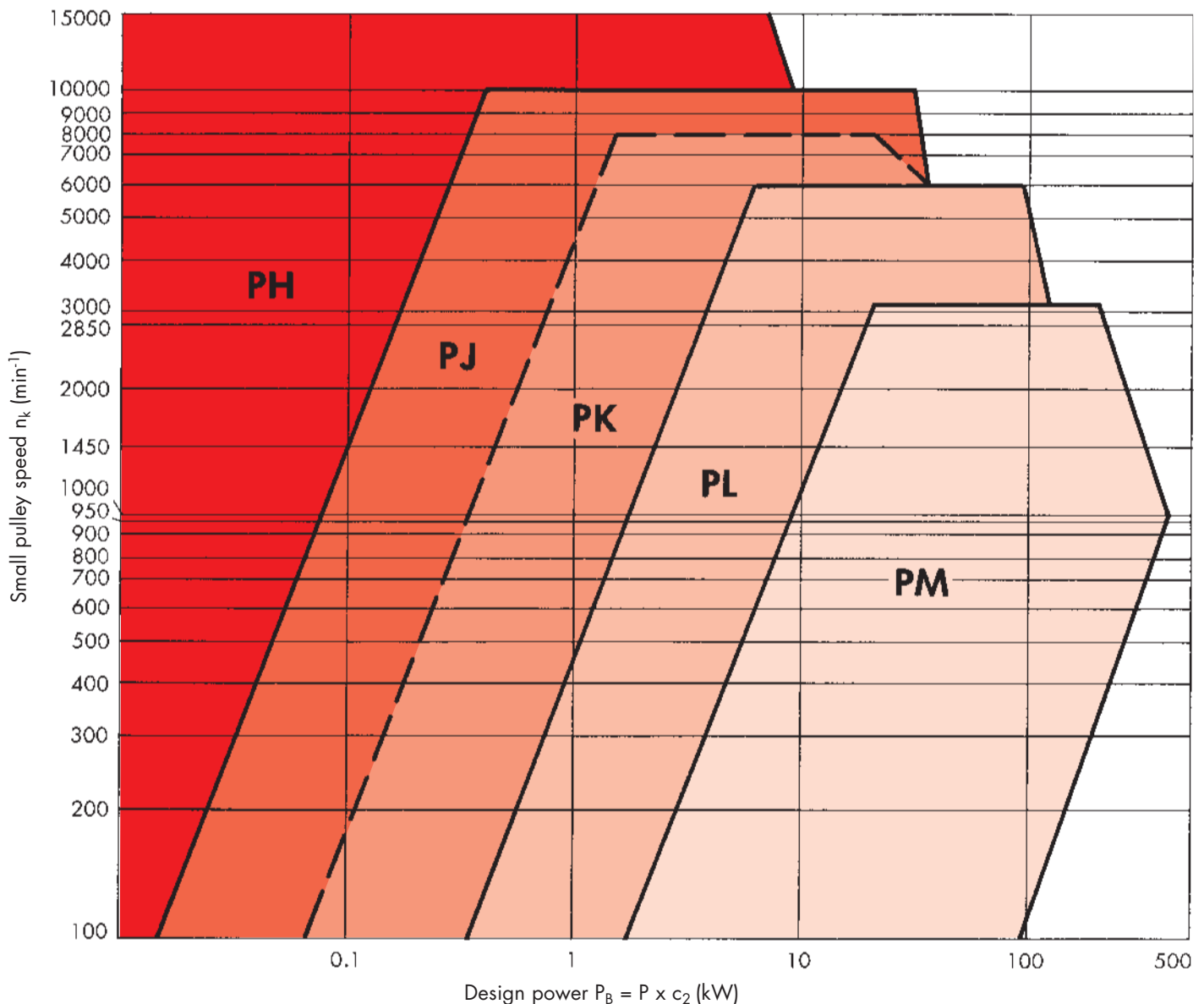
In such borderline cases the use of the next smaller belt section on similar pulley diameters will often save both cost and space.

In these boundary areas, it is advisable to design the drive with both sections.

Section PH	$v_{\max} = 60 \text{ m/s}$
Section PJ	$v_{\max} = 60 \text{ m/s}$
Section PK	$v_{max} = 50 \text{ m/s}$
Section PL	$v_{\max} = 40 \text{ m/s}$
Section PM	$v_{\max} = 30 \text{ m/s}$

Experience has shown that minimum pulley diameters should be avoided. Such drives are not cheap and require large face widths.

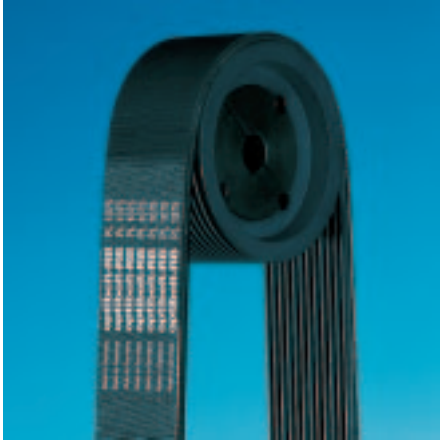
Diagram 1



Drive Design

Formulae and Drive Design Method

Prime Mover



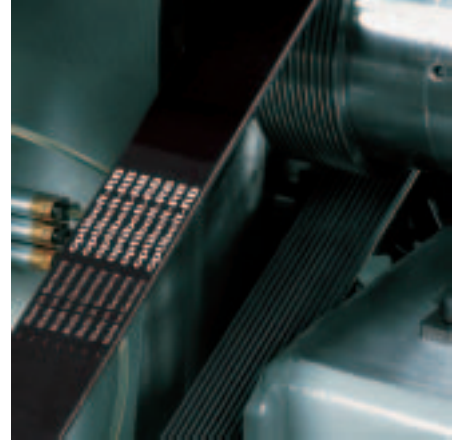
Electric motor
 $P = 13 \text{ kW}$
 $n_1 = 2440 \text{ min}^{-1}$
 Start up: direct
 Starting torque: $M_A = 2.7 M_N$

Drive Conditions

Operational hours per day:
 approx. 8 hours
 Number of starts: approx. 20 per day
 Normal ambient temperature, no
 exposure to oil and water

Drive centre distance: between 250 and
 300 mm acceptable
 Effective diameter of driver pulley:
 $d_{e1} = 140 \text{ mm}$

Driven Machine



Grinding spindle
 $P = 13 \text{ kW}$
 $n_2 = 3100 \pm 100 \text{ min}^{-1}$
 Start up: from idling

Formulae

Drive service factor

c_2 from Table 4 page 13

Design power

$$P_B = P \cdot c_2$$

Belt section selection

from Diagram 1 page 14

Speed ratio

$$r = \frac{n_1}{n_2} = \frac{D_p}{d_p} = \frac{d_{e2} + 2 b_e}{d_{e1} + 2 b_e}$$

h_b see page 24

Effective diameters of ribbed belt pulleys

d_{e1} Page 37

$$d_{e2} = d_{e1} \cdot r + 2 b_e (r - 1)$$

when d_{e2} is known:

$$d_{e1} = \frac{d_{e2}}{r} + 2 h_b \frac{1}{r} - 1$$

Calculation Example

$$c_2 = 1.8$$

$$P_B = 13 \cdot 1.8 = 23.40 \text{ kW}$$

Profil PL

$$r = \frac{2440}{3173} = 0.769$$

$$d_{e1} = 123 \text{ mm selected}$$

$$d_{e2} = 123 \text{ mm} \cdot 0.769 + 2 \cdot 3.5 (0.769 - 1) = 92.97 \text{ mm}$$

$$d_{e2} = 93 \text{ mm see page 37}$$



Power Transmission

Drive Design

Formulae and Drive Design Method

Formulae

Recalculation of speed of driven machine

$$r_{\text{actual}} = \frac{D_p}{d_p} = \frac{d_{e2} + 2 b_e}{d_{e1} + 2 b_e}$$

$$n_{2 \text{ actual}} = \frac{n_1}{r_{\text{actual}}}$$

Drive centre distance (suggested)

Empfehlung: $c > 0.7 (D_e + d_e)$
 $c < 2 (D_e + d_e)$

Effective length of Ribbed Belt

$$L_{\text{eth}} \approx 2 c + 1.57 (D_e + d_e) + \frac{(D_e - d_e)^2}{4 c}$$

Actual:

$$L_{\text{eth}} = 2 c \cdot \sin \frac{\beta}{2} + \frac{\pi}{2} (D_e + d_e) + \frac{\alpha \times \pi}{180^\circ} (D_e + d_e)$$

Drive centre distance

Calculated from L_{es} and L_{eth}

(when $L_{\text{es}} > L_{\text{eth}}$) $C_{\text{nom}} \approx C + \frac{L_{\text{es}} - L_{\text{eth}}}{2}$

(when $L_{\text{es}} < L_{\text{eth}}$) $C_{\text{nom}} \approx C - \frac{L_{\text{es}} - L_{\text{eth}}}{2}$

actual: $L_{\text{es}} - \frac{\pi}{2} (D_e + d_e)$

$$C_{\text{nom}} = \frac{L_{\text{es}} - \frac{\pi}{2} (D_e + d_e)}{4} +$$

$$\sqrt{\left[\frac{L_{\text{es}} - \frac{\pi}{2} (D_e + d_e)}{4} \right]^2 - \frac{(D_e - d_e)^2}{8}}$$

Minimum allowances x/y above and below drive centre distance C_{nom}

x/y from table 3 page 11

Belt speed

$$v = \frac{d_{pk} \cdot n_k}{19100} = \frac{(d_{bk} + 2 \cdot h_b) \cdot n_k}{19100}$$

Calculation Example

$$r_{\text{actual}} = \frac{93 + 2 \cdot 3.5}{123 + 2 \cdot 3.5} = \mathbf{0.769}$$

$$n_{2 \text{ actual}} = \frac{2440}{0.769} = \mathbf{3173 \text{ min}^{-1}}$$

Required:
 $3100 \pm 100 \text{ min}^{-1}$
 (Calculated speed meets requirement)

$$c = \mathbf{380 \text{ mm}}$$
 suggested

$$L_{\text{eth}} \approx 2 \cdot 380 + 1.57 \cdot (123 + 93) + \frac{(123 - 93)^2}{4 \cdot 380} \approx 1099.7 \text{ mm}$$

Nearest standard length from page 7 selected

$$L_{\text{es}} = \mathbf{1075 \text{ mm}}$$

$$C_{\text{nom}} \approx 380 - \frac{1099.7 - 1075}{2} \approx \mathbf{367.65 \text{ mm}}$$

$$x \geq \mathbf{20 \text{ mm}} / y \geq \mathbf{25 \text{ mm}}$$

$$v = \frac{(93 + 2 \cdot 3.5) \cdot 3173}{19100} = \mathbf{16.61 \text{ m/s}}$$



Power Transmission

Drive Design

Formulae and Drive Design Method

Formulae

Arc of contact and arc of contact correction factor

$$D_e - d_e$$

$$C_{nom}$$

Approximate β° and c_1 from table 1 page 9

$$\text{Actual: } \cos \frac{\beta}{2} = \frac{D_e - d_e}{2 C_{nom}}$$

Belt length correction factor

c_3 from table 2 page 11

Power rating per rib

$$d_e = 93 \text{ mm}$$

$$P_N \text{ for } n = 3173 \text{ min}^{-1}$$

$$r^* = \frac{1}{0.769} = 1.3$$

Section PL
from table 8 page 21

When a speed up drive is involved use the formula marked * to generate "r" for use with the power rating tables.

Number of ribs

$$z = \frac{P \cdot c_2}{P_N \cdot c_1 \cdot c_3}$$

Static belt tension per rib

$$T \approx \frac{500 \cdot (2.03 - c_1) \cdot P_B}{c_1 \cdot z \cdot v} + k \cdot v^2$$

k from diagram 2 page 41

Minimum static shaft loading

$$S_a \approx 2 T \cdot \sin \frac{\beta}{2} \cdot z$$

Belt deflection for a given span length

$$E_a \approx \frac{E \cdot L}{100}$$

E from diagram 2 page 41

$$L = C_{nom} \cdot \sin \frac{\beta}{2}$$

For explanation see chapter
on tensioning on page 40

Calculation Example

$$\frac{123 - 93}{368} = 0.082$$

$$\left. \begin{array}{l} \beta \approx 175^\circ \\ c_1 = 1.0 \end{array} \right\} \text{linearly interpolated}$$

$$c_3 = 0.86$$

$$P_N = 2.28 + 0.2 = 2.48 \text{ kW}$$

$$z = \frac{13 \cdot 1.8}{2.48 \cdot 1.0 \cdot 0.86} = 10.97$$

Suggested:

1 Optibelt-RB Ribbed Belt 12 PL 1075

$$T \approx \frac{500 \cdot (2.03 - 1.0) \cdot 23.4}{1.0 \cdot 12 \cdot 16.6} + 0.036 \cdot 16.6^2 \approx 70 \text{ N}$$

$$S_a \approx 2 \cdot 70 \cdot 0.9986 \cdot 12 \approx 1678 \text{ N}$$

$$E_a \approx \frac{2.5 \cdot 367.0}{100} \approx 9 \text{ mm}$$

$$E \approx 2.5 \text{ mm}$$

$$L = 367.6 \cdot 0.9986 = 367.0 \text{ mm}$$



Power Transmission

Section PH

Power Ratings P_N (kW) per Rib for $\beta = 180^\circ$ and $L_{eff} = 813$ mm

Table 5

v (m/s)	n (min ⁻¹)	Effective diameter of the small pulley d _e (mm)												Additional power per rib for speed ratio r.				
		13	17	20	25	31.5	35.5	40	45	50	63	71	80	1.01	1.06	1.27	>1.57	
														to 1.05	to 1.26	to 1.57		
②	700	0.01	0.02	0.02	0.03	0.04	0.05	0.05	0.06	0.07	0.09	0.10	0.11	0.01	0.01			
	950	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.13	0.15					
	1450	0.02	0.03	0.04	0.06	0.08	0.09	0.10	0.11	0.13	0.17	0.19	0.21					
	2850	0.03	0.05	0.07	0.10	0.14	0.16	0.18	0.21	0.23	0.30	0.34	0.38					
	100	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02					
	300	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.05					
	500	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.08					
	700	0.01	0.02	0.02	0.03	0.04	0.05	0.05	0.06	0.07	0.09	0.10	0.11					
	900	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.08	0.11	0.12	0.14					
	1000	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.12	0.13	0.15					
	1100	0.02	0.02	0.03	0.04	0.06	0.07	0.08	0.09	0.10	0.13	0.15	0.17					
	1200	0.02	0.03	0.03	0.05	0.06	0.07	0.08	0.10	0.11	0.14	0.16	0.18					
	1300	0.02	0.03	0.04	0.05	0.07	0.08	0.09	0.10	0.12	0.15	0.17	0.19					
	1400	0.02	0.03	0.04	0.05	0.07	0.08	0.10	0.11	0.13	0.16	0.18	0.21					
	1500	0.02	0.03	0.04	0.06	0.08	0.09	0.10	0.12	0.13	0.17	0.19	0.22					
	1600	0.02	0.03	0.04	0.06	0.08	0.10	0.11	0.13	0.14	0.18	0.20	0.23					
	1700	0.02	0.04	0.05	0.06	0.09	0.10	0.12	0.13	0.15	0.19	0.22	0.24					
	1800	0.02	0.04	0.05	0.07	0.09	0.11	0.12	0.14	0.16	0.20	0.23	0.26					
	1900	0.02	0.04	0.05	0.07	0.10	0.11	0.13	0.15	0.16	0.21	0.24	0.27					
	2000	0.02	0.04	0.05	0.07	0.10	0.12	0.13	0.15	0.17	0.22	0.25	0.28					
	2100	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.23	0.26	0.29					
	2200	0.03	0.04	0.06	0.08	0.11	0.13	0.15	0.17	0.19	0.24	0.27	0.31					
	2300	0.03	0.05	0.06	0.08	0.11	0.13	0.15	0.17	0.19	0.25	0.28	0.32					
	2400	0.03	0.05	0.06	0.09	0.12	0.14	0.16	0.18	0.20	0.26	0.29	0.33					
	2500	0.03	0.05	0.06	0.09	0.12	0.14	0.16	0.19	0.21	0.27	0.30	0.34					
	2600	0.03	0.05	0.07	0.09	0.13	0.15	0.17	0.19	0.22	0.28	0.31	0.35					
	2700	0.03	0.05	0.07	0.10	0.13	0.15	0.17	0.20	0.22	0.29	0.32	0.37					
	2800	0.03	0.05	0.07	0.10	0.13	0.16	0.18	0.21	0.23	0.30	0.33	0.38					
	2900	0.03	0.06	0.07	0.10	0.14	0.16	0.18	0.21	0.24	0.30	0.34	0.39					
3000	0.03	0.06	0.08	0.10	0.14	0.17	0.19	0.22	0.24	0.31	0.35	0.40						
3100	0.03	0.06	0.08	0.11	0.15	0.17	0.20	0.22	0.25	0.32	0.37	0.41						
3200	0.03	0.06	0.08	0.11	0.15	0.17	0.20	0.23	0.26	0.33	0.38	0.42						
3300	0.03	0.06	0.08	0.11	0.15	0.18	0.21	0.24	0.27	0.34	0.39	0.43						
3400	0.04	0.06	0.08	0.12	0.16	0.18	0.21	0.24	0.27	0.35	0.39	0.44						
3500	0.04	0.06	0.09	0.12	0.16	0.19	0.22	0.25	0.28	0.36	0.40	0.46						
3600	0.04	0.07	0.09	0.12	0.17	0.19	0.22	0.26	0.29	0.37	0.41	0.47						
3700	0.04	0.07	0.09	0.13	0.17	0.20	0.23	0.26	0.29	0.38	0.42	0.48						
3800	0.04	0.07	0.09	0.13	0.17	0.20	0.23	0.27	0.30	0.38	0.43	0.49						
3900	0.04	0.07	0.09	0.13	0.18	0.21	0.24	0.27	0.31	0.39	0.44	0.50						
4000	0.04	0.07	0.10	0.13	0.18	0.21	0.24	0.28	0.31	0.40	0.45	0.51						
4100	0.04	0.07	0.10	0.14	0.19	0.22	0.25	0.29	0.32	0.41	0.46	0.52						
4200	0.04	0.08	0.10	0.14	0.19	0.22	0.25	0.29	0.33	0.42	0.47	0.53						
4400	0.04	0.08	0.10	0.15	0.20	0.23	0.26	0.30	0.34	0.43	0.49	0.55						
4600	0.04	0.08	0.11	0.15	0.21	0.24	0.27	0.31	0.35	0.45	0.51	0.57						
4800	0.05	0.08	0.11	0.16	0.21	0.25	0.28	0.33	0.37	0.47	0.52	0.59						
5000	0.05	0.09	0.12	0.16	0.22	0.26	0.29	0.34	0.38	0.48	0.54	0.60						
5200	0.05	0.09	0.12	0.17	0.23	0.26	0.30	0.35	0.39	0.50	0.56	0.62						
5400	0.05	0.09	0.12	0.17	0.24	0.27	0.31	0.36	0.40	0.51	0.57	0.64						
5600	0.05	0.09	0.13	0.18	0.24	0.28	0.32	0.37	0.42	0.53	0.59	0.66						
5800	0.05	0.10	0.13	0.18	0.25	0.29	0.33	0.38	0.43	0.54	0.61	0.67						
6000	0.05	0.10	0.13	0.19	0.26	0.30	0.34	0.39	0.44	0.56	0.62	0.69						
6200	0.06	0.10	0.14	0.19	0.26	0.31	0.35	0.40	0.45	0.57	0.64	0.70						
6400	0.06	0.11	0.14	0.20	0.27	0.31	0.36	0.41	0.46	0.58	0.65	0.72						
6600	0.06	0.11	0.14	0.20	0.28	0.32	0.37	0.42	0.47	0.60	0.66	0.73						
6800	0.06	0.11	0.15	0.21	0.29	0.33	0.38	0.43	0.49	0.61	0.68	0.75						
7000	0.06	0.11	0.15	0.21	0.29	0.34	0.39	0.44	0.50	0.62	0.69	0.76						
7200	0.06	0.12	0.15	0.22	0.30	0.35	0.40	0.45	0.51	0.63	0.70	0.77						
7400	0.06	0.12	0.16	0.22	0.31	0.35	0.41	0.46	0.52	0.65	0.71	0.78						
7600	0.06	0.12	0.16	0.23	0.31	0.36	0.42	0.47	0.53	0.66	0.73	0.79						
7800	0.06	0.12	0.17	0.23	0.32	0.37	0.42	0.48	0.54	0.67	0.74	0.80						
8000	0.07	0.13	0.17	0.24	0.33	0.38	0.43	0.49	0.55	0.68	0.75	0.81						
8200	0.07	0.13	0.17	0.24	0.33	0.38	0.44	0.50	0.56	0.69	0.76	0.82						
8400	0.07	0.13	0.18	0.25	0.34	0.39	0.45	0.51	0.57	0.70	0.77	0.83						
8600	0.07	0.13	0.18	0.25	0.34	0.40	0.46	0.52	0.58	0.71	0.78	0.83						
8800	0.07	0.13	0.18	0.26	0.35	0.41	0.46	0.53	0.59	0.72	0.78	0.84						
9000	0.07	0.14	0.18	0.26	0.36	0.41	0.47	0.54	0.59	0.73	0.79	0.85						
9200	0.07	0.14	0.19	0.27	0.36	0.42	0.48	0.54	0.60	0.74	0.80	0.85						
9400	0.07	0.14	0.19	0.27	0.37	0.43	0.49	0.55	0.61	0.74	0.81	0.86						
9600	0.07	0.14	0.19	0.28	0.38	0.43	0.50	0.56	0.62	0.75	0.81	0.86						
9800	0.08	0.15	0.20	0.28	0.38	0.44	0.50	0.57	0.63	0.76	0.82	0.86						
10000	0.08	0.15	0.20	0.28	0.39	0.45	0.51	0.58	0.64	0.77	0.82	0.86						
10300	0.08	0.15	0.21	0.29	0.40	0.46	0.52	0.59	0.65	0.77	0.83	0.86						
10600	0.08	0.15	0.21	0.30	0.40	0.47	0.53	0.60	0.66	0.78	0.83	0.86						
10900	0.08	0.16	0.21	0.30	0.41	0.48	0.54	0.61	0.67	0.79	0.84	0.86						
11500	0.08	0.16	0.22	0.32	0.43	0.49	0.56	0.63	0.69	0.80	0.84	0.84						
12100	0.09	0.17	0.23	0.33	0.44	0.51	0.58	0.65	0.70	0.81	0.83	0.82						
12500	0.09	0.17	0.24	0.34	0.45	0.52	0.59	0.66	0.71	0.81	0.83	0.80						
Where v >60 m/s, please consult our Applications Engineers																		
⑩		②0												③0	④0	v (m/s)		

Section PK

Power Ratings P_N (kW) per Rib for $\beta = 180^\circ$ and $L_{\text{eff}} = 1600$ mm

Table 7

v [m/s]	n (min ⁻¹)	Effective diameter of the small pulley d _e (mm)																	Additional power per rib for speed ratio r.			
		45	50	63	71	80	90	100	112	125	140	160	180	190	224	250	280	315	1.01 to 1.05	1.06 to 1.26	1.27 to 1.57	>1.57
②	700	0.17	0.21	0.32	0.38	0.45	0.53	0.61	0.70	0.80	0.91	1.06	1.21	1.28	1.53	1.71	1.92	2.16				
	950	0.21	0.27	0.41	0.49	0.59	0.69	0.79	0.92	1.05	1.20	1.39	1.58	1.68	2.00	2.23	2.50	2.81	0.01	0.02	0.03	0.04
	1450	0.29	0.37	0.58	0.70	0.84	0.99	1.14	1.32	1.51	1.73	2.01	2.28	2.42	2.86	3.19	3.56	3.97	0.01	0.04	0.05	0.06
	2850	0.48	0.63	1.00	1.23	1.48	1.75	2.01	2.32	2.65	3.01	3.47	3.90	4.11	4.75	5.16	5.56	5.91	0.02	0.07	0.10	0.12
	200	0.06	0.08	0.11	0.13	0.15	0.18	0.20	0.23	0.27	0.30	0.35	0.40	0.42	0.50	0.56	0.63	0.71			0.01	0.01
	400	0.11	0.13	0.20	0.24	0.28	0.33	0.37	0.43	0.49	0.56	0.65	0.74	0.78	0.93	1.04	1.17	1.32			0.01	0.02
	600	0.15	0.19	0.28	0.33	0.40	0.46	0.53	0.61	0.70	0.80	0.93	1.06	1.12	1.33	1.49	1.68	1.89		0.01	0.02	0.03
	800	0.19	0.23	0.35	0.43	0.51	0.60	0.68	0.79	0.90	1.03	1.20	1.36	1.44	1.72	1.92	2.16	2.42		0.02	0.03	0.03
	1000	0.22	0.28	0.43	0.52	0.61	0.72	0.83	0.96	1.09	1.25	1.45	1.66	1.76	2.09	2.34	2.62	2.93	0.01	0.02	0.03	0.04
	1100	0.24	0.30	0.46	0.56	0.67	0.78	0.90	1.04	1.19	1.36	1.58	1.80	1.91	2.27	2.53	2.84	3.18		0.01	0.03	0.04
⑤	1200	0.25	0.32	0.50	0.60	0.72	0.85	0.97	1.12	1.28	1.47	1.70	1.94	2.06	2.44	2.73	3.05	3.41	0.01	0.03	0.04	0.05
	1300	0.27	0.34	0.53	0.64	0.77	0.91	1.04	1.20	1.37	1.57	1.83	2.08	2.20	2.61	2.92	3.26	3.64	0.01	0.03	0.04	0.06
	1400	0.29	0.36	0.56	0.68	0.82	0.96	1.11	1.28	1.47	1.67	1.95	2.21	2.35	2.78	3.10	3.46	3.86	0.01	0.03	0.05	0.06
	1500	0.30	0.38	0.60	0.72	0.87	1.02	1.18	1.36	1.56	1.78	2.07	2.35	2.49	2.95	3.28	3.66	4.07	0.01	0.04	0.05	0.06
	1600	0.32	0.40	0.63	0.76	0.92	1.08	1.24	1.44	1.64	1.88	2.18	2.48	2.62	3.11	3.46	3.85	4.28	0.01	0.04	0.05	0.07
	1700	0.33	0.42	0.66	0.80	0.96	1.14	1.31	1.51	1.73	1.98	2.30	2.61	2.76	3.26	3.63	4.03	4.47	0.01	0.04	0.06	0.07
	1800	0.34	0.44	0.69	0.84	1.01	1.19	1.38	1.59	1.82	2.07	2.41	2.73	2.89	3.41	3.79	4.21	4.65	0.01	0.04	0.06	0.08
	1900	0.36	0.46	0.72	0.88	1.06	1.25	1.44	1.66	1.90	2.17	2.52	2.86	3.02	3.56	3.95	4.37	4.83	0.01	0.05	0.06	0.08
	2000	0.37	0.48	0.75	0.92	1.10	1.31	1.50	1.74	1.98	2.27	2.63	2.98	3.15	3.71	4.11	4.54	4.99	0.01	0.05	0.07	0.08
	2100	0.39	0.50	0.79	0.96	1.15	1.36	1.57	1.81	2.07	2.36	2.74	3.10	3.27	3.85	4.25	4.69	5.15	0.01	0.05	0.07	0.09
⑩	2200	0.40	0.52	0.82	1.00	1.20	1.41	1.63	1.88	2.15	2.45	2.84	3.21	3.40	3.98	4.40	4.83	5.29	0.01	0.05	0.07	0.09
	2300	0.41	0.53	0.84	1.03	1.24	1.47	1.69	1.95	2.23	2.54	2.94	3.33	3.51	4.11	4.53	4.97	5.42	0.01	0.06	0.08	0.10
	2400	0.42	0.55	0.87	1.07	1.28	1.52	1.75	2.02	2.31	2.63	3.04	3.44	3.63	4.24	4.66	5.10	5.54	0.01	0.06	0.08	0.10
	2500	0.44	0.57	0.90	1.10	1.33	1.57	1.81	2.09	2.39	2.72	3.14	3.55	3.74	4.36	4.79	5.22	5.64	0.01	0.06	0.08	0.11
	2600	0.45	0.59	0.93	1.14	1.37	1.62	1.87	2.16	2.46	2.80	3.24	3.65	3.85	4.48	4.90	5.33	5.74	0.02	0.06	0.09	0.11
	2700	0.46	0.60	0.96	1.18	1.41	1.67	1.93	2.22	2.54	2.89	3.33	3.76	3.96	4.59	5.01	5.43	5.82	0.02	0.07	0.09	0.11
	2800	0.47	0.62	0.99	1.21	1.46	1.72	1.98	2.29	2.61	2.97	3.43	3.86	4.06	4.69	5.11	5.52	5.88	0.02	0.07	0.09	0.12
	2900	0.49	0.64	1.02	1.25	1.50	1.77	2.04	2.36	2.69	3.05	3.52	3.95	4.16	4.79	5.21	5.60	5.94	0.02	0.07	0.10	0.12
	3000	0.50	0.65	1.04	1.28	1.54	1.82	2.10	2.42	2.76	3.13	3.61	4.05	4.25	4.89	5.30	5.67	5.97	0.02	0.07	0.10	0.13
	3100	0.51	0.67	1.07	1.31	1.58	1.87	2.15	2.48	2.83	3.21	3.69	4.14	4.35	4.98	5.38	5.73	6.00	0.02	0.08	0.10	0.13
②0	3200	0.52	0.68	1.10	1.35	1.62	1.92	2.21	2.54	2.90	3.29	3.77	4.22	4.43	5.06	5.45	5.78	6.01	0.02	0.08	0.11	0.14
	3300	0.53	0.70	1.12	1.38	1.66	1.97	2.26	2.61	2.97	3.36	3.86	4.31	4.52	5.14	5.51	5.82		0.02	0.08	0.11	0.14
	3400	0.54	0.71	1.15	1.41	1.70	2.01	2.31	2.67	3.03	3.43	3.93	4.39	4.60	5.21	5.57	5.85		0.02	0.08	0.11	0.14
	3500	0.55	0.73	1.18	1.44	1.74	2.06	2.37	2.73	3.10	3.51	4.01	4.47	4.67	5.28	5.62	5.86		0.02	0.09	0.12	0.15
	3600	0.56	0.74	1.20	1.48	1.78	2.10	2.42	2.78	3.16	3.58	4.08	4.54	4.75	5.34	5.65	5.87		0.02	0.09	0.12	0.15
	3700	0.57	0.76	1.23	1.51	1.82	2.15	2.47	2.84	3.23	3.64	4.15	4.61	4.82	5.39	5.68	5.86		0.02	0.09	0.12	0.16
	3800	0.58	0.77	1.25	1.54	1.85	2.19	2.52	2.90	3.29	3.71	4.22	4.68	4.88	5.43	5.70			0.02	0.09	0.13	0.16
	3900	0.59	0.79	1.28	1.57	1.89	2.24	2.57	2.95	3.35	3.77	4.29	4.74	4.94	5.47	5.71			0.02	0.10	0.13	0.17
	4000	0.60	0.80	1.30	1.60	1.93	2.28	2.62	3.01	3.41	3.83	4.35	4.80	4.99	5.50	5.72			0.02	0.10	0.13	0.17
	4100	0.61	0.82	1.33	1.63	1.96	2.32	2.66	3.06	3.46	3.89	4.41	4.85	5.04	5.53	5.71			0.02	0.10	0.14	0.17
③0	4200	0.62	0.83	1.35	1.66	2.00	2.36	2.71	3.11	3.52	3.95	4.47	4.91	5.09	5.54	5.69			0.02	0.10	0.14	0.18
	4300	0.63	0.84	1.37	1.69	2.03	2.40	2.76	3.16	3.57	4.01	4.52	4.95	5.13	5.55				0.03	0.11	0.14	0.18
	4400	0.64	0.86	1.40	1.72	2.07	2.44	2.80	3.21	3.63	4.06	4.57	5.00	5.17	5.56				0.03	0.11	0.15	0.19
	4500	0.65	0.87	1.42	1.75	2.10	2.48	2.85	3.26	3.68	4.12	4.62	5.03	5.20	5.55				0.03	0.11	0.15	0.19
	4600	0.66	0.88	1.44	1.78	2.14	2.52	2.89	3.31	3.73	4.17	4.67	5.07	5.23	5.54				0.03	0.11	0.15	0.19
	4700	0.67	0.90	1.47	1.80	2.17	2.56	2.93	3.35	3.77	4.21	4.71	5.10	5.25	5.51				0.03	0.11	0.16	0.20
	4800	0.68	0.91	1.49	1.83	2.20	2.60	2.97	3.40	3.82	4.26	4.75	5.13	5.27	5.48				0.03	0.12	0.16	0.20
	4900	0.69	0.92	1.51	1.86	2.23	2.63	3.01	3.44	3.87	4.30	4.79	5.15	5.28					0.03	0.12	0.16	0.21
	5000	0.69	0.93	1.53	1.88	2.27	2.67	3.05	3.48	3.91	4.34	4.82	5.16	5.28					0.03	0.12	0.17	0.21
	5100	0.70	0.94	1.55	1.91	2.30	2.71	3.09	3.53	3.95	4.38	4.85	5.18	5.28					0.03	0.12	0.17	0.22
④0	5200	0.71	0.96	1.57	1.94	2.33	2.74	3.13	3.57	3.99	4.42	4.87	5.18	5.28					0.03	0.13	0.17	0.22
	5300	0.72	0.97	1.59	1.96	2.36	2.78	3.17	3.60	4.03	4.45	4.90	5.19	5.27					0.03	0.13	0.18	0.22
	5400	0.73	0.98	1.62	1.99	2.39	2.81	3.20	3.64													



Power Transmission

Section PL

Power Ratings P_N (kW) per Rib for $\beta = 180^\circ$ and $L_{eff} = 2096$ mm

Table 8

v (m/s)	n (min ⁻¹)	Effective diameter of the small pulley d _e (mm)																Additional power per rib for speed ratio r.			
		76	80	90	100	112	125	140	160	180	200	224	250	280	315	355	400	1.01 to 1.05	1.06 to 1.26	1.27 to 1.57	>1.57
5	700	0.49	0.53	0.64	0.74	0.87	1.00	1.15	1.34	1.54	1.73	1.96	2.20	2.48	2.80	3.16	3.55	0.01	0.03	0.04	0.06
	950	0.63	0.69	0.83	0.96	1.12	1.30	1.49	1.75	2.01	2.26	2.56	2.87	3.23	3.64	4.09	4.58	0.01	0.04	0.06	0.08
	1450	0.89	0.97	1.17	1.37	1.60	1.85	2.14	2.51	2.88	3.23	3.65	4.09	4.58	5.12	5.71	6.32	0.02	0.07	0.09	0.12
	2850	1.50	1.65	2.00	2.35	2.76	3.19	3.67	4.28	4.85	5.38	5.96	6.51	7.04	7.51	7.82	7.84	0.03	0.13	0.18	0.23
	100	0.10	0.10	0.12	0.14	0.16	0.18	0.21	0.24	0.28	0.31	0.35	0.39	0.44	0.50	0.56	0.63			0.01	0.01
	200	0.17	0.19	0.22	0.25	0.29	0.34	0.38	0.45	0.51	0.57	0.65	0.73	0.82	0.92	1.04	1.17		0.01	0.01	0.02
	300	0.24	0.26	0.31	0.36	0.42	0.48	0.55	0.64	0.73	0.82	0.93	1.04	1.17	1.32	1.50	1.69		0.01	0.02	0.02
	400	0.31	0.34	0.40	0.46	0.53	0.61	0.70	0.82	0.94	1.06	1.20	1.35	1.52	1.71	1.93	2.18		0.02	0.03	0.03
	500	0.37	0.40	0.48	0.56	0.65	0.75	0.86	1.00	1.15	1.29	1.46	1.64	1.85	2.09	2.35	2.65	0.01	0.02	0.03	0.04
	600	0.43	0.47	0.56	0.65	0.76	0.87	1.00	1.18	1.35	1.51	1.71	1.93	2.17	2.45	2.76	3.11	0.01	0.03	0.04	0.05
	700	0.49	0.53	0.64	0.74	0.87	1.00	1.15	1.34	1.54	1.73	1.96	2.20	2.48	2.80	3.16	3.55	0.01	0.03	0.04	0.06
	800	0.55	0.60	0.71	0.83	0.97	1.12	1.29	1.51	1.73	1.95	2.20	2.48	2.79	3.14	3.54	3.97	0.01	0.04	0.05	0.06
	900	0.61	0.66	0.79	0.92	1.07	1.24	1.42	1.67	1.92	2.16	2.44	2.74	3.08	3.47	3.91	4.38	0.01	0.04	0.06	0.07
	1000	0.66	0.72	0.86	1.00	1.17	1.35	1.56	1.83	2.10	2.36	2.67	3.00	3.37	3.80	4.27	4.78	0.01	0.05	0.06	0.08
	10	1100	0.71	0.78	0.93	1.09	1.27	1.47	1.69	1.99	2.28	2.56	2.90	3.25	3.65	4.11	4.61	5.15	0.01	0.05	0.07
1200		0.76	0.83	1.00	1.17	1.37	1.58	1.82	2.14	2.45	2.76	3.12	3.50	3.93	4.41	4.94	5.51	0.01	0.06	0.08	0.10
1300		0.82	0.89	1.07	1.25	1.46	1.69	1.95	2.29	2.62	2.95	3.33	3.74	4.19	4.70	5.26	5.85	0.01	0.06	0.08	0.11
1400		0.87	0.94	1.14	1.33	1.56	1.80	2.08	2.44	2.79	3.14	3.55	3.97	4.45	4.98	5.56	6.16	0.02	0.07	0.09	0.11
1500		0.91	1.00	1.20	1.41	1.65	1.91	2.20	2.58	2.96	3.32	3.75	4.20	4.70	5.25	5.85	6.46	0.02	0.07	0.10	0.12
1600		0.96	1.05	1.27	1.49	1.74	2.01	2.32	2.73	3.12	3.50	3.95	4.42	4.94	5.51	6.12	6.74	0.02	0.07	0.10	0.13
1700		1.01	1.10	1.33	1.56	1.83	2.12	2.44	2.87	3.28	3.68	4.15	4.63	5.17	5.75	6.37	6.99	0.02	0.08	0.11	0.14
1800		1.06	1.15	1.40	1.64	1.92	2.22	2.56	3.00	3.43	3.85	4.34	4.84	5.39	5.99	6.61	7.22	0.02	0.08	0.12	0.15
1900		1.10	1.21	1.46	1.71	2.00	2.32	2.68	3.14	3.59	4.02	4.52	5.04	5.60	6.21	6.82	7.42	0.02	0.09	0.12	0.15
2000		1.15	1.25	1.52	1.78	2.09	2.42	2.79	3.27	3.73	4.18	4.70	5.23	5.80	6.41	7.02	7.59	0.02	0.09	0.13	0.16
2100		1.19	1.30	1.58	1.85	2.17	2.52	2.90	3.40	3.88	4.34	4.87	5.41	5.99	6.60	7.20	7.74	0.02	0.10	0.13	0.17
2200		1.24	1.35	1.64	1.92	2.26	2.61	3.01	3.53	4.02	4.50	5.04	5.59	6.17	6.78	7.36	7.86	0.02	0.10	0.14	0.18
2300		1.28	1.40	1.70	1.99	2.34	2.70	3.12	3.65	4.16	4.65	5.20	5.75	6.34	6.94	7.49	7.95	0.03	0.11	0.15	0.19
2400		1.32	1.45	1.76	2.06	2.42	2.80	3.22	3.77	4.29	4.79	5.35	5.91	6.50	7.08	7.61	8.00	0.03	0.11	0.15	0.19
20		2500	1.36	1.49	1.81	2.13	2.50	2.89	3.33	3.89	4.42	4.93	5.50	6.06	6.64	7.21	7.70	8.03	0.03	0.12	0.16
	2600	1.40	1.54	1.87	2.19	2.57	2.98	3.43	4.00	4.55	5.06	5.64	6.20	6.77	7.32	7.76	8.02	0.03	0.12	0.17	0.21
	2700	1.44	1.58	1.92	2.26	2.65	3.06	3.52	4.11	4.67	5.19	5.77	6.33	6.89	7.41	7.81	7.98	0.03	0.13	0.17	0.22
	2800	1.48	1.63	1.98	2.32	2.72	3.15	3.62	4.22	4.79	5.32	5.90	6.45	7.00	7.48	7.82	7.90	0.03	0.13	0.18	0.23
	2900	1.52	1.67	2.03	2.38	2.80	3.23	3.72	4.33	4.90	5.43	6.01	6.56	7.09	7.54	7.81		0.03	0.14	0.19	0.23
	3000	1.56	1.71	2.08	2.45	2.87	3.31	3.81	4.43	5.01	5.55	6.13	6.67	7.17	7.57	7.77		0.03	0.14	0.19	0.24
	3100	1.60	1.75	2.13	2.51	2.94	3.39	3.90	4.53	5.12	5.65	6.23	6.76	7.23	7.59	7.71		0.03	0.14	0.20	0.25
	3200	1.63	1.79	2.18	2.56	3.01	3.47	3.98	4.62	5.22	5.75	6.32	6.83	7.28	7.58			0.04	0.15	0.20	0.26
	3300	1.67	1.83	2.23	2.62	3.08	3.55	4.07	4.72	5.31	5.85	6.41	6.90	7.31	7.56			0.04	0.15	0.21	0.27
	3400	1.71	1.87	2.28	2.68	3.14	3.62	4.15	4.81	5.40	5.94	6.49	6.96	7.33	7.51			0.04	0.16	0.22	0.28
	3500	1.74	1.91	2.33	2.74	3.21	3.69	4.23	4.89	5.49	6.02	6.56	7.00	7.33	7.44			0.04	0.16	0.22	0.28
	3600	1.78	1.95	2.38	2.79	3.27	3.77	4.31	4.97	5.57	6.09	6.62	7.04	7.32	7.34			0.04	0.17	0.23	0.29
	3700	1.81	1.99	2.42	2.84	3.33	3.83	4.38	5.05	5.65	6.16	6.67	7.06	7.29				0.04	0.17	0.24	0.30
	3800	1.84	2.02	2.47	2.90	3.39	3.90	4.45	5.13	5.72	6.23	6.71	7.07	7.24				0.04	0.18	0.24	0.31
	3900	1.87	2.06	2.51	2.95	3.45	3.96	4.52	5.20	5.78	6.28	6.74	7.06	7.17				0.04	0.18	0.25	0.32
30	4000	1.91	2.09	2.55	3.00	3.51	4.03	4.59	5.26	5.85	6.33	6.76	7.04	7.09				0.05	0.19	0.26	0.32
	4100	1.94	2.13	2.60	3.05	3.56	4.09	4.65	5.32	5.90	6.37	6.78	7.01					0.05	0.19	0.26	0.33
	4200	1.97	2.16	2.64	3.09	3.61	4.15	4.71	5.38	5.95	6.40	6.78	6.97					0.05	0.20	0.27	0.34
	4300	2.00	2.19	2.68	3.14	3.67	4.20	4.77	5.44	5.99	6.43	6.77	6.91					0.05	0.20	0.28	0.35
	4400	2.03	2.23	2.72	3.18	3.72	4.25	4.82	5.49	6.03	6.45	6.75	6.83					0.05	0.21	0.28	0.36
	4500	2.05	2.26	2.75	3.23	3.76	4.31	4.88	5.53	6.06	6.46	6.73	6.74					0.05	0.21	0.29	0.36
	4600	2.08	2.29	2.79	3.27	3.81	4.36	4.92	5.58	6.09	6.46	6.68						0.05	0.22	0.29	0.37
	4700	2.11	2.32	2.83	3.31	3.86	4.40	4.97	5.61	6.11	6.45	6.63						0.05	0.22	0.30	0.38
	4800	2.13	2.35	2.86	3.35	3.90	4.45	5.01	5.64	6.13	6.44	6.57						0.05	0.22	0.31	0.39
	4900	2.16	2.37	2.89	3.39	3.94	4.49	5.05	5.67	6.13	6.42	6.50						0.06	0.23	0.31	0.40
	5000	2.18	2.40	2.93	3.42	3.98	4.53	5.09	5.70	6.13	6.38	6.41						0.06	0.23	0.32	0.40
	5100	2.21	2.43	2.96	3.46	4.02	4.57	5.12	5.71	6.13	6.34							0.06	0.24	0.33	0.41
	5200	2.23	2.45	2.99	3.49	4.05	4.60	5.15	5.73	6.12	6.29										

Section PM

Power Ratings P_N (kW) per Rib for $\beta = 180^\circ$ and $L_{eff} = 4089$ mm

Table 9

v (m/s)	n (min ⁻¹)	Effective diameter of the small pulley d_e (mm)																Additional power per rib for speed ratio r .			
		180	190	200	224	250	280	315	355	400	450	500	560	630	710	800	1000	to 1.05	to 1.26	to 1.57	>1.57
5	700	3.51	3.83	4.16	4.93	5.75	6.68	7.74	8.93	10.22	11.60	12.92	14.43	16.07	17.78	19.47	22.23	0.06	0.24	0.33	0.42
	950	4.46	4.88	5.30	6.29	7.34	8.52	9.85	11.31	12.86	14.48	15.97	17.58	19.20	20.65	21.74	21.79	0.08	0.33	0.45	0.56
	1450	6.06	6.65	7.22	8.57	9.96	11.47	13.11	14.80	16.43	17.90	18.97	19.66	19.57	18.16	14.71		0.12	0.50	0.68	0.86
	2850	8.24	8.97	9.64	11.01	12.10	12.77	12.69	11.34	8.03	1.86							0.24	0.98	1.34	1.69
	100	0.70	0.76	0.81	0.95	1.09	1.26	1.45	1.66	1.90	2.17	2.43	2.74	3.10	3.50	3.95	4.93	0.01	0.03	0.05	0.06
	200	1.25	1.36	1.46	1.72	1.99	2.30	2.66	3.06	3.51	4.00	4.49	5.07	5.73	6.48	7.31	9.10	0.02	0.07	0.09	0.12
	300	1.76	1.91	2.06	2.43	2.82	3.27	3.78	4.36	5.00	5.71	6.40	7.22	8.16	9.22	10.37	12.82	0.02	0.10	0.14	0.18
	400	2.23	2.43	2.62	3.10	3.60	4.18	4.84	5.59	6.42	7.32	8.20	9.24	10.42	11.73	13.15	16.08	0.03	0.14	0.19	0.24
	500	2.67	2.92	3.16	3.73	4.35	5.05	5.86	6.76	7.75	8.83	9.89	11.12	12.50	14.01	15.62	18.79	0.04	0.17	0.23	0.30
	600	3.10	3.39	3.67	4.35	5.07	5.88	6.82	7.87	9.02	10.26	11.46	12.85	14.39	16.04	17.74	20.87	0.05	0.21	0.28	0.36
10	700	3.51	3.83	4.16	4.93	5.75	6.68	7.74	8.93	10.22	11.60	12.92	14.43	16.07	17.78	19.47	22.23	0.06	0.24	0.33	0.42
	800	3.90	4.27	4.63	5.49	6.41	7.44	8.62	9.92	11.34	12.83	14.25	15.83	17.51	19.20	20.75	22.76	0.07	0.27	0.38	0.48
	900	4.27	4.68	5.08	6.03	7.04	8.17	9.45	10.86	12.38	13.96	15.43	17.05	18.70	20.26	21.55	22.37	0.07	0.31	0.42	0.53
	1000	4.63	5.07	5.51	6.55	7.64	8.86	10.24	11.74	13.33	14.97	16.47	18.07	19.62	20.94	21.79		0.08	0.34	0.47	0.59
	1100	4.98	5.45	5.93	7.04	8.21	9.51	10.97	12.55	14.20	15.87	17.35	18.86	20.22	21.19	21.44		0.09	0.38	0.52	0.65
	1200	5.31	5.82	6.32	7.51	8.75	10.12	11.65	13.28	14.97	16.63	18.05	19.42	20.50	20.97			0.10	0.41	0.56	0.71
	1300	5.62	6.16	6.70	7.95	9.26	10.70	12.28	13.95	15.64	17.25	18.57	19.72	20.42	20.26			0.11	0.45	0.61	0.77
	1400	5.92	6.49	7.05	8.37	9.73	11.23	12.85	14.53	16.20	17.73	18.89	19.75	19.95				0.12	0.48	0.66	0.83
	1500	6.20	6.80	7.39	8.76	10.18	11.71	13.36	15.04	16.64	18.04	18.99	19.49					0.12	0.51	0.70	0.89
	1600	6.47	7.09	7.71	9.13	10.58	12.15	13.80	15.45	16.97	18.19	18.87	18.91					0.13	0.55	0.75	0.95
20	1700	6.72	7.36	8.00	9.47	10.96	12.54	14.18	15.78	17.17	18.16	18.51						0.14	0.58	0.80	1.01
	1800	6.95	7.62	8.27	9.78	11.29	12.88	14.49	16.00	17.23	17.94	17.90						0.15	0.62	0.85	1.07
	1900	7.16	7.85	8.52	10.06	11.58	13.16	14.73	16.13	17.15	17.53							0.16	0.65	0.89	1.13
	2000	7.36	8.07	8.75	10.30	11.84	13.39	14.89	16.15	16.92	16.91							0.17	0.69	0.94	1.19
	2100	7.54	8.26	8.96	10.52	12.05	13.56	14.97	16.06	16.54								0.17	0.72	0.99	1.25
	2200	7.70	8.43	9.13	10.71	12.21	13.67	14.97	15.85	16.00								0.18	0.76	1.03	1.31
	2300	7.84	8.58	9.29	10.86	12.33	13.72	14.88	15.52	15.29								0.19	0.79	1.08	1.37
	2400	7.96	8.70	9.41	10.97	12.41	13.71	14.70	15.07									0.20	0.82	1.13	1.43
	2500	8.06	8.81	9.51	11.05	12.43	13.62	14.43	14.48									0.21	0.86	1.17	1.48
	2600	8.14	8.88	9.59	11.09	12.40	13.47	14.06	13.76									0.22	0.89	1.22	1.54
	2700	8.20	8.94	9.63	11.09	12.32	13.25	13.59										0.22	0.93	1.27	1.60
	2800	8.23	8.96	9.64	11.05	12.19	12.95	13.02										0.23	0.96	1.32	1.66
	2900	8.24	8.96	9.63	10.97	12.00	12.57	12.34										0.24	1.00	1.36	1.72
	3000	8.23	8.93	9.58	10.85	11.75	12.12											0.25	1.03	1.41	1.78
	3100	8.19	8.88	9.50	10.68	11.44	11.58											0.26	1.06	1.46	1.84
	3200	8.13	8.79	9.38	10.46	11.07	10.96											0.26	1.10	1.50	1.90

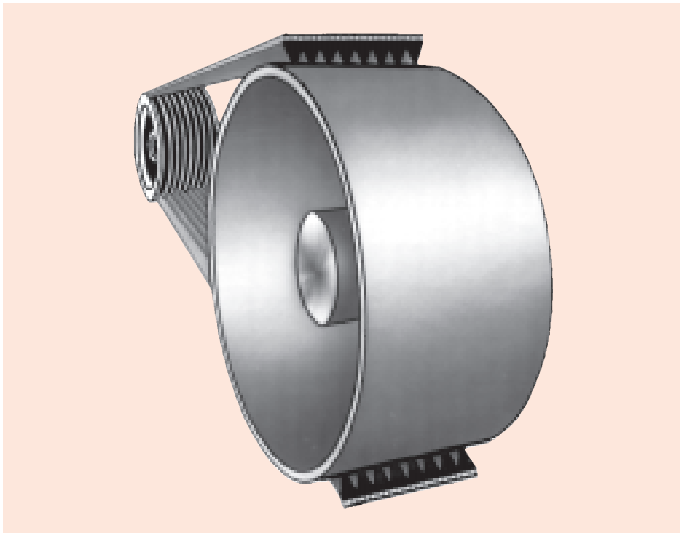
Where $v > 30$ m/s,
please consult our
Applications
Engineers

Special Drives

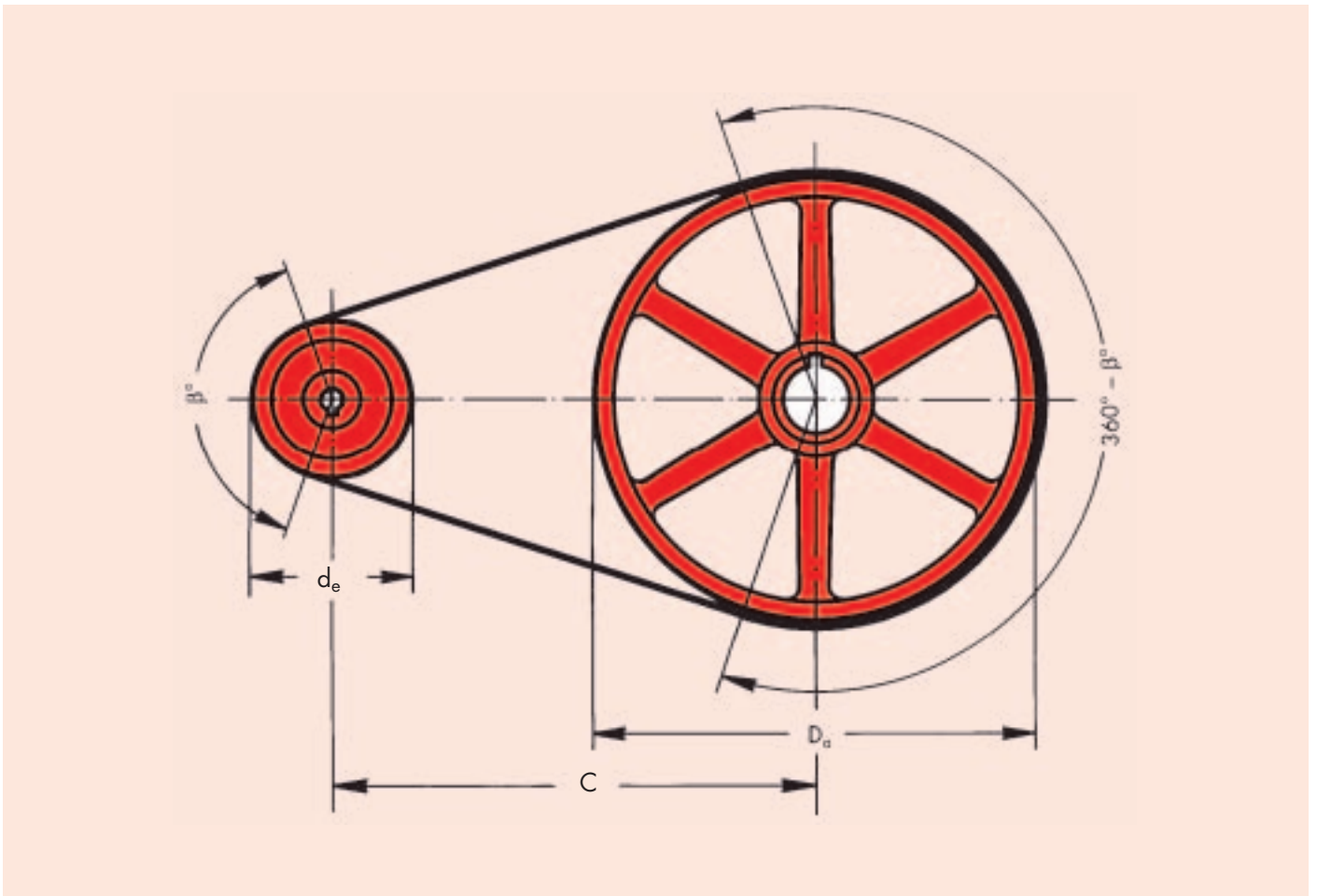
V-Flat Drive

The V-Flat drive utilises a Ribbed Belt pulley and a flat faced pulley. Under certain conditions, this type of drive can be used for drives which are subject to shock loadings or have high moments of inertia. Because flywheels or flat pulleys are quite often already fitted, drive costs can be reduced. When converting a flat belt drive

to a V-Flat drive, it is usually economical to continue to use the larger flat pulley.



C	= Drive centre distance	(mm)
b	= Flat pulley face width	(mm)
b_2	= Ribbed Belt pulley face width	(mm)
D_a	= Flat pulley outside diameter	(mm)
D_z	= Allowance for determining the theoretical diameter	(mm)
d_e	= Effective diameter of Ribbed Belt pulley(mm)	
f	= Allowance for determining the flat pulley face width	(mm)
h	= Crown height per 100 mm of pulley face width	(mm)
r	= Speed ratio	
L_{eth}	= Calculated belt effective length	(mm)
K	= K factor	



Special Drives

V-Flat Drive

Calculation of V-Flat Drives

The calculation for a V-Flat drive is undertaken in the same manner as shown on pages 15 to 17. The following important requirements must be checked so as to ensure a reliable and efficient V-Flat drive.

- The grooved pulley must always be the small pulley.
- The V-Flat drive is particularly economical when

$$K = \frac{D_a - d_e}{a} \text{ lies between } 0.5 \text{ and } 1.15.$$

The ideal drive is achieved when $K = 0.85$. If the "K" factor falls outside the recommended range, it is then more economical to use a normal ribbed belt drive with grooved pulleys.

- The following recommendations are made based upon the above requirements:

Speed ratio	$i = \frac{D_a + D_z}{d_e + 2 b_e} \geq 3$
Drive centre distance	$c_{\text{actual}} \leq D_a$
	$c = \frac{D_a - d_e}{0.85}$
K-Factor	$K = \frac{D_a - d_e}{a}$
	$K_{\text{actual}} \text{ } 0.5 \text{ to } 1.15$

- When calculating the number of ribs and the belt tension, care must be taken to ensure that a **special arc of contact correction factor c_1** as detailed in the following table 10 is applied.

Table 10 Arc of contact correction factor c_1 (for V-Flat drives only)

$K = \frac{D_a - d_e}{c}$	$\beta \approx$	c_1
0	180°	0.75
0.07	176°	0.76
0.15	170°	0.77
0.22	167°	0.79
0.29	163°	0.79
0.35	160°	0.80
0.40	156°	0.81
0.45	153°	0.81
0.50	150°	0.82
0.57	146°	0.83
0.64	143°	0.84
0.70	140°	0.85
0.75	137°	0.85
0.80	134°	0.86
0.85	130°	0.86
0.92	125°	0.84
1.00	120°	0.82
1.07	115°	0.80
1.15	110°	0.78
1.21	106°	0.77
1.30	100°	0.73
1.36	96°	0.72
1.45	90°	0.70

The length calculation is for the effective length L_e . Therefore, in order to obtain the theoretical calculation diameter, an allowance D_z must be added to the flat pulley outside diameter.

Table 11: Effective Line Difference h_b

Section	PH	PJ	PK	PL	PM
h_b	0.80	1.25	1.60	3.50	5.00
D_z	1.60	2.70	3.50	6.50	11.00

Calculation of the Effective Length

$$L_{\text{eth}} \approx 2 c + 1.57 (d_e + D_a + D_z) + \frac{(D_a + D_z - d_e)^2}{4 c}$$

Formula:

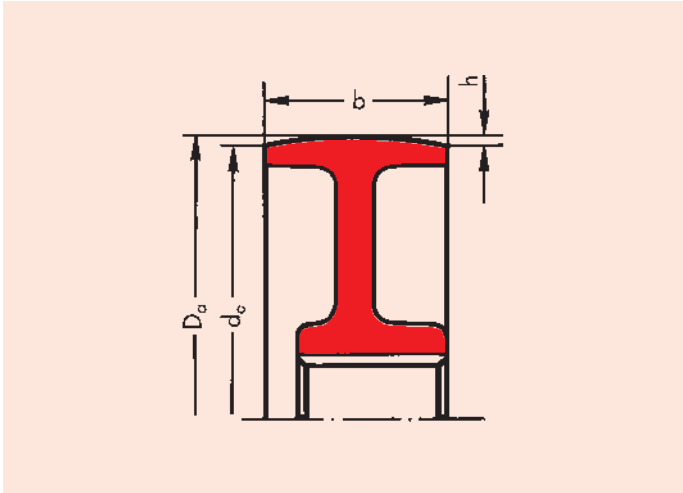
Calculation of the static belt tension for V-Flat Drives

$$T = \frac{500 \cdot (2.25 - c_1) \cdot P_B}{c_1 \cdot z \cdot v} + k \cdot v^2$$

In addition to the drive design on page 15 to 17, the static belt tension for V-Flat Drives must be calculated with the adjoining formula.

Special Drives V-Flat Drive

- The flat pulley should have a flat faced outside diameter. If a crowned pulley is to be re-used then the crown height should be checked as follows.



The following condition is to be maintained:

Maximum Crown Height

$h_{\max} = 1 \text{ mm per } 100 \text{ mm pulley face width}$

$$h = \frac{D_a - d_a}{2}$$

Additionally, the pulley face width must be calculated, or checked, as follows: Given/calculated

Grooved pulley 12 grooves
Section PJ
Drive centre distance C 380 mm

Solution:

$$b = b_2 + f$$

$$b = 62.0 + 10 = \mathbf{72.0 \text{ mm}}$$

b_2 from page 37

f taken from table 12

Choose standard flat pulley face width $b = \mathbf{72 \text{ mm}}$

Table 12: Allowance f for Determining the Flat Pulley Face Width

Sections PH, PJ, PK, PL, PM	
Drive centre distance C (mm)	f (mm)
≤ 500	10
$> 500 \leq 750$	15
$> 750 \leq 1000$	20
$> 1000 \leq 1250$	25
$> 1250 \leq 1750$	30
$> 1750 \leq 2250$	40
> 2250	50

Special Drives Tensioning / Guide Pulleys

Tensioning / guide pulleys are ribbed or flat faced and do not transmit power within a drive system. Because they create additional bending stresses within the belt their use should be restricted to the following applications if possible:

- with fixed drive centres to produce the required belt tension and to provide for maximum belt stretch and wear
- as damping and guide rollers with long span lengths
- as guide rollers on drives where the pulleys are not all positioned in one plane
- as movable tensioners, to achieve a constant belt tension. This results in reduced maintenance and longer service life. The tension force is normally generated by springs, pneumatics or hydraulics

If idler pulleys have to be used for the reasons mentioned above, the following criteria should be observed in drive design:

- position of the pulley in the belt span
- diameter
- shape
- the adjustment travel of the pulley, both for tensioning and retensioning the ribbed belts
- correction of the power rating per rib P_N

Idler Arrangement

Depending upon the drive conditions, idlers can be used externally or internally.

If the design conditions do not favour an external idler, an internal idler is then generally more advantageous. Internal idler diameters can be smaller than external idler diameters.

Flat pulleys, whether used internally or externally should be at least as wide as the other pulleys on the drive and should be placed as close as possible to the next pulley the belt will run onto.

Internal idlers can be grooved pulleys or flat pulleys, if in doubt, please contact our engineers.

Internal idler reduce the arc of contact on the loaded pulleys and hence also the arc of contact correction factor c_1 . When calculating the number of ribs, the arc of contact correction factor is to be selected at the point of the maximum belt extension (see table 14, page 27).

Ribbed belt pulleys are to be preferred as internal idlers on long spans as flat pulleys could permit the development of lateral vibration.

External idlers Because they run on the belt top surface, external idlers must basically be produced as flat pulleys. They increase the arc of contact. Care must be taken to ensure that maximum possible belt stretch can be taken up, and, in doing so, that contact is not made with the opposite belt span.

Idlers in the Tight / Slack Side

Both the theoretical power transmission formulae and actual practice have shown that wherever possible the idler should be placed in the slack side of the drive. This allows the idler tension force to be maintained at a considerably lower level. A spring loaded idler must not be used in a reversing drive because the tight and slack sides change continuously.

Our engineers will give advice concerning the special problems regarding spring loaded idlers.

Minimum diameter for internal idlers

Internal idler \geq the smallest driven pulley in the system.

Minimum diameter for external idlers

External idler ≥ 1.2 times the smallest loaded pulley in the system.

Exceptions

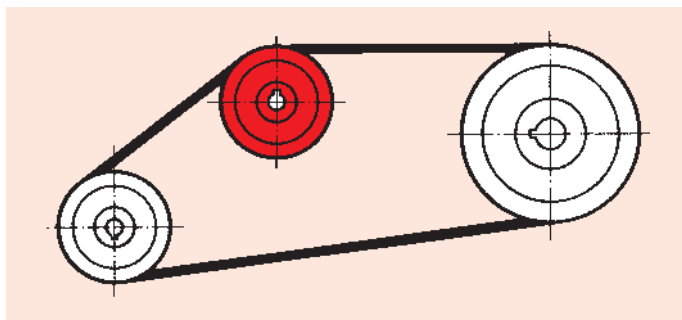
Section	Diameter of the smallest loaded pulley in the system (mm)	Minimum diameter of the external idler (mm)
PH	13 to 30	40
PJ	20 to 40	50
PK	45 to 50	60
PL	75 to 125	150
PM	180 to 250	300

Failure to observe the minimum recommended idler size will impair the service life of the ribbed belts

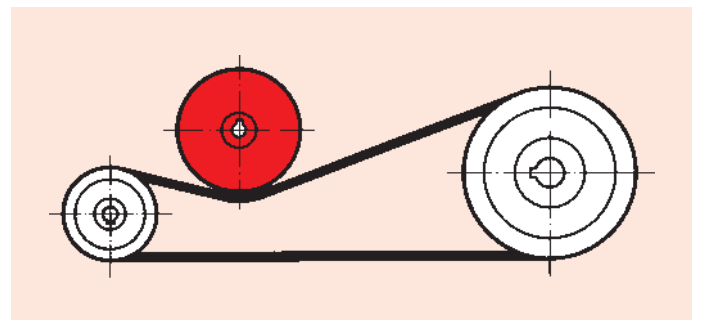
Idler design

Ribbed belt pulleys used as idlers should have standard groove dimensions. Flat pulleys should wherever possible be cylindrical, not crowned.

Internal idler



External idler



Special Drives Tensioning / Guide Pulleys

Drive calculation

The length calculation and the determination of the number of ribs is undertaken as for two pulley drives. Certain details are, however, to be noted:

1. Calculate the Ribbed Belt length over two pulleys using the formula:

$$L_{eth} \approx 2c + 1.57 (D_e + d_e) + \frac{(D_e - d_e)^2}{4c}$$

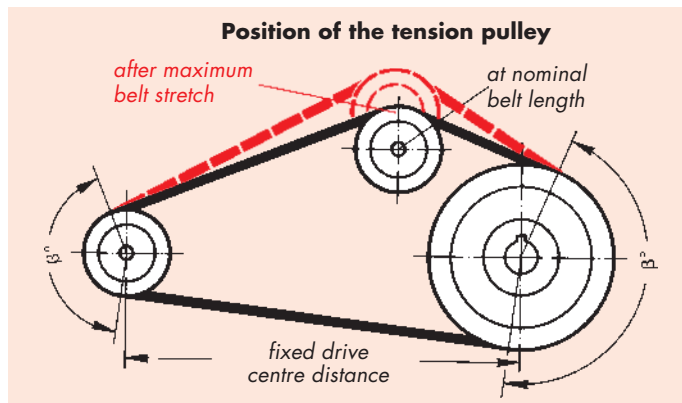
2. If the ribbed belt has to be fitted with a fixed drive centre distance, double the adjustment travel y from table 3 page 12 should be added to the belt length L_{eth}

$$L_e = L_{eth} + 2y$$

3. The next longest standard length L_{es} should then be selected.

A check should be made, usually by layout drawing, to determine whether the belt can be adequately tensioned with the idler in the outermost position. In this idler position, both the standard length L_{es} and double the adjustment for stretch and wear x must be taken up.

$$L_e \text{ for idler end position} = L_{es} + 2x$$



Number of idlers

The application of idlers increases the bending stress in the ribbed belts. To avoid a reduction in belt service life, the idler correction factor c_4 must also be included in the calculation. This correction factor takes the number of idlers into consideration with the minimum diameter being maintained.

Table 13

Number of idlers	c_4
0	1.00
1	0.91
2	0.86
3	0.81

The nominal power rating P_N per rib is as previously based on the smallest **loaded pulley**.

In determining the arc of contact correction factor c_1 , the smallest contact angle of the loaded pulley which occurs at maximum belt extension must be used.

Table 14: Arc of Contact Correction Factor c_1

$\beta \approx$	c_1	$\beta \approx$	c_1
75°	0.78	175°	1.00
80°	0.82	180°	1.00
85°	0.84	185°	1.00
90°	0.85	190°	1.01
95°	0.87	195°	1.01
100°	0.89	200°	1.01
105°	0.90	205°	1.01
110°	0.91	210°	1.01
115°	0.92	215°	1.02
120°	0.93	220°	1.02
125°	0.94	225°	1.02
130°	0.95	230°	1.02
135°	0.96	240°	1.02
140°	0.97	250°	1.02
145°	0.97		
150°	0.98		
155°	0.98		
160°	0.99		
165°	0.99		
170°	0.99		

The following formula for the determination of the number of ribs is obtained using the idler correction factor c_4 .

$$z = \frac{P \cdot c_2}{P_N \cdot c_1 \cdot c_3 \cdot c_4}$$

Ribbed Belt Pulleys

Measuring Pulleys - Length Measuring Conditions to DIN 7867 / ISO 9982

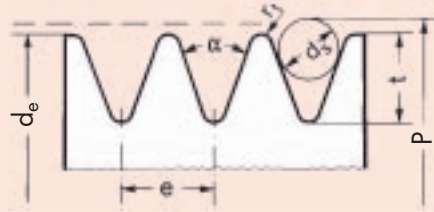


Table 15

Section	Pulley effective circumference $U_e = d_e \cdot \pi$ (mm)	Effective diameter d_e (mm)	Groove angle α $\pm 0.5^\circ$	Checking ball or rod diameter d_B ± 0.01 (mm)	Diameter over balls or rods P ± 0.1 (mm)	Groove Depth t_{min} (mm)	Transitional rip radius $r_{t min}$ (mm)	Measuring force per rib F (N)
PH*	100	31.8	40°	1.0	31.94	1.33	0.15	30
PH	300	95.5	40°	1.0	95.60	1.33	0.15	30
PJ*	100	31.8	40°	1.5	32.06	2.06	0.20	50
PJ	300	95.5	40°	1.5	95.72	2.06	0.20	50
PK	300	95.5	40°	2.5	96.48	3.45	0.25	100
PL	500	159.2	40°	3.5	161.51	4.92	0.40	200
PM	800	254.6	40°	7.0	259.17	10.03	0.75	450

* These values apply only for effective lengths under 457 mm.

The appropriate manufacturing tolerances for the dimensions of the grooves and measuring pulleys may be found in tables 15 and 16. Care must be taken to monitor wear or damage to the groove profiles.

Other diameters may be used for measuring pulleys providing the basic groove dimensions are used from the tables.

Measuring of Ribbed Belt Length

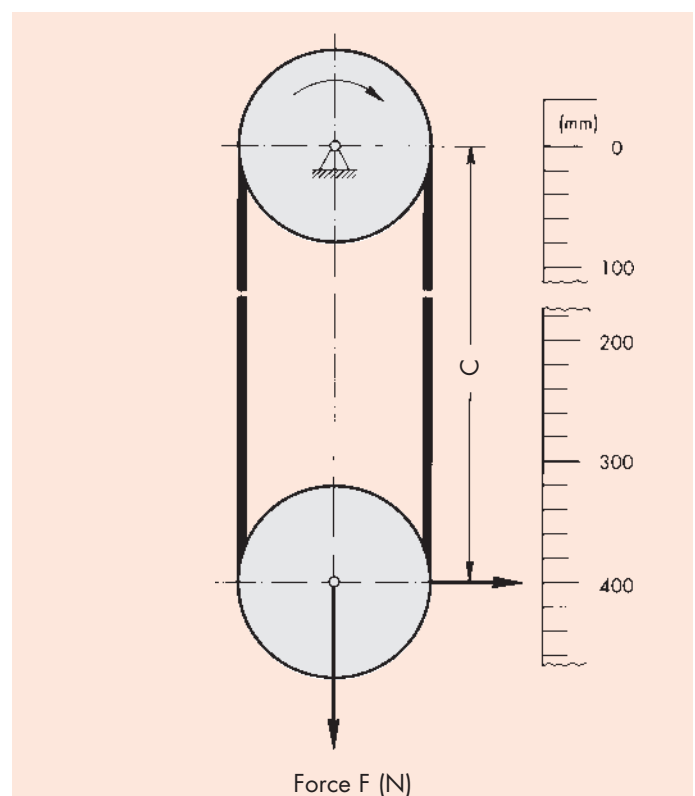
The belt is placed over two identical measuring pulleys as shown in the adjoining figure.

The appropriate measuring force F is applied to the moveable pulley. The Ribbed Belt should be rotated three revolutions at least before the drive centre distance C can be measured. Only then is the belt settled properly into the pulley grooves and exact measurement possible.

The effective length is given by twice the centre distance plus the effective circumference of the measurement pulleys.

$$L_e = 2 C + U_e$$

Method of Measuring Ribbed Belt Effective Length



Ribbed Belt Pulleys

Pulley Dimensions to DIN 7867 / ISO 9982

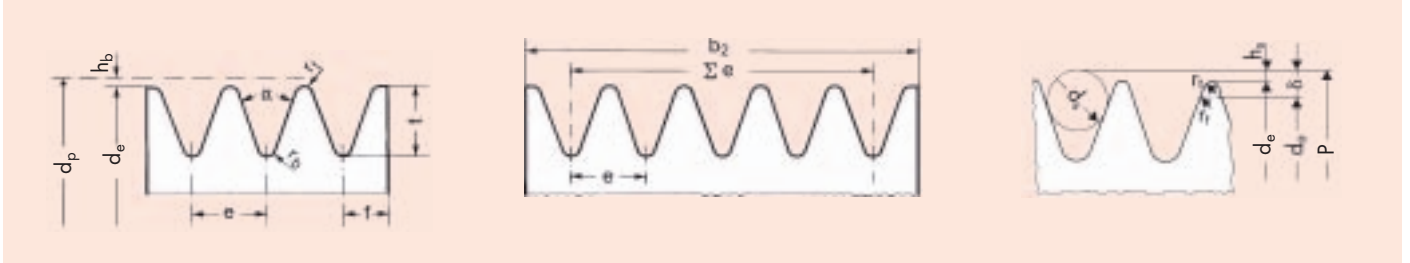


Table 16

Section	Effective Diameter $d_{e \min}$ (mm)	Groove Angle α $\pm 0.5^\circ$	Groove pitch e (mm)	$\Sigma e \pm 0.3$ (mm)	Groove Depth t_{\min} (mm)	f_{\min} (mm)	Eff. Line Difference h_b (mm)	Trans. Tip Radius $r_{t \min}$ (mm)	Gr. Bottom Radius $r_{b \max}$ (mm)	$2 h_s$ (mm)	$2 \delta_{\max}$ (mm)
PH	13	40°	$1.60 (\pm 0.03)$	$(z - 1) 1.60$	1.33	1.3	0.80	0.15	0.30	0.11	0.69
PJ	20	40°	$2.34 (\pm 0.03)$	$(z - 1) 2.34$	2.06	1.8	1.25	0.20	0.40	0.23	0.81
PK	45	40°	$3.56 (\pm 0.05)$	$(z - 1) 3.56$	3.45	2.5	1.60	0.25	0.50	0.99	1.68
PL	75	40°	$4.70 (\pm 0.05)$	$(z - 1) 4.70$	4.92	3.3	3.50	0.40	0.40	2.36	3.50
PM	180	40°	$9.40 (\pm 0.08)$	$(z - 1) 9.40$	10.03	6.4	5.00	0.75	0.75	4.53	5.92

The diameter d_a may be reduced by the dimension $2\delta - 2h_s$ depending upon the choice of manufacturer.
The arc with the radius r_t must have an angle of at least 30° and merge tangentially with the flank of the groove.

Pulley Face Width

$$b_2 = e(z - 1) + 2f$$

Maximum variation of diameter P

The difference between the diameters measured as distance P between the outer tangential plane of the checking ball or rod in all the grooves of a pulley must not exceed the value given in table 17.

Table 17: Groove to Groove Diameter P Variation

Effective Diameter (mm)	Total tolerance for number of grooves (mm)		Allowance for each extra groove (mm)
	≤ 6 Grooves	≤ 10 Grooves	
≤ 74	0.10	—	0.003
$> 74 \leq 500$	—	0.15	0.005
> 500	—	0.25	0.010

Material

All conventional lasily machined material may be used, preferably steel, cast iron, aluminium alloy, brass or high strength plastics.

Surface Finish

Groove surface should have a maximum roughness R_t of $25 \mu\text{m}$ and must be free from defects.

Balancing

For velocities $< 30 \text{ m/s}$ static balancing is sufficient. Dynamic balancing is necessary for velocities of $\geq 30 \text{ m/s}$.

Manufacture

Pulleys for Optibelt-RB Ribbed Belts can be made to your specifications. Cutting tools for ribbed belt pulleys are available on special request.

Table 18: Run out tolerance

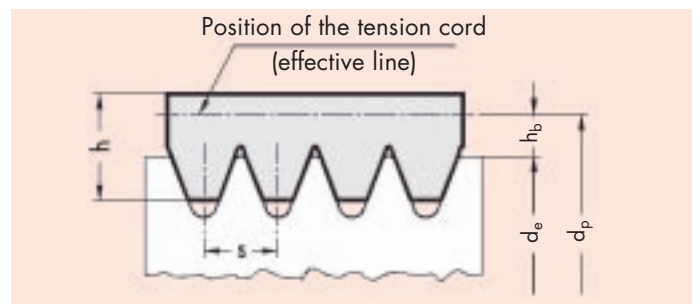
Effective diameter d_e (mm)	Run-out tolerance t_R
≤ 74	0.13
$> 74 \leq 250$	0.25
> 250	$0.25 + 0.0004 \text{ per mm}$ effective diameter above 250

Side wobble tolerance

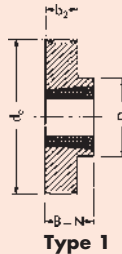
The side wobble tolerance t_p is 0.002 mm for each mm effective diameter.

Pitch diameter

The schematic illustration shows the seating of a ribbed belt in the pulley.



Ribbed Belt Pulleys bored for taper bushes, Section PJ

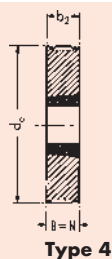
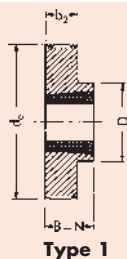


Designation	No. of Grooves	Pulley Type	Material	d_e (mm)	b_2 (mm)	B (mm)	N (mm)	D (mm)	Taper-Bush
TB 4 PJ 47.5	4	1	GG	47.5	13	23	23	47.5	1008
TB 4 PJ 52.5	4	1	GG	52.5	13	23	23	47.5	1008
TB 4 PJ 57.5	4	1	GG	57.5	13	23	23	54.0	1108
TB 4 PJ 62.5	4	1	GG	62.5	13	23	23	54.0	1108
TB 4 PJ 67.5	4	1	GG	67.5	13	23	23	54.0	1108
TB 4 PJ 72.5	4	1	GG	72.5	13	23	23	54.0	1108
TB 4 PJ 77.5	4	1	GG	77.5	13	26	26	70.0	1210
TB 4 PJ 82.5	4	1	GG	82.5	13	26	26	78.0	1210
TB 4 PJ 87.5	4	1	GG	87.5	13	26	26	78.0	1210
TB 4 PJ 92.5	4	1	GG	92.5	13	26	26	78.0	1210
TB 4 PJ 97.5	4	1	GG	97.5	13	26	26	78.0	1210
TB 4 PJ 102.5	4	1	GG	102.5	13	26	26	85.0	1610
TB 4 PJ 107.5	4	1	GG	107.5	13	26	26	85.0	1610
TB 4 PJ 112.5	4	1	GG	112.5	13	26	26	85.0	1610
TB 4 PJ 117.5	4	1	GG	117.5	13	26	26	85.0	1610
TB 4 PJ 122.5	4	1	GG	122.5	13	26	26	85.0	1610
TB 4 PJ 127.5	4	1	GG	127.5	13	26	26	85.0	1610
TB 4 PJ 137.5	4	1	GG	137.5	13	26	26	85.0	1610
TB 4 PJ 152.5	4	1	GG	152.5	13	26	26	85.0	1610
TB 4 PJ 162.5	4	1	GG	162.5	13	26	26	85.0	1610
TB 4 PJ 172.5	4	1	GG	172.5	13	26	26	85.0	1610
TB 4 PJ 182.5	4	1	GG	182.5	13	26	26	85.0	1610
TB 4 PJ 192.5	4	1	GG	192.5	13	26	26	85.0	1610
TB 4 PJ 202.5	4	1	GG	202.5	13	33	33	100.0	2012
TB 4 PJ 222.5	4	1	GG	222.5	13	33	33	100.0	2012

Taper bush	1008	1108	1210	1610	2012
Bore diameter d_2 (mm) from... up to ...	10-25	10-28	11-32	14-42	14-50

GG = Cast iron
Further sizes upon request
We reserve to alter specifications without notice
For standard bore diameters d_2 see page 52

Ribbed Belt Pulleys bored for taper bushes, Section PJ



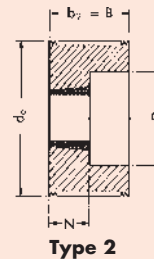
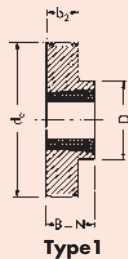
Designation	No. of Grooves	Pulley Type	Material	d _e (mm)	b ₂ (mm)	B (mm)	N (mm)	D (mm)	Taper-Bush
TB 8 PJ 47.5	8	4	GG	47.5	23	23	23	—	1008
TB 8 PJ 52.5	8	4	GG	52.5	23	23	23	—	1008
TB 8 PJ 57.5	8	4	GG	57.5	23	23	23	—	1108
TB 8 PJ 62.5	8	4	GG	62.5	23	23	23	—	1108
TB 8 PJ 67.5	8	4	GG	67.5	23	23	23	—	1108
TB 8 PJ 72.5	8	4	GG	72.5	23	23	23	—	1108
TB 8 PJ 77.5	8	1	GG	77.5	23	26	26	70.0	1210
TB 8 PJ 82.5	8	1	GG	82.5	23	26	26	78.0	1210
TB 8 PJ 87.5	8	1	GG	87.5	23	26	26	78.0	1210
TB 8 PJ 92.5	8	1	GG	92.5	23	26	26	78.0	1210
TB 8 PJ 97.5	8	1	GG	97.5	23	26	26	78.0	1210
TB 8 PJ 102.5	8	1	GG	102.5	23	26	26	85.0	1610
TB 8 PJ 107.5	8	1	GG	107.5	23	26	26	85.0	1610
TB 8 PJ 112.5	8	1	GG	112.5	23	26	26	85.0	1610
TB 8 PJ 117.5	8	1	GG	117.5	23	26	26	85.0	1610
TB 8 PJ 122.5	8	1	GG	122.5	23	26	26	85.0	1610
TB 8 PJ 127.5	8	1	GG	127.5	23	26	26	85.0	1610
TB 8 PJ 137.5	8	1	GG	137.5	23	26	26	85.0	1610
TB 8 PJ 152.5	8	1	GG	152.5	23	26	26	85.0	1610
TB 8 PJ 162.5	8	1	GG	162.5	23	26	26	85.0	1610
TB 8 PJ 172.5	8	1	GG	172.5	23	26	26	85.0	1610
TB 8 PJ 182.5	8	1	GG	182.5	23	26	26	85.0	1610
TB 8 PJ 192.5	8	1	GG	192.5	23	26	26	85.0	1610
TB 8 PJ 202.5	8	1	GG	202.5	23	33	33	100.0	2012
TB 8 PJ 222.5	8	1	GG	222.5	23	33	33	100.0	2012

Taper bush	1008	1108	1210	1610	2012
Bore diameter d ₂ (mm) from... up to ...	10-25	10-28	11-32	14-42	14-50

GG = Cast iron
Further sizes upon request
We reserve to alter specifications without notice

For standard bore diameters d₂ see page 52

Ribbed Belt Pulleys bored for taper bushes, Section PJ



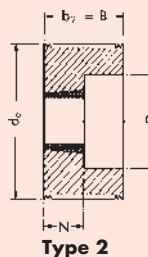
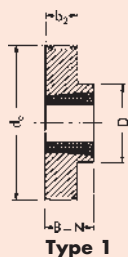
Designation	No. of Grooves	Pulley Type	Material	d _e (mm)	b ₂ (mm)	B (mm)	N (mm)	D (mm)	Taper-Bush
TB 12 PJ 62.5	12	2	GG	62.5	32	32	23	50.0	1108
TB 12 PJ 67.5	12	2	GG	67.5	32	32	23	50.0	1108
TB 12 PJ 72.5	12	2	GG	72.5	32	32	23	50.0	1108
TB 12 PJ 77.5	12	2	GG	77.5	32	32	26	62.0	1210
TB 12 PJ 82.5	12	2	GG	82.5	32	32	26	62.0	1210
TB 12 PJ 87.5	12	2	GG	87.5	32	32	26	70.0	1610
TB 12 PJ 92.5	12	2	GG	92.5	32	32	26	70.0	1610
TB 12 PJ 97.5	12	2	GG	97.5	32	32	26	70.0	1610
TB 12 PJ 102.5	12	2	GG	102.5	32	32	26	70.0	1610
TB 12 PJ 107.5	12	2	GG	107.5	32	32	26	70.0	1610
TB 12 PJ 112.5	12	2	GG	112.5	32	32	26	70.0	1610
TB 12 PJ 117.5	12	2	GG	117.5	32	32	26	70.0	1610
TB 12 PJ 122.5	12	2	GG	122.5	32	32	26	70.0	1610
TB 12 PJ 127.5	12	1	GG	127.5	32	32	33	100.0	2012
TB 12 PJ 137.5	12	1	GG	137.5	32	32	33	100.0	2012
TB 12 PJ 152.5	12	1	GG	152.5	32	32	33	100.0	2012
TB 12 PJ 162.5	12	1	GG	162.5	32	32	33	100.0	2012
TB 12 PJ 172.5	12	1	GG	172.5	32	32	33	100.0	2012
TB 12 PJ 182.5	12	1	GG	182.5	32	46	46	110.0	2517
TB 12 PJ 192.5	12	1	GG	192.5	32	46	46	110.0	2517
TB 12 PJ 202.5	12	1	GG	202.5	32	46	46	110.0	2517
TB 12 PJ 222.5	12	1	GG	222.5	32	46	46	110.0	2517

Taper bush	1108	1210	1610	2012	2557
Bore diameter d ₂ (mm) from... up to ...	10-28	11-32	14-42	14-50	16-60

GG = Cast iron
Further sizes upon request
We reserve to alter specifications without notice

For standard bore diameters d₂ see page 52

Ribbed Belt Pulleys bored for taper bushes, Section PJ



Designation	No. of Grooves	Pulley Type	Material	d _e (mm)	b ₂ (mm)	B (mm)	N (mm)	D (mm)	Taper-Bush
TB 16 PJ 62.5	16	2	GG	62.5	41	41	23	50.0	1108
TB 16 PJ 67.5	16	2	GG	67.5	41	41	23	50.0	1108
TB 16 PJ 72.5	16	2	GG	72.5	41	41	26	62.0	1210
TB 16 PJ 77.5	16	2	GG	77.5	41	41	26	62.0	1210
TB 16 PJ 82.5	16	2	GG	82.5	41	41	26	62.0	1210
TB 16 PJ 87.5	16	2	GG	87.5	41	41	26	70.0	1610
TB 16 PJ 92.5	16	2	GG	92.5	41	41	26	70.0	1610
TB 16 PJ 97.5	16	2	GG	97.5	41	41	26	70.0	1610
TB 16 PJ 102.5	16	2	GG	102.5	41	41	26	70.0	1610
TB 16 PJ 107.5	16	2	GG	107.5	41	41	26	70.0	1610
TB 16 PJ 112.5	16	2	GG	112.5	41	41	33	85.0	2012
TB 16 PJ 117.5	16	2	GG	117.5	41	41	33	85.0	2012
TB 16 PJ 122.5	16	2	GG	122.5	41	41	33	85.0	2012
TB 16 PJ 127.5	16	2	GG	127.5	41	41	33	85.0	2012
TB 16 PJ 137.5	16	2	GG	137.5	41	41	33	85.0	2012
TB 16 PJ 152.5	16	2	GG	152.5	41	41	33	85.0	2012
TB 16 PJ 162.5	16	2	GG	162.5	41	41	33	85.0	2012
TB 16 PJ 172.5	16	2	GG	172.5	41	41	33	85.0	2012
TB 16 PJ 182.5	16	1	GG	182.5	41	46	46	110.0	2517
TB 16 PJ 192.5	16	1	GG	192.5	41	46	46	110.0	2517
TB 16 PJ 202.5	16	1	GG	202.5	41	46	46	110.0	2517
TB 16 PJ 222.5	16	1	GG	222.5	41	46	46	110.0	2517

Taper bush

1108

1210

1610

2012

2557

Bore diameter d₂ (mm)
from... up to ...

10-28

11-32

14-42

14-50

16-60

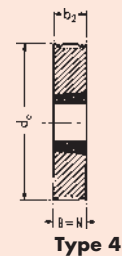
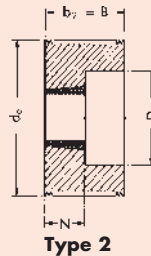
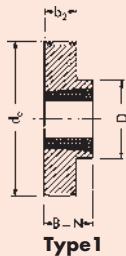
GG = Cast iron

Further sizes upon request

We reserve to alter specifications without notice

For standard bore diameters d₂ see page 52

Ribbed Belt Pulleys bored for taper bushes, Section PL

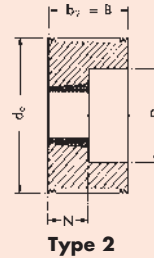
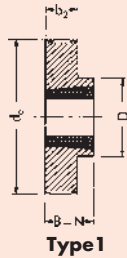


Designation	No. of Grooves	Pulley Type	Material	d _e (mm)	b ₂ (mm)	B (mm)	N (mm)	D (mm)	Taper-Bush
TB 6 PL 78	6	2	GG	78	33	33	26	62.0	1210
TB 6 PL 83	6	2	GG	83	33	33	26	62.0	1210
TB 6 PL 88	6	2	GG	88	33	33	26	70.0	1610
TB 6 PL 93	6	2	GG	93	33	33	26	70.0	1610
TB 6 PL 98	6	2	GG	98	33	33	26	70.0	1610
TB 6 PL 103	6	2	GG	103	33	33	26	70.0	1610
TB 6 PL 108	6	2	GG	108	33	33	26	70.0	1610
TB 6 PL 113	6	2	GG	113	33	33	26	70.0	1610
TB 6 PL 118	6	2	GG	118	33	33	26	70.0	1610
TB 6 PL 123	6	4	GG	123	33	33	33	—	2012
TB 6 PL 133	6	4	GG	133	33	33	33	—	2012
TB 6 PL 148	6	4	GG	148	33	33	33	—	2012
TB 6 PL 158	6	4	GG	158	33	33	33	—	2012
TB 6 PL 168	6	4	GG	168	33	33	33	—	2012
TB 6 PL 178	6	1	GG	178	33	46	46	110.0	2517
TB 6 PL 188	6	1	GG	188	33	46	46	110.0	2517
TB 6 PL 198	6	1	GG	198	33	46	46	110.0	2517
TB 6 PL 218	6	1	GG	218	33	46	46	110.0	2517
TB 6 PL 238	6	1	GG	238	33	46	46	110.0	2517
TB 6 PL 258	6	1	GG	258	33	46	46	110.0	2517
TB 6 PL 278	6	1	GG	278	33	46	46	110.0	2517
TB 6 PL 298	6	1	GG	298	33	46	46	110.0	2517
TB 6 PL 318	6	1	GG	318	33	46	46	110.0	2517
TB 6 PL 348	6	1	GG	348	33	46	46	110.0	2517
TB 6 PL 388	6	1	GG	388	33	46	46	110.0	2517

Taper bush	1210	1610	2012	2557
Bore diameter d ₂ (mm) from... up to ...	11-32	14-42	14-50	16-60

GG = Cast iron
Further sizes upon request
We reserve to alter specifications without notice
For standard bore diameters d₂ see page 52

Ribbed Belt Pulleys bored for taper bushes, Section PL



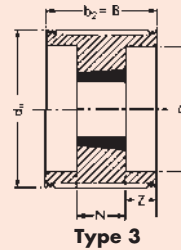
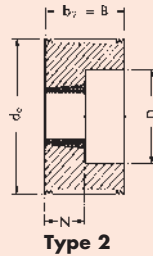
Designation	No. of Grooves	Pulley Type	Material	d _e (mm)	b ₂ (mm)	B (mm)	N (mm)	D (mm)	Taper-Bush
TB 8 PL 78	8	2	GG	78	42	42	26	62.0	1210
TB 8 PL 83	8	2	GG	83	42	42	26	62.0	1210
TB 8 PL 88	8	2	GG	88	42	42	26	70.0	1610
TB 8 PL 93	8	2	GG	93	42	42	26	70.0	1610
TB 8 PL 98	8	2	GG	98	42	42	26	70.0	1610
TB 8 PL 103	8	2	GG	103	42	42	33	85.0	2012
TB 8 PL 108	8	2	GG	108	42	42	33	85.0	2012
TB 8 PL 113	8	2	GG	113	42	42	33	85.0	2012
TB 8 PL 118	8	2	GG	118	42	42	33	85.0	2012
TB 8 PL 123	8	2	GG	123	42	42	33	85.0	2012
TB 8 PL 133	8	2	GG	133	42	42	33	85.0	2012
TB 8 PL 148	8	2	GG	148	42	42	33	85.0	2012
TB 8 PL 158	8	2	GG	158	42	42	33	85.0	2012
TB 8 PL 168	8	2	GG	168	42	42	33	85.0	2012
TB 8 PL 178	8	1	GG	178	42	46	46	110.0	2517
TB 8 PL 188	8	1	GG	188	42	46	46	110.0	2517
TB 8 PL 198	8	1	GG	198	42	46	46	110.0	2517
TB 8 PL 218	8	1	GG	218	42	46	46	110.0	2517
TB 8 PL 238	8	1	GG	238	42	46	46	110.0	2517
TB 8 PL 258	8	1	GG	258	42	46	46	110.0	2517
TB 8 PL 278	8	1	GG	278	42	46	46	110.0	2517
TB 8 PL 298	8	1	GG	298	42	46	46	110.0	2517
TB 8 PL 318	8	1	GG	318	42	46	46	110.0	2517
TB 8 PL 348	8	1	GG	348	42	46	46	110.0	2517
TB 8 PL 388	8	1	GG	388	42	46	46	110.0	2517

Taper bush	1210	1610	2012	2557
Bore diameter d ₂ (mm) from... up to ...	11-32	14-42	14-50	16-60

GG = Cast iron
Further sizes upon request
We reserve to alter specifications without notice

For standard bore diameters d₂ see page 52

Ribbed Belt Pulleys bored for taper bushes, Section PL



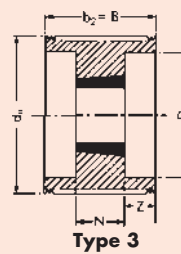
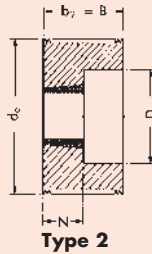
Designation	No. of Grooves	Pulley Type	Material	d _e (mm)	b ₂ (mm)	B (mm)	N (mm)	D (mm)	Taper-Bush
TB 10 PL 88	10	3	GG	88	53	53	26	70.0	1610
TB 10 PL 93	10	3	GG	93	53	53	26	70.0	1610
TB 10 PL 98	10	3	GG	98	53	53	26	70.0	1610
TB 10 PL 103	10	2	GG	103	53	53	33	85.0	2012
TB 10 PL 108	10	2	GG	108	53	53	33	85.0	2012
TB 10 PL 113	10	2	GG	113	53	53	33	85.0	2012
TB 10 PL 118	10	2	GG	118	53	53	33	85.0	2012
TB 10 PL 123	10	2	GG	123	53	53	33	85.0	2012
TB 10 PL 133	10	2	GG	133	53	53	33	85.0	2012
TB 10 PL 148	10	2	GG	148	53	53	33	85.0	2012
TB 10 PL 158	10	2	GG	158	53	53	33	85.0	2012
TB 10 PL 168	10	2	GG	168	53	53	33	85.0	2012
TB 10 PL 178	10	2	GG	178	53	53	46	105.0	2517
TB 10 PL 188	10	2	GG	188	53	53	46	105.0	2517
TB 10 PL 198	10	2	GG	198	53	53	46	105.0	2517
TB 10 PL 218	10	2	GG	218	53	53	46	105.0	2517
TB 10 PL 238	10	2	GG	238	53	53	46	105.0	2517
TB 10 PL 258	10	2	GG	258	53	53	46	105.0	2517
TB 10 PL 278	10	2	GG	278	53	53	46	105.0	2517
TB 10 PL 298	10	2	GG	298	53	53	46	105.0	2517
TB 10 PL 318	10	2	GG	318	53	53	46	105.0	2517
TB 10 PL 348	10	2	GG	348	53	53	46	105.0	2517
TB 10 PL 388	10	2	GG	388	53	53	46	105.0	2517

Taper bush	1610	2012	2557
Bore diameter d ₂ (mm) from... up to ...	14-42	14-50	16-60

GG = Cast iron
Further sizes upon request
We reserve to alter specifications without notice

For standard bore diameters d₂ see page 52

Ribbed Belt Pulleys bored for taper bushes, Section PL



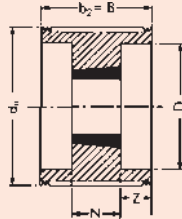
Designation	No. of Grooves	Pulley Type	Material	d _e (mm)	b ₂ (mm)	B (mm)	N (mm)	D (mm)	Taper-Bush
TB 12 PL 88	12	3	GG	88	62	62	26	70.0	1610
TB 12 PL 93	12	3	GG	93	62	62	26	70.0	1610
TB 12 PL 98	12	3	GG	98	62	62	26	70.0	1610
TB 12 PL 103	12	3	GG	103	62	62	33	85.0	2012
TB 12 PL 108	12	3	GG	108	62	62	33	85.0	2012
TB 12 PL 113	12	3	GG	113	62	62	33	85.0	2012
TB 12 PL 118	12	3	GG	118	62	62	33	85.0	2012
TB 12 PL 123	12	3	GG	123	62	62	33	85.0	2012
TB 12 PL 133	12	3	GG	133	62	62	33	85.0	2012
TB 12 PL 148	12	2	GG	148	62	62	46	105.0	2517
TB 12 PL 158	12	2	GG	158	62	62	46	105.0	2517
TB 12 PL 168	12	2	GG	168	62	62	46	105.0	2517
TB 12 PL 178	12	2	GG	178	62	62	46	105.0	2517
TB 12 PL 188	12	2	GG	188	62	62	46	105.0	2517
TB 12 PL 198	12	2	GG	198	62	62	46	105.0	2517
TB 12 PL 218	12	2	GG	218	62	62	46	105.0	2517
TB 12 PL 238	12	2	GG	238	62	62	52	130.0	3020
TB 12 PL 258	12	2	GG	258	62	62	52	130.0	3020
TB 12 PL 278	12	2	GG	278	62	62	52	130.0	3020
TB 12 PL 298	12	2	GG	298	62	62	52	130.0	3020
TB 12 PL 318	12	2	GG	318	62	62	52	130.0	3020
TB 12 PL 348	12	2	GG	348	62	62	52	130.0	3020
TB 12 PL 388	12	2	GG	388	62	62	52	130.0	3020

Taper bush	1610	2012	2557	3020
Bore diameter d ₂ (mm) from... up to ...	14-42	14-50	16-60	25-75

GG = Cast iron
Further sizes upon request
We reserve to alter specifications without notice

For standard bore diameters d₂ see page 52

Ribbed Belt Pulleys bored for taper bushes, Section PL



Type 3

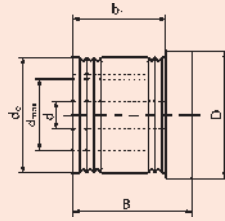
Designation	No. of Grooves	Pulley Type	Material	d _e (mm)	b ₂ (mm)	B (mm)	N (mm)	D (mm)	Taper-Bush
TB 16 PL 103	16	3	GG	103	80	80	33	85.0	2012
TB 16 PL 108	16	3	GG	108	80	80	33	85.0	2012
TB 16 PL 113	16	3	GG	113	80	80	33	85.0	2012
TB 16 PL 118	16	3	GG	118	80	80	33	85.0	2012
TB 16 PL 123	16	3	GG	123	80	80	33	85.0	2012
TB 16 PL 133	16	3	GG	133	80	80	33	85.0	2012
TB 16 PL 148	16	3	GG	148	80	80	46	105.0	2517
TB 16 PL 158	16	3	GG	158	80	80	46	105.0	2517
TB 16 PL 168	16	3	GG	168	80	80	46	105.0	2517
TB 16 PL 178	16	3	GG	178	80	80	46	105.0	2517
TB 16 PL 188	16	3	GG	188	80	80	46	105.0	2517
TB 16 PL 198	16	3	GG	198	80	80	46	105.0	2517
TB 16 PL 218	16	3	GG	218	80	80	46	105.0	2517
TB 16 PL 238	16	3	GG	238	80	80	52	130.0	3020
TB 16 PL 258	16	3	GG	258	80	80	52	130.0	3020
TB 16 PL 278	16	3	GG	278	80	80	52	130.0	3020
TB 16 PL 298	16	3	GG	298	80	80	52	130.0	3020
TB 16 PL 318	16	3	GG	318	80	80	52	130.0	3020
TB 16 PL 348	16	3	GG	348	80	80	52	130.0	3020
TB 16 PL 388	16	3	GG	388	80	80	52	130.0	3020

Taper bush	2012	2557	3020
Bore diameter d ₂ (mm) from... up to ...	14-50	16-60	25-75

GG = Cast iron
Further sizes upon request
We reserve to alter specifications without notice
For standard bore diameters d₂ see page 52

Ribbed Belt Pulleys

pilot bored, Section PJ



Type VB (pilot bored)

Designation	No. of Grooves	Pulley Type	Material	d _e (mm)	b ₁ (mm)	B (mm)	D (mm)	Pilot Bore d (mm)	Finished Bore d _{max} (mm)	Weight (= kg)
4 PJ 22.5	4	VB	GG	22.5	13	20	25	8	12.0	0.045
4 PJ 27.5	4	VB	GG	27.5	13	20	30	8	14.0	0.070
4 PJ 32.5	4	VB	GG	32.5	13	20	35	8	18.0	0.100
4 PJ 37.5	4	VB	GG	37.5	13	20	40	8	20.0	0.135
4 PJ 42.5	4	VB	GG	42.5	13	20	45	8	22.0	0.180
8 PJ 22.5	8	VB	GG	22.5	23	30	25	8	12.0	0.063
8 PJ 27.5	8	VB	GG	27.5	23	30	30	8	14.0	0.100
8 PJ 32.5	8	VB	GG	32.5	23	30	35	8	18.0	0.150
8 PJ 37.5	8	VB	GG	37.5	23	30	40	8	20.0	0.200
8 PJ 42.5	8	VB	GG	42.5	23	30	45	8	22.0	0.265
12 PJ 22.5	12	VB	GG	22.5	32	40	25	8	12.0	0.086
12 PJ 27.5	12	VB	GG	27.5	32	40	30	8	14.0	0.140
12 PJ 32.5	12	VB	GG	32.5	32	40	35	8	18.0	0.200
12 PJ 37.5	12	VB	GG	37.5	32	40	40	8	20.0	0.280
12 PJ 42.5	12	VB	GG	42.5	32	40	45	8	22.0	0.360

Design Hints

Ribbed Belt Tension

The correct level of belt tension is of extreme importance for trouble free transmission of power, and for the achievement of acceptable belt service life. Often, tension which is either too high or too low results in early belt failure. A belt which is over tensioned sometimes causes bearing failure.

It has been shown that the more common tensioning instructions - e. g. using the "thumb pressure deflection method" - do not result in tension being obtained which would enable drives to be operated at optimum efficiency. It is therefore recommended that the required static belt tension "T" be calculated individually for every drive using the following Optibelt formulae. The best initial tension is the absolute minimum for a drive which permits the highest level of power transmission under consideration of the normal slip.

Once the ribbed belt has been fitted, the tension should be checked, using our tension gauge.

The belt should be observed regularly during the first few hours of service. Experience indicates that the first retensioning should be undertaken after approximately 0.5 to 4 hours full load running. The initial belt stretch is then taken up.

After approximately 24 hours running, especially if the belt has not run continuously under full load conditions, the drive should be checked and, if necessary, retensioned. The checking intervals can then be increased considerably to several hundred or thousand operating hours, and the tension adjusted when necessary. In addition, our basic fitting and service instructions should be observed.

Over or undertensioning of the drive will be avoided if the belt tension is calculated, set or checked by one of the following methods:

I. Checking the Belt Tension by Span Deflection

This method provides an indirect measurement of the calculated or actual static belt tension

- E = Belt deflection per 100 mm span length (mm)
- E_a = Belt deflection for a given span length (mm)
- f = Load per rib used to set belt tension (N)
- k = Constant for calculation of centrifugal force
- L = Drive span length (mm)
- S_a = Static shaft loading (N)
- T = Static belt tension per rib (N)

1. Calculate the static belt tension using the following formula:

$$T \approx \frac{500 \cdot (2.03 - c_1) \cdot P_B}{c_1 \cdot z \cdot v} + k \cdot v^2$$

The drive should initially be tensioned to a maximum of 1.3 x T (initial tensioning).

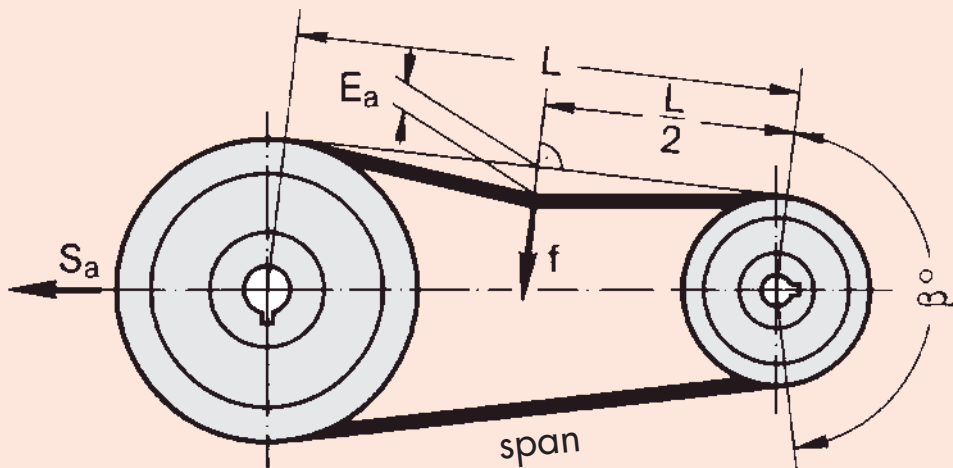
2. Determine E - the deflection per 100 mm length - from the belt tension deflection characteristics as given in diagram 2 page 41.
3. Calculate E_a - the deflection for a given span length - for the actual drive span length L.

$$E_a \approx \frac{E \cdot L}{100}$$

$$L = C_{nom} \cdot \sin \frac{\beta}{2}$$

Apply the load to set belt tension f^* , using the value from Diagram 2 for the appropriate belt section, to the centre of, and at right angles to, the span, as shown in the figure below. Measure the deflection and if necessary adjust the centres until the correct belt tension is achieved.

- * When choosing the load to set belt tension the number of ribs must be taken into consideration.



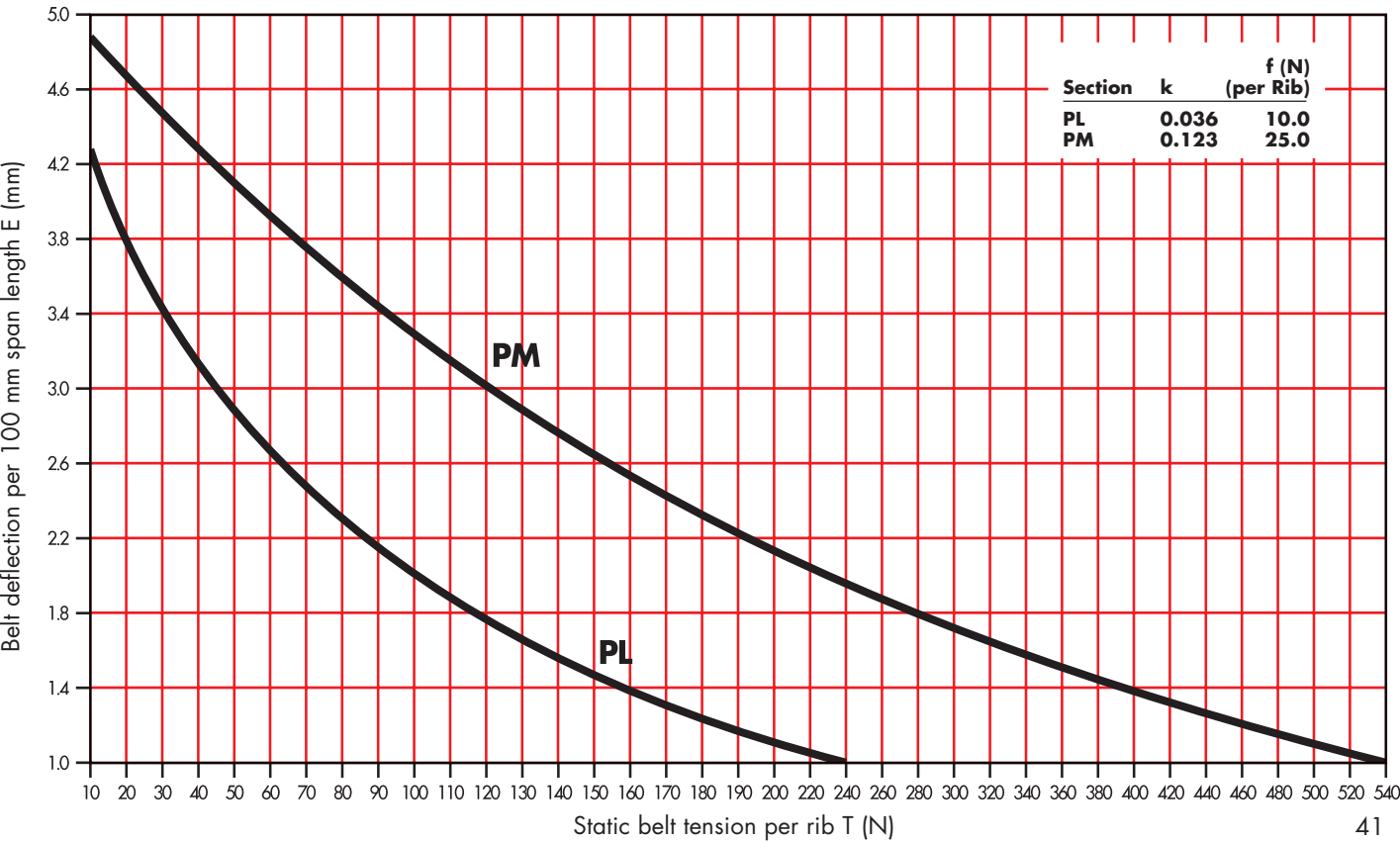
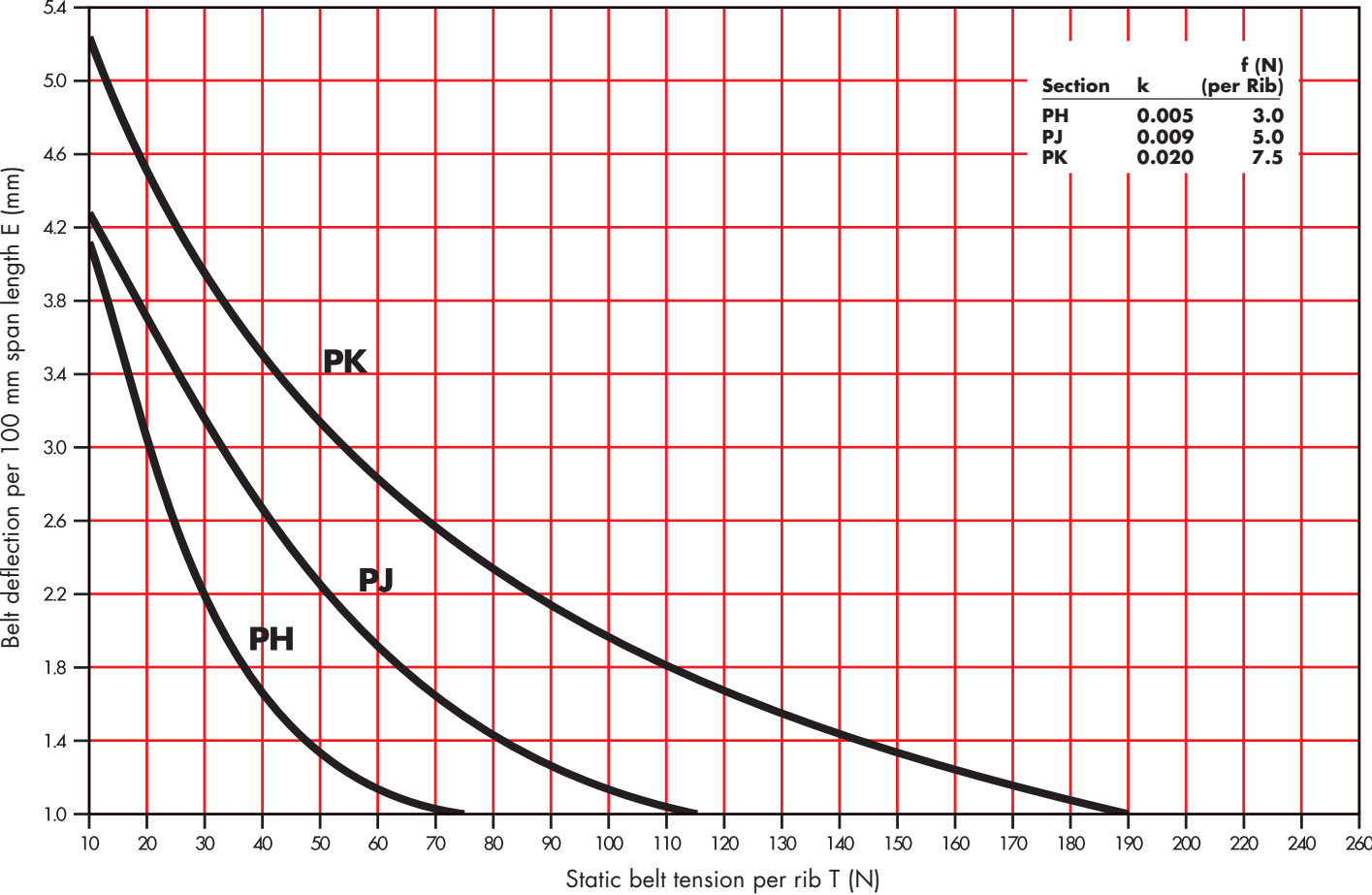


Power Transmission

Design Hints

Ribbed Belt Tension

Diagram 2 Ribbed Belt Tension Graphs



Design Hints

Ribbed Belt Tension

II. Belt Tensioning using a "Length Additional Value"

It has become evident that span deflection methods are not always the ideal checking procedures for ribbed belts. The following very simple method for the determination of the belt tension is therefore recommended:

1. Calculate the static belt tension "T".

$$T \approx \frac{500 \cdot (2.03 - c_1) \cdot P_B}{c_1 \cdot z \cdot v} + k \cdot v^2$$

2. The outside length L_a of the Ribbed Belt should be measured on the top surface with the belt slack prior to fitting it to the drive. Measurement may also be taken on the drive itself, but **without tension**.

3. Calculate the length additional value "A" by using the formula:

$$A \approx L_{est} \cdot R$$

R = Stretch factor from table 19 page 43.

4. This length additional value A should then be added to the measured outside length (from step 2).

$$L_a^* \approx L_a + A$$

5. The ribbed belt should then be tensioned until the outside length L_a^* calculated in step 4 is obtained. The belt tension will then be correct.
6. If the drive is to be retensioned, the ribbed belt must first be slackened off so that it can be measured in a stress free condition. The procedure as detailed in steps 4. and 5. is then repeated.

III. Checking the Ribbed Belt Tension by Measurement of the Static Shaft Loading

A very accurate method for the setting of the correct belt tension is by **direct measurement of the static shaft loading** using the formula:

$$S_a \approx 2 T \cdot \sin \frac{\beta}{2} \cdot z$$

This checking method, however, does call for specialised measuring instruments.

Example::

$$P_B = 23.4 \text{ kW}$$

$$c_1 = 1.0$$

$$v = 16.6 \text{ m/s}$$

Drive specification with Optibelt-RB Ribbed Belt **12 PL 1075**

$$T \approx \frac{500 \cdot (2.03 - 1.0) \cdot 23.4}{1.0 \cdot 12 \cdot 16.6} + 0.036 \cdot 16.6^2 \approx \mathbf{70 \text{ N}}$$

When fitted for the first time, the tension should be multiplied by a factor of 1.3.

$$T \approx 1,3 \cdot 70 \approx \mathbf{91 \text{ N}}$$

Length measured on the back of the belt whilst slack

$$A \approx 1075 \cdot 0.00264 \approx \mathbf{3 \text{ mm}}$$

Tighten the belt until the length measured around the outside is 1103 mm. The belt is then correctly tensioned.

$$L_a^* \approx 1100 + 3 = \mathbf{1103 \text{ mm}}$$

IV. Checking the Belt Tension by Speed Measurement

In this method, the belt tension is checked using the theoretical slip. The speeds of the driver and driven pulleys are measured first in an unloaded and then in a loaded condition.

$$S = \text{Slip} \quad (\%)$$

$$n_{1L} = \text{Speed of driver pulley, unloaded} \quad (\text{r.p.m.}) \quad (\text{min}^{-1})$$

$$n_{2L} = \text{Speed of driven pulley, unloaded} \quad (\text{r.p.m.}) \quad (\text{min}^{-1})$$

$$n_{1B} = \text{Speed of driver pulley, under load (r.p.m.)} \quad (\text{min}^{-1})$$

$$n_{2B} = \text{Speed of driven pulley, under load (r.p.m.)} \quad (\text{min}^{-1})$$

Formula for the calculation of slip:

$$S = \left(1 - \frac{n_{1L}/n_{2L}}{n_{1B}/n_{2B}} \right) \cdot 100$$

At the rated loading, the slip should not exceed 1%. The belt service is considerably shortened due to excessive flank wear with an unacceptably low initial tension or under extreme loading conditions, with slip in excess of 2%.



Power Transmission

Design Hints

Ribbed Belt Tension

Table 19: Stretch Factor R for Optibelt-RB Ribbed Belts

Section		PH	PJ	PK	PL	PM
Minimum static belt tension per rib T (N)	15	0.00155	0.00090			
	20	0.00207	0.00130			
	25	0.00263	0.00168			
	30	0.00331	0.00206	0.00065	0.00066	
	35	0.00407	0.00248	0.00077	0.00080	
	40	0.00500	0.00300	0.00093	0.00094	
	45	0.00600	0.00348	0.00114	0.00109	
	50	0.00700	0.00406	0.00136	0.00127	
	55	0.00831	0.00459	0.00160	0.00142	0.00062
	60	0.00958	0.00522	0.00192	0.00160	0.00072
	65	0.01085	0.00580	0.00223	0.00175	0.00079
	70	0.01229	0.00644	0.00254	0.00191	0.00087
	75	0.01356	0.00715	0.00280	0.00212	0.00098
	80	0.01500	0.00786	0.00312	0.00228	0.00101
	85	0.01636	0.00863	0.00346	0.00242	0.00111
	90	0.01780	0.00949	0.00377	0.00261	0.00120
	95	0.01924	0.01021	0.00411	0.00277	0.00124
	100	0.02070	0.01106	0.00445	0.00297	0.00135
	120	0.02644	0.01469	0.00572	0.00369	0.00159
	140		0.01849	0.00693	0.00437	0.00190
	160		0.02229	0.00820	0.00509	0.00219
	180			0.00949	0.00580	0.00249
	200			0.01095	0.00651	0.00279
	220				0.00735	0.00314
	240				0.00811	0.00340
	250				0.00849	0.00356
	260					0.00373
	280					0.00405
	300					0.00438
	350					0.00518
	400					0.00598
	440					0.00674
	460					0.00706
	480					0.00742
	500					0.00772
	520					0.00814
	540					0.00850
	560					0.00889
	580					0.00929
	600					0.00968
	620					0.01004
	640					0.01036
	660					0.01076
	680					0.01116
	700					0.01156
	720					0.01196

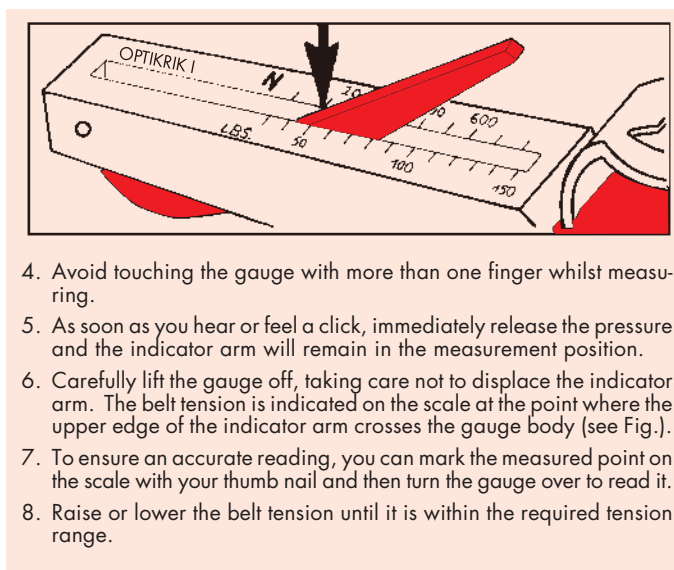
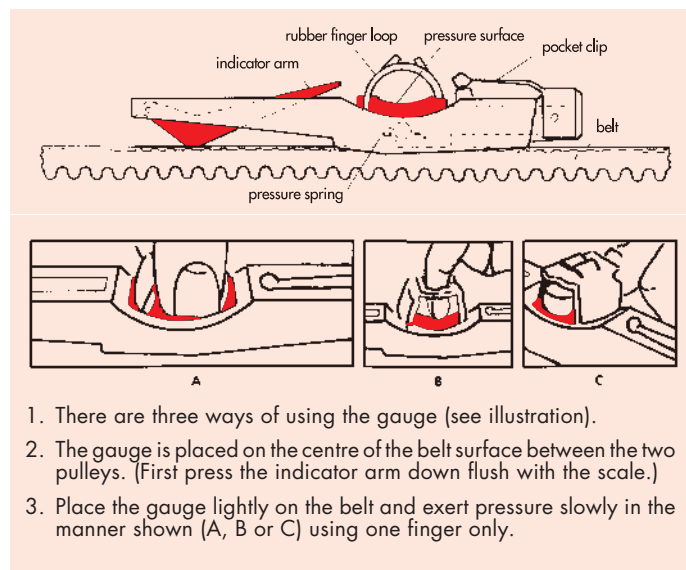
Intermediate values can be calculated by linear interpolation

Design Hints

Optikrik Tension Gauges 0, I, II, III

These tension gauges have been devised to simplify the maintenance of ribbed belt drives where the more essential technical data is unknown and the optimum tension cannot therefore be arrived at by calculation. With these simplified methods, all that is required is the pulley diameter.

Optikrik tension gauges - operating instructions -



Belt Section	Diameter of the smallest pulley d_e (mm)	Static belt tension T_{max} (N)									
		Initial Installation	Retension	Initial Installation	Retension	Initial Installation	Retension	Initial Installation	Retension	Initial Installation	Retension
PH	≤ 25	4 PH		8 PH		12 PH		16 PH		20 PH	
	$> 25 \leq 71$	90	70	150	130	250	200	300	250	400	300
	> 71 *	110	90	200	150	300	250	350	300	450	350
PJ	≤ 40	4 PJ		8 PJ		12 PJ		16 PJ		24 PJ	
	$> 40 \leq 80$	200	150	350	300	500	400	700	550	1000	800
	$> 80 \leq 132$	200	150	400	350	600	500	800	650	1200	1000
	> 132 *	250	200	450	350	700	550	900	700	1300	1000
PK	≤ 63	4 PK		8 PK		10 PK		12 PK		16 PK	
	$> 63 \leq 100$	300	250	600	450	700	600	900	700	1200	900
	$> 100 \leq 140$	400	300	800	600	1000	700	1200	900	1500	1200
	> 140 *	450	350	900	700	1100	800	1300	1000	1600	1300
PL	≤ 90	6 PL		8 PL		10 PL		12 PL		16 PL	
	$> 90 \leq 140$	800	600	1000	800	1300	1000	1500	1200	1900	1500
	$> 140 \leq 200$	1000	700	1300	1000	1600	1300	1900	1500	2500	1900
	> 200 *	1100	800	1400	1100	1900	1400	2100	1600	2800	2100

Method

- Locate the section in the left hand column.
- Select the smallest pulley diameter in the drive system.
- The table shows the corresponding static belt tension.
- Check the belt tension with the gauge as described.

Example

- Optibelt-RB Ribbed Belt section
 - Smallest pulley diameter in drive system d_e
 - Static belt tension - initial fitting
 - Static belt tension - retension
- 4 PJ
100 mm
250 N
200 N

*Tension settings for these pulleys must be calculated.

Tension gauges

Optikrik 0	Measurement range:	70 – 150 N
Optikrik I	Measurement range:	150 – 600 N
Optikrik II	Measurement range:	500 – 1400 N
Optikrik III	Measurement range:	1300 – 3100 N

The tension figures (static belt tension) are for guidance only when sufficient drive data is not available. They are based on the maximum transmissible power (per ribbed belt).

Calculation basis

PH, PJ	Speed $v = 5$ bis 60 m/s.
PK	Speed $v = 5$ bis 50 m/s.
PL	Speed $v = 5$ bis 40 m/s.

Design Hints

Determining the Axial Force / Shaft Loading under Dynamic Conditions

In order to prevent premature bearing failure, shaft fracture or over engineered bearings and shafts, it is recommended that the dynamic axial force be calculated exactly. This is the only way to determine the stresses to which these components are exposed in the prime mover and driven machines.

In the case of two pulley drives, the driver and driven shafts or bearings are subject to the same dynamic axial force, but in opposite directions.

When tension or guide pulleys are incorporated, the magnitude and direction of the axial force are almost always different on each pulley. If the magnitude and direction of the dynamic axial force is to be determined, a graphical solution using the force parallelogram for the dynamic forces in the tight side S_1 and slack side S_2 is recommended.

If only the magnitude of the dynamic axial force is to be determined, this can be achieved using the formula for $S_{a\text{dyn}}$. Both methods are illustrated by the following example:

Details of the calculation example given on pages 15 to 17.

$$P_B = 23.4 \text{ kW}$$

$$c_1 = 1.0$$

$$v = 16.6 \text{ m/s}$$

$$\beta = 175^\circ$$

Dynamic tight side tension

$$S_1 \approx \frac{1030 \cdot P_B}{c_1 \cdot v}$$

$$S_1 \approx \frac{1030 \cdot 23.4}{1.0 \cdot 16.6} \approx \mathbf{1452 \text{ N}}$$

Dynamic slack side tension

$$S_2 \approx \frac{1000 \cdot (1.03 - c_1) \cdot P_B}{c_1 \cdot v}$$

$$S_2 \approx \frac{1000 \cdot (1.03 - 1.0) \cdot 23.4}{1.0 \cdot 16.6} \approx \mathbf{42 \text{ N}}$$

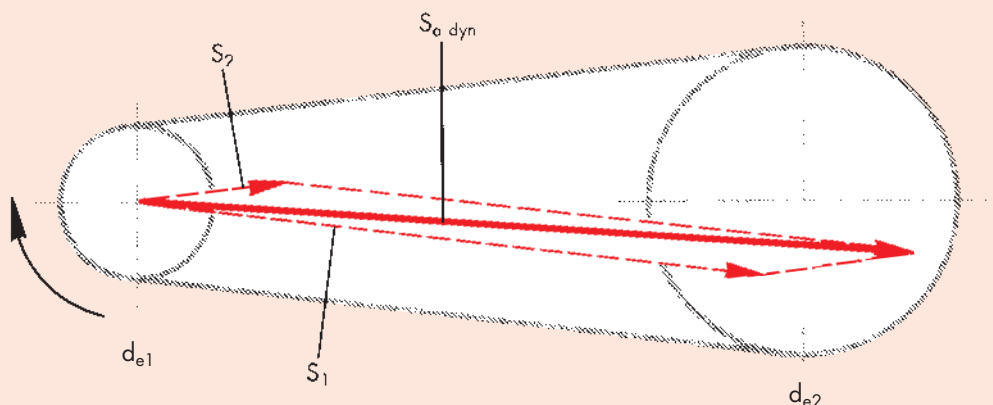
A) Solution using the Formula for $S_{a\text{dyn}}$

Dynamic axial force

$$S_{a\text{dyn}} \approx \sqrt{S_1^2 + S_2^2 - 2 \cdot S_1 \cdot S_2 \cdot \cos\beta}$$

$$S_{a\text{dyn}} \approx \sqrt{1452^2 + 42^2 - 2 \cdot 1452 \cdot 42 \cdot (-0.99619)} \approx \mathbf{1494 \text{ N}}$$

B) Graphical Solution



Design Hints

Length Tolerances - Installation and Maintenance

Table 20 Length Tolerances

Effective length L_e (mm)	Section PH	Section PJ	Section PK	Section PL	Section PM
	Tolerance (mm)	Tolerance (mm)	Tolerance (mm)	Tolerance (mm)	Tolerance (mm)
> 200 ≤ 500	+ 4 - 8	+ 4 - 8	+ 4 - 8		
> 500 ≤ 750	+ 5 - 10	+ 5 - 10	+ 5 - 10		
> 750 ≤ 1000	+ 6 - 12	+ 6 - 12	+ 6 - 12	+ 6 - 12	
> 1000 ≤ 1500	+ 8 - 16	+ 8 - 16	+ 8 - 16	+ 8 - 16	
> 1500 ≤ 2000	+ 10 - 20	+ 10 - 20	+ 10 - 20	+ 10 - 20	
> 2000 ≤ 3000	+ 12 - 24	+ 12 - 24	+ 12 - 24	+ 12 - 24	+ 12 - 24
> 3000 ≤ 4000				+ 15 - 30	+ 15 - 30
> 4000 ≤ 6000				+ 20 - 40	+ 20 - 40
> 6000 ≤ 8000				+ 30 - 60	+ 30 - 60
> 8000 ≤ 12500					+ 45 - 90
> 12500 ≤ 17000					+ 60 - 120

Installation and Maintenance

Correct design of drives using Optibelt-RB Ribbed Belts ensures long belt life and a high degree of operating safety.

Practice has shown that premature failure can often be traced to faulty installation or maintenance, thus the following recommendations are very important.

● Safety

Before commencing any maintenance work, ensure that all machine components are safely positioned and cannot be altered whilst the work is in progress. It is also important that the manufacturer's safety instructions be carefully followed.

● Pulleys

The grooves should be in good condition, free from scoring or sharp edges, and all dimensions should conform to the relevant standard.

● Alignment

Shafts and pulleys should be correctly aligned prior to belt installation.

We recommend a maximum tolerance of 0.5° in both planes.

● Installation of Ribbed Belts

The centre distance should be reduced prior to the installation of ribbed belts so that they may be fitted without undue force. Forcing ribbed belts over the pulley flanges with a tyre lever, screwdriver or the like, must be avoided as the damage this

causes to the ribs and low stretch tension members is often not visible.

● Belt Tensionin

Once the calculated axial force has been applied, the tension of the ribbed belts should be checked, using our tension gauges and the methods described on pages 40 to 44. The tension should be monitored during the first few hours of operation. Experience has shown that the belt will need retensioning after between 30 minutes and 4 hours at full load, to compensate for the small initial belt stretch and "bedding" into the pulley grooves.

● Idler Pulleys

Where possible, the use of idler pulleys should be avoided. If, for design reasons, such an arrangement is necessary, refer to the notes on pages 26 and 27 of this manual.

● Maintenance

It is recommended that ribbed belt drives should be regularly inspected for loss of belt tension, unusual heat build up or wear. Suitable shielding must be provided to prevent the intrusion of foreign bodies such as stones, swarf or other material between pulley and belt.

Optibelt-RB Ribbed Belts do not require any special maintenance measures. It is imperative belt dressing should not be used.



Power Transmission

Design Hints Ribbed Belt Widths

Table 21

Number of ribs z	Section PH (mm)	Section PJ (mm)	Section PK (mm)	Section PL (mm)	Section PM (mm)
2	3.20	4.68	7.12	9.40	18.80
3	4.80	7.02	10.68	14.10	28.20
4	6.40	9.36	14.24	18.80	37.60
5	8.00	11.70	17.80	23.50	47.00
6	9.60	14.04	21.36	28.20	56.40
7	11.20	16.38	24.92	32.90	65.80
8	12.80	18.72	28.48	37.60	75.20
9	14.40	21.06	32.04	42.30	84.60
10	16.00	23.40	35.60	47.00	94.00
11	17.60	25.74	39.16	51.70	103.40
12	19.20	28.08	42.72	56.40	112.80
13	20.80	30.42	46.28	61.10	122.20
14	22.40	32.76	49.84	65.80	131.60
15	24.00	35.10	53.40	70.50	141.00
16	25.60	37.44	56.96	75.20	150.40
17	27.20	39.78	60.52	79.90	159.80
18	28.80	42.12	64.08	84.60	169.20
19	30.40	44.46	67.64	89.30	178.60
20	32.00	46.80	71.20	94.00	188.00
21	33.60	49.14	74.76	98.70	197.40
22	35.20	51.48	78.32	103.40	206.80
23	36.80	53.82	81.88	108.10	216.20
24	38.40	56.16	85.44	112.80	225.60
25	40.00	58.50	89.00	117.50	235.00
26	41.60	60.84	92.56	122.20	244.40
27	43.20	63.18	96.12	126.90	253.80
28	44.80	65.52	99.68	131.60	263.20
29	46.40	67.86	103.24	136.30	272.60
30	48.00	70.20	106.80	141.00	282.00
31	49.60	72.54	110.36	145.70	291.40
32		74.88	113.92	150.40	300.80
33		77.22	117.48	155.10	310.20
34		79.56	121.04	159.90	319.60
35		81.90	124.60	164.50	329.00
36		84.24	128.16	169.20	338.46
37		86.58	131.72	173.90	347.80
38		88.92	135.28	178.60	357.20
39		91.26	138.84	183.30	366.60
40		93.60	142.40	188.00	376.00
41		95.94	145.96	192.70	385.40
42		98.28	149.52	197.40	394.80
43		100.62	153.08	202.10	404.20
44		102.96	156.64	206.80	413.60
45		105.30	160.20	211.50	423.00
46		107.54	163.76	216.20	
47		109.98	167.32	220.90	
48		112.32	170.88	225.60	
49		114.66	174.44	230.30	
50		117.00	178.00	235.00	
51				239.70	
52				244.40	
53				249.10	
54				253.80	
55				258.50	
56				263.20	
57				267.90	
58				272.60	
59				277.30	
60				282.00	



Power Transmission

Design Hints

Problems - Causes - Remedies

Problems	Causes	Remedies
Ribbed Belt breaking after a short period of running	Forcing ribbed belt over pulley when fitting, damaging tension cord Ingress of foreign body during running Overloaded drive, check number of ribs Drive stalled	Reduce drive centre distance to fit ribbed belt Fit an effective guard Check drive details and fit correct number of ribs Ascertain cause and put right
Cuts and splits in the ribs	Outside idler pulley in use whose position and size is not as recommended Pulley diameter too small Ambient temperature too high Ambient temperature too low Abnormal belt slip Contamination by chemical	Follow Optibelt recommendations e.g. increase pulley size; replace with inside idler pulley on the slack side of the drive Redesign using recommended minimum pulley diameters Ensure good ventilation and protect the belt from direct heat. Warm area around belt before start up Check drive design to ensure correct number of ribs, redesign if necessary. Check drive tension Protect drive from contamination
Severe belt vibration	Overloaded drive Drive centre distance significantly longer than recommended High shock loading Belt tension too low Unbalanced pulleys	Check drive design and modify if necessary Shorten centres. Use an inside idler in the drive slack side. Use an inside idler on the slack side Correct Balance pulleys

Design Hints

Problems - Causes - Remedies

Problems	Causes	Remedies
Ribbed Belt cannot be retensioned	<p>Insufficient allowance for drive centre adjustment</p> <p>Excessive stretch caused by overloaded drive</p> <p>Incorrect belt length</p>	<p>Modify drive to allow more take-up</p> <p>Recalculate drive and modify</p> <p>Use a shorter belt</p>
Excessive wear of ribs	<p>Starting torque too high</p> <p>Faulty pulleys</p> <p>Excessive wear in pulley grooves</p> <p>Wrong section of belt for pulley</p> <p>Poor drive alignment</p> <p>Small pulley diameter below recommended minimum</p> <p>Belt tension too low</p> <p>Belt rubbing or catching on protruding parts</p>	<p>Check drive details and redesign if necessary</p> <p>Renew or re-machine pulleys</p> <p>Renew pulleys</p> <p>Section of belt or pulley must be Corrected</p> <p>Realign</p> <p>Redesign using correct pulley diameters</p> <p>Check belt tension and correct</p> <p>Remove protrusions or move drive away if necessary</p>
Excessive noise	<p>Poor drive alignment</p> <p>Incorrect belt tension, overloaded drive</p> <p>High shock loading</p>	<p>Realign</p> <p>Retension and check drive details and redesign if necessary</p> <p>Check drive design and modify if necessary</p>
Ribbed Belt swelling or softening	<p>Contamination by oil, grease or chemicals</p>	<p>Protect drive from contamination</p> <p>Clean pulley grooves with petrol or alcohol before fitting new ribbed belt</p>

Further clarification of the various remedies shown above can be found elsewhere in this manual



Power Transmission

Data Sheet For Drive Calculation/Checking

Company _____

Address _____

Contact _____

Position _____ Date _____

Tel. () Fax: _____

For trials ☐ New drive ☐
For pilot series ☐ Existing drive ☐
For production series ☐ Requirement _____ belts/year

Fitted with:

Pieces	Effective length	Section	No. of ribs	Manufacturer

Prime Mover

Type (e.g. electric motor, diesel engine 3 cyl.) _____

Size of Starting Load (e.g. starting load = 1,8 normal load) _____

Method of Starting (e.g. star delta) _____

Operation hours per day _____

Number of starts _____ per hour ☐ per day ☐

Rotational reverses _____ per minute ☐ per hour ☐

Power: P normal _____ kW

P maximum _____ kW

or max. torque _____ Nm at n_1 _____ rpm

Speed of driver pulley n_1 _____ rpm

Position of shafts: horizontal ☐ vertical ☐
angled ☐ \angle _____ °

Maximum allowed static shaft loading $S_{a \max}$ _____ N

Effective (or outside) diameter of driver pulley:

d_{e1} _____ mm

$d_{e1 \min}$ _____ mm

$d_{e1 \max}$ _____ mm

Pulley face width L_{\max} _____ mm

Speed ratio r _____

Drive centre distance C _____ mm

Tension/guide pulleys: inside ☐

outside ☐

d_e _____ mm Ribbed pulley ☐

d_a _____ mm Flat pulley ☐

Drive Conditions: Ambient temperature

Exposure to oil ☐

water ☐

acid ☐

dust ☐

Driven Machine

Type (e.g. fan, compressor) _____

Start: loaded ☐ unloaded ☐

Nature of load: constant ☐ pulsating ☐

Shock ☐

Load: P normal _____ kW

P maximum _____ kW

or max. torque _____ Nm at n_2 _____ rpm

Speed of driven pulley n_2 _____ rpm

$n_{2 \min}$ _____ rpm

$n_{2 \max}$ _____ rpm

Maximum allowable static shaft loading $S_{a \max}$ _____ N

Effective (or outside) diameter of driven pulley:

d_{e2} _____ mm

$d_{e2 \min}$ _____ mm

$d_{e2 \max}$ _____ mm

Pulley face width L_{\max} _____ mm

r_{\min} _____ r_{\max} _____

C_{\min} _____ mm C_{\max} _____ mm

in drive slack side ☐

in drive tight side ☐

moveable ☐ (e.g. spring loaded) _____

fixed ☐

_____ °C/F min.

_____ °C/F max.

(e.g. oil mist, droplets) _____

(e.g. spray) _____

(type, concentration, temperature) _____

(type) _____

Special conditions: Where the drive is subjected to unusual conditions (e.g. inside or outside idler pulleys, two or more driven pulleys) then a sketch or any other relevant information should accompany this completed sheet.

[illegible]

51



Power Transmission

Standard Range

optibelt-TB Taper Bushes

Taper Bushes with metric bores and keyways to DIN 6885 part 1

	Taper Bush No.															
	1008	1108	1210	1215	1310	1610	1615	2012	2517	3020	3030	3525	3535	4040	4545	5050
Bore diameter d ₂ (mm)	10	10	11	11	14	14	14	14	16	25	35	35	35	40	55	70
	11	11	12	12	16	16	16	16	18	28	38	38	38	42	60	75
	12	12	14	14	18	18	18	18	19	30	40	40	40	45	65	80
	14	14	16	16	19	19	19	19	20	32	42	42	42	48	70	85
	16	16	18	18	20	20	20	20	22	35	45	45	45	50	75	90
	18	18	19	19	22	22	22	22	24	38	48	48	48	55	80	95
	19	19	20	20	24	24	24	24	25	40	50	50	50	60	85	100
	20	20	22	22	25	25	25	25	28	42	55	55	55	65	90	105
	22	22	24	24	28	28	28	28	30	45	60	60	60	70	95	110
	24*	24	25	25	30	30	30	30	32	48	65	65	65	75	100	115
	25*	25	28	28	32	32	32	32	35	50	70	70	70	80	105	120
		28*	30	30	35	35	35	35	38	55	75	75	75	85	110	125
			32	32		38	38	38	40	60		80	80	90		
						40	40	40	42	65		85	85	95		
						42*	42*	42	45	70		90	90	100		
Material: cast iron 20																
Torque (Nm)	5.7	5.7	20	20	20	20	20	31	49	92	92	115	115	172	195	275
Bush length(mm)	22.3	22.3	25.4	38.1	25.4	25.4	38.1	31.8	44.5	50.8	76.2	63.5	88.9	101.6	114.3	127.0
Weight with d _{2 min} (≈ kg)	0.12	0.16	0.28	0.39	0.32	0.41	0.60	0.75	1.06	2.50	3.75	3.90	5.13	7.68	12.70	15.17

* This bore is provided with a shallow keyway

Shallow keys for taper bushes

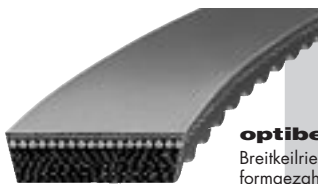
Bore diameter d ₂ (mm)	Keyway width b (mm)	Keyway depth t ₂ (mm)	Bore diameter d ₂ (mm)	Keyway width b (mm)	Keyway depth t ₂ (mm)
24	8	2.0	28	8	2.0
25	8	1.3	42	12	2.2

Taper Bushes with inch bores and keyway to British Standard BS 46 part 1

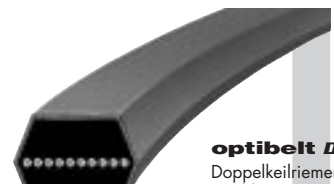
	Taper Bush No.															
	1008	1108	1210	1215	1310	1610	1615	2012	2517	3020	3030	3525	3535	4040	4545	5050
Bore diameter d ₂ (inch)	3/8	3/8	1/2	5/8	1/2	1/2	1/2	5/8	3/4	1 1/4	1 1/4	1 1/2	1 1/2	1 3/4	2 1/4	3
	1/2	1/2	5/8	3/4	5/8	5/8	5/8	3/4	7/8	1 3/8	1 3/8	1 5/8	1 5/8	1 7/8	2 3/8	3 1/4
	5/8	5/8	3/4	7/8	3/4	3/4	3/4	7/8	1	1 1/2	1 3/4	1 3/4	1 3/4	2	2 1/2	3 1/2
	3/4	3/4	7/8	1	7/8	7/8	7/8	1	1 1/8	1 5/8	1 5/8	1 7/8	1 7/8	2 1/8	2 3/4	3 3/4
	7/8	7/8	1	1 1/8	1	1	1	1 1/8	1 1/4	1 3/4	1 3/4	2	2	2 1/4	2 7/8	4
	1 ♦	1	1 1/8	1 1/4 ♦	1 1/8	1 1/8	1 1/8	1 1/4	1 3/8	1 7/8	1 7/8	2 1/8	2 1/8	2 3/8	3	4 1/4
		1 1/8 ♦	1 1/4 ♦		1 1/4	1 1/4	1 1/4	1 3/8	1 1/2	2	2	2 1/4	2 1/4	2 1/2	3 1/4	4 1/2
					1 3/8 ♦	1 3/8	1 3/8	1 1/2	1 5/8	2 1/8	2 1/8	2 3/8	2 3/8	2 5/8	3 3/8	4 3/4
						1 5/8 ♦	1 5/8 ♦	1 3/4	1 7/8	2 1/4	2 1/4	2 1/2	2 1/2	2 3/4	3 1/2	5
								1 7/8	2	2 1/2	2 1/2	2 3/4	2 3/4	3	4	
								2	2 1/8	2 5/8	2 5/8	2 7/8	2 7/8	3 1/8	4 1/4	
									2 1/4	2 3/4	2 3/4	3	3	3 1/4	4 1/2	
									2 3/8	2 7/8	2 7/8	3 1/8	3 1/8	3 3/8		
									2 1/2	3	3	3 1/4	3 1/4	3 1/2		
Material: cast iron 20																
Torque (Nm)	5.7	5.7	20	20	20	20	20	31	49	92	92	115	115	172	195	275
Bush length(mm)	22.3	22.3	25.4	38.1	25.4	25.4	38.1	31.8	44.5	50.8	76.2	63.5	88.9	101.6	114.3	127.0
Weight with d _{2 min} (≈ kg)	0.12	0.16	0.28	0.39	0.32	0.41	0.60	0.75	1.06	2.50	3.75	3.90	5.13	7.68	12.70	15.17



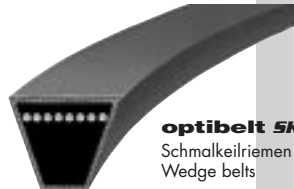
optibelt VB
Klassische Keilriemen
Classical V-belts



optibelt SUPER VX
Breitkeilriemen, flankenoffen,
formgezahnt
Variable speed belts,
raw edge, moulded cogged



optibelt DK
Doppelkeilriemen
Double section V-belts



optibelt SK
Schmalkeilriemen
Wedge belts



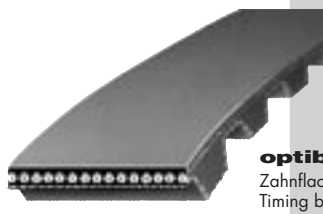
optibelt SUPER DVX
Doppel-Breitkeilriemen,
flankenoffen, formgezahnt
Double section variable speed
belts, raw edge, moulded cogged



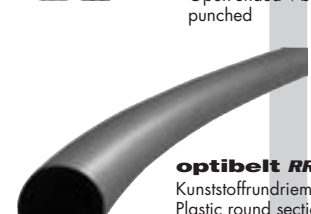
optimat OE
Endliche Keilriemen
DIN 2216, gelocht
Open-ended V-belt, punched



optibelt RED POWER II
Hochleistungs-Schmalkeilriemen,
wartungsfrei
High performance wedge belts,
service-free



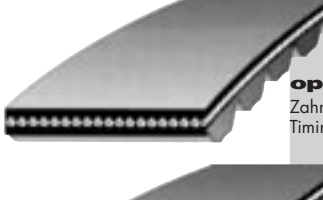
optibelt ZR
Zahnflachriemen
Timing belts



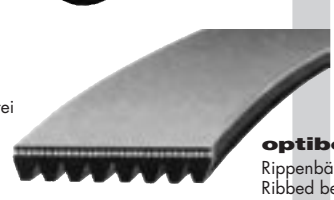
optibelt RR
Kunststoffrundriemen
Plastic round section
belting



optibelt Super X-POWER M=5
Keilriemen, flankenoffen, formgezahnt
V-belts, raw edge, moulded cogged



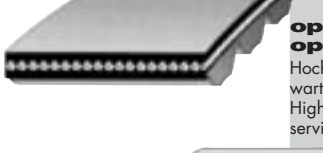
optibelt OMEGA
Zahnflachriemen, wartungsfrei
Timing belts, service-free



optibelt RB
Rippenbänder
Ribbed belts



optibelt KB
Kraftbänder
Kraftbands



optibelt OMEGA HL
optibelt OMEGA HP
Hochleistungs-Zahnflachriemen,
wartungsfrei
High performance timing belts,
service-free



optibelt KK
Kunststoffkeilriemen
Plastic V-beltting



optibelt KB
RED POWER II
Hochleistungs-Kraftbänder
High performance kraftbands



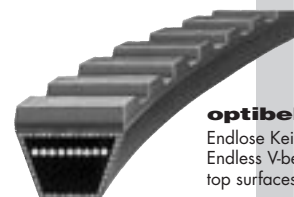
optibelt HTD® D
Doppel-Zahnflachriemen
Double section timing belts



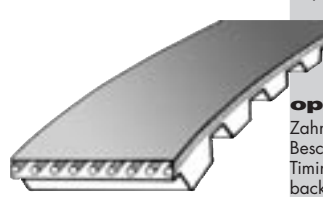
optibelt KBX
Kraftbänder, flankenoffen
Kraftbands, raw edge



optibelt ALPHA
optibelt ALPHA linear/V
optibelt ALPHAflex
Zahnflachriemen aus Polyurethan
Polyurethane timing belts



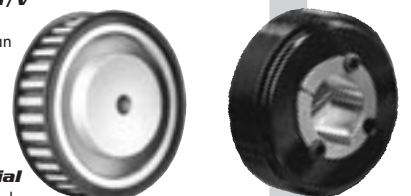
optibelt PKR
Endlose Keilriemen mit Auflage
Endless V-belts with special
top surfaces



optibelt ALPHA Spezial
Zahnflachriemen mit Nocken und
Beschichtungen
Timing belts with cleats and
back coverings



optibelt KS
Keilrillenscheiben
V-grooved pulleys



optibelt ZRS
Zahnriemenscheiben
Timing belt pulleys

optibelt RBS
Rippenbandscheiben
Ribbed belt pulleys

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