Center Distance Designer: Provides computerized Drive Ratio and Center Distance calculations. The Center Distance Designer program, on the web, computes belt lengths for various center distances and checks the number of teeth in mesh for both pulleys. It calculates pulley drive ratios and the minimal center distance for a designated pulley pair.

The Center Distance Designer searches and retrieves all pulleys and belts shown in the handbook that fits within the customer criteria. Once the design is completed, the part numbers can be instantly retrieved from the database. Each part number is then linked to an electronic catalog page, which is viewable and can be printed.

The user can design a drive in a most efficient manner, since the program described above presents available alternatives, as well as a direct reference to catalog page numbers and part numbers involved.

It is assumed, however, that not all users of this Handbook have access to a computer. Therefore, the Drive Ratio and Center Distance Tables are presented in this Handbook in printed format.

SECTION 21 DRIVE RATIO TABLES

In the design of belt drives, we usually know the speed ratio (transmission ratio) and we need to determine pulley sizes, center distance and belt length. These quantities are shown in **Figure 39**, for an open (uncrossed) belt.

The Drive Ratio Tables (**Table 41**, starting on page T-74) are designed to facilitate the determination of these quantities. They list the following information:

N1/N2 = the transmission ratio obtained when the larger pulley (N1 teeth) is the input and smaller pulley (N2 teeth) is the output. Given to 3 decimal places.

N2/N1 = the transmission ratio obtained when the larger pulley (N1 teeth) is the output and the smaller pulley (N2 teeth) is the input. Given to 3 decimal places. (Note that N1/N2 is the reciprocal of N2/N1)

N1 = number of teeth on larger pulley.

N2 = number of teeth on smaller pulley.

N1 – N2 = difference between number of teeth on larger and smaller pulleys. This number is useful in center-distance determination.

C MIN = The minimum center distance between pulleys for a belt of unit pitch. If the pitch is denoted by *p*, the actual minimum center distance is a product of C MIN and *p*. The minimum center distance is determined from the condition that at the minimum center distance, the pitch circles of the pulleys can be assumed to touch. This will generally give a satisfactory approximation to the practical minimum center distance. The table is based on the equation:

$$\text{C MIN} = \frac{\text{N1} + \text{N2}}{2\pi} \times \text{Belt Pitch} \qquad \textbf{(21-1)}$$

At the beginning of the table, a list of standard pulley sizes is shown. The smallest pulley has 10 teeth and the largest, 156 teeth. A standard size will be the most economical. If a nonstandard size is needed, however, please contact Stock Drive Products for assistance.

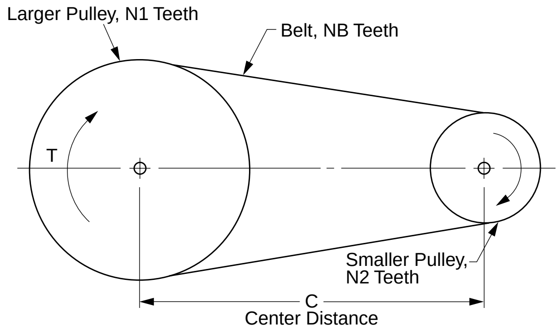

Fig. 39 Belt Nomenclature

The use of the tables is best illustrated by means of examples.

Example 1: For a transmission ratio of 1.067, find the number of teeth of the pulleys and the minimum center distance for a belt of 5 mm pitch.

When the transmission ratio is greater than unity, the larger pulley is the input and the smaller pulley is the output. That is to say, the transmission ratio is equal to N1/N2. The table is organized in order of increasing values of N1/N2 and decreasing values of N2/N1. Referring to the table at this value of N1/N2, we find the following entries:

N1/N2	N2/N1	N1	N2	N1 – N2	C MIN
1.067	0.938	16	15	1	4.934
		32	30	2	9.868

Hence, there are 2 different pulley combinations for the given transmission ratio of 1.067. For each of these, the minimum center distance is 5 x (C MIN) in mm. If the smaller pulley were driving, the transmission ratio would have been 0.938. The quantity (N1 – N2) is needed in center-distance calculations, as described in the next section.

Example 2: Given a transmission ratio of 0.680, determine the pulley sizes.

Since the transmission ratio is less than one, the smaller pulley is the input and the transmission ratio is given by N2/N1 = 0.680. Looking up this ratio in the table, we find N1 = 25, N2 = 17, N1 – N2 = 8. In this case, only one pulley combination is available.

Example 3: Given a driving pulley of 48 teeth and a driven pulley of 19 teeth, find the minimum center distance for a belt pitch of 3 mm.

The transmission ratio is N1/N2 = 48/19 = 2.526. Looking up this ratio in the table, we find C MIN = 10.663. The minimum center distance, therefore, is given by 3 x 10.663 or 31.989 mm.

Example 4: Given a transmission ratio of 2.258, find the pulley sizes.

Looking through the table, there is no entry at this value of the transmission ratio. The nearest entries are:

N1/N2	N2/N1	N1	N2	N1 – N2
2.250	0.444	36	16	20
		72	32	40
2.273	0.440	25	11	14

Since the difference between the desired ratio and the nearest available ratios is only about 0.008, it is likely that the 2.250 or 2.273 ratios will be acceptable. If this is not the case, however, the design may require review, or a nonstandard pulley combination may be considered.

SDP/SI
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Drive Ratio Tables

Table 41

Definition:

Drive Ratio (Transmission Ratio) is the ratio of number of teeth of the input and output pulleys. If the input pulley is larger than the output, the Drive Ratio will be larger than one and we have a step-up drive. If the input pulley is smaller than the output pulley, the Drive Ratio will be smaller than one and we have a step-down drive.

Nomenclature Used:

N1	=	Number of teeth of large pulley
N2	=	Number of teeth of small pulley
N1/N2	=	Step-up Drive Ratio
N2/N1	=	Step-down Drive Ratio
N1 – N2	=	Pulley tooth differential needed for **Table 42 – Center Distance Factor Table**
C MIN	=	Minimum center distance for particular pulley combination expressed in belt pitches

Pulley Sizes Included:

10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 24, 25,
28, 30, 32, 36, 40, 48, 60, 72, 84, 96, 120, 156

Note:

These pulley sizes reflect the preferred sizes per ISO Standard 5294 for synchronous belt drives – Pulleys (First edition – 1979-07-15). Many other sizes are offered in this catalog. The availability of stock sizes varies depending on the particular choice of pitch, material and configuration. Nonstandard sizes are available as custom made specials. Please submit your requirement for us to quote.

Continued on the next page

Table 41 (Cont.)

N1/N2	N2/N1	N1	N2	N1-N2	C MIN
1.000	1.000	10	10	0	3.183
		11	11	0	3.501
		12	12	0	3.820
		13	13	0	4.138
		14	14	0	4.456
		15	15	0	4.775
		16	16	0	5.093
		17	17	0	5.411
		18	18	0	5.730
		19	19	0	6.048
		20	20	0	6.366
		22	22	0	7.003
		24	24	0	7.639
		25	25	0	7.958
		28	28	0	8.913
		30	30	0	9.549
		32	32	0	10.186
		36	36	0	11.459
		40	40	0	12.732
		48	48	0	15.279
		60	60	0	19.099
		72	72	0	22.918
		84	84	0	26.738
		96	96	0	30.558
		120	120	0	38.197
		156	156	0	49.656
1.042	0.960	25	24	1	7.799
1.053	0.950	20	19	1	6.207
1.056	0.947	19	18	1	5.889
1.059	0.944	18	17	1	5.570
1.063	0.941	17	16	1	5.252
1.067	0.938	16	15	1	4.934
		32	30	2	9.868
1.071	0.933	15	14	1	4.615
		30	28	2	9.231
1.077	0.929	14	13	1	4.297
1.083	0.923	13	12	1	3.979
1.091	0.917	12	11	1	3.661
		24	22	2	7.321
1.100	0.909	11	10	1	3.342
		22	20	2	6.685
1.111	0.900	20	18	2	6.048
		40	36	4	12.096
1.118	0.895	19	17	2	5.730
1.120	0.893	28	25	3	8.435
1.125	0.889	18	16	2	5.411
		36	32	4	10.823
1.133	0.882	17	15	2	5.093
1.136	0.880	25	22	3	7.480
1.143	0.875	16	14	2	4.775
		32	28	4	9.549
		96	84	12	28.648
1.154	0.867	15	13	2	4.456
1.158	0.864	22	19	3	6.525
1.167	0.857	14	12	2	4.138
		28	24	4	8.276
		84	72	12	24.828
1.176	0.850	20	17	3	5.889
1.182	0.846	13	11	2	3.820
1.188	0.842	19	16	3	5.570
1.200	0.833	12	10	2	3.501
		18	15	3	5.252
		24	20	4	7.003
		30	25	5	8.754
		36	30	6	10.504
		48	40	8	14.006
		72	60	12	21.008
1.214	0.824	17	14	3	4.934
1.222	0.818	22	18	4	6.366
1.231	0.813	16	13	3	4.615
1.250	0.800	15	12	3	4.297
		20	16	4	5.730
		25	20	5	7.162
		30	24	6	8.594
		40	32	8	11.459
		60	48	12	17.189
		120	96	24	34.377
1.263	0.792	24	19	5	6.844
1.267	0.789	19	15	4	5.411
1.273	0.786	14	11	3	3.979
		28	22	6	7.958
1.280	0.781	32	25	7	9.072
1.286	0.778	18	14	4	5.093
		36	28	8	10.186
1.294	0.773	22	17	5	6.207
1.300	0.769	13	10	3	3.661
		156	120	36	43.927
1.308	0.765	17	13	4	4.775

Continued on the next page

Table 41 (Cont.)

N1/N2	N2/N1	N1	N2	N1-N2	C MIN
1.316	0.760	25	19	6	7.003
1.333	0.750	16	12	4	4.456
		20	15	5	5.570
		24	18	6	6.685
		32	24	8	8.913
		40	30	10	11.141
		48	36	12	13.369
		96	72	24	26.738
1.357	0.737	19	14	5	5.252
1.364	0.733	15	11	4	4.138
		30	22	8	8.276
1.375	0.727	22	16	6	6.048
1.385	0.722	18	13	5	4.934
1.389	0.720	25	18	7	6.844
1.400	0.714	14	10	4	3.820
		28	20	8	7.639
		84	60	24	22.918
1.412	0.708	24	17	7	6.525
1.417	0.706	17	12	5	4.615
1.429	0.700	20	14	6	5.411
		40	28	12	10.823
		120	84	36	32.468
1.440	0.694	36	25	11	9.708
1.455	0.688	16	11	5	4.297
		32	22	10	8.594
1.462	0.684	19	13	6	5.093
1.467	0.682	22	15	7	5.889
1.471	0.680	25	17	8	6.685
1.474	0.679	28	19	9	7.480
1.500	0.667	15	10	5	3.979
		18	12	6	4.775
		24	16	8	6.366
		30	20	10	7.958
		36	24	12	9.549
		48	32	16	12.732
		60	40	20	15.915
		72	48	24	19.099
1.538	0.650	20	13	7	5.252
1.545	0.647	17	11	6	4.456
1.556	0.643	28	18	10	7.321
1.563	0.640	25	16	9	6.525
1.571	0.636	22	14	8	5.730
1.579	0.633	30	19	11	7.799
1.583	0.632	19	12	7	4.934

N1/N2	N2/N1	N1	N2	N1-N2	C MIN
1.600	0.625	16	10	6	4.138
		24	15	9	6.207
		32	20	12	8.276
		40	25	15	10.345
		48	30	18	12.414
		96	60	36	24.828
1.625	0.615	156	96	60	40.107
1.636	0.611	18	11	7	4.615
		36	22	14	9.231
1.647	0.607	28	17	11	7.162
1.667	0.600	20	12	8	5.093
		25	15	10	6.366
		30	18	12	7.639
		40	24	16	10.186
		60	36	24	15.279
		120	72	48	30.558
1.684	0.594	32	19	13	8.117
1.692	0.591	22	13	9	5.570
1.700	0.588	17	10	7	4.297
1.714	0.583	24	14	10	6.048
		48	28	20	12.096
1.727	0.579	19	11	8	4.775
1.750	0.571	28	16	12	7.003
		84	48	36	21.008
1.765	0.567	30	17	13	7.480
1.778	0.563	32	18	14	7.958
1.786	0.560	25	14	11	6.207
1.800	0.556	18	10	8	4.456
		36	20	16	8.913
		72	40	32	17.825
1.818	0.550	20	11	9	4.934
		40	22	18	9.868
1.833	0.545	22	12	10	5.411
1.846	0.542	24	13	11	5.889
1.857	0.538	156	84	72	38.197
1.867	0.536	28	15	13	6.844
1.875	0.533	30	16	14	7.321
		60	32	28	14.642
1.882	0.531	32	17	15	7.799
1.895	0.528	36	19	17	8.754
1.900	0.526	19	10	9	4.615
1.920	0.521	48	25	23	11.618
1.923	0.520	25	13	12	6.048
2.000	0.500	20	10	10	4.775

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Table 41 (Cont.)

N1/N2	N2/N1	N1	N2	N1-N2	C MIN
2.000	0.500	22	11	11	5.252
		24	12	12	5.730
		28	14	14	6.685
		30	15	15	7.162
		32	16	16	7.639
		36	18	18	8.594
		40	20	20	9.549
		48	24	24	11.459
		60	30	30	14.324
		72	36	36	17.189
		96	48	48	22.918
		120	60	60	28.648
2.083	0.480	25	12	13	5.889
2.100	0.476	84	40	44	19.735
2.105	0.475	40	19	21	9.390
2.118	0.472	36	17	19	8.435
2.133	0.469	32	15	17	7.480
2.143	0.467	30	14	16	7.003
2.143	0.467	60	28	32	14.006
2.154	0.464	28	13	15	6.525
2.167	0.462	156	72	84	36.287
2.182	0.458	24	11	13	5.570
		48	22	26	11.141
2.200	0.455	22	10	12	5.093
2.222	0.450	40	18	22	9.231
2.250	0.444	36	16	20	8.276
		72	32	40	16.552
2.273	0.440	25	11	14	5.730
2.286	0.438	32	14	18	7.321
2.308	0.433	30	13	17	6.844
2.333	0.429	28	12	16	6.366
		84	36	48	19.099
2.353	0.425	40	17	23	9.072
2.400	0.417	24	10	14	5.411
		36	15	21	8.117
		48	20	28	10.823
		60	25	35	13.528
		72	30	42	16.234
		96	40	56	21.645
2.462	0.406	32	13	19	7.162
2.500	0.400	25	10	15	5.570
		30	12	18	6.685
		40	16	24	8.913
		60	24	36	13.369
2.500	0.400	120	48	72	26.738
2.526	0.396	48	19	29	10.663
2.545	0.393	28	11	17	6.207
2.571	0.389	36	14	22	7.958
		72	28	44	15.915
2.600	0.385	156	60	96	34.377
2.625	0.381	84	32	52	18.462
2.667	0.375	32	12	20	7.003
		40	15	25	8.754
		48	18	30	10.504
		96	36	60	21.008
2.727	0.367	30	11	19	6.525
		60	22	38	13.051
2.769	0.361	36	13	23	7.799
2.800	0.357	28	10	18	6.048
		84	30	54	18.144
2.824	0.354	48	17	31	10.345
2.857	0.350	40	14	26	8.594
2.880	0.347	72	25	47	15.438
2.909	0.344	32	11	21	6.844
3.000	0.333	30	10	20	6.366
		36	12	24	7.639
		48	16	32	10.186
		60	20	40	12.732
		72	24	48	15.279
		84	28	56	17.825
		96	32	64	20.372
		120	40	80	25.465
3.077	0.325	40	13	27	8.435
3.158	0.317	60	19	41	12.573
3.200	0.313	32	10	22	6.685
		48	15	33	10.027
		96	30	66	20.054
3.250	0.308	156	48	108	32.468
3.273	0.306	36	11	25	7.480
		72	22	50	14.961
3.333	0.300	40	12	28	8.276
		60	18	42	12.414
		120	36	84	24.828
3.360	0.298	84	25	59	17.348
3.429	0.292	48	14	34	9.868
		96	28	68	19.735
3.500	0.286	84	24	60	17.189
3.529	0.283	60	17	43	12.255

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Table 41 (Cont.)

N1/N2	N2/N1	N1	N2	N1-N2	C MIN
3.600	0.278	36	10	26	7.321
		72	20	52	14.642
3.636	0.275	40	11	29	8.117
3.692	0.271	48	13	35	9.708
3.750	0.267	60	16	44	12.096
		120	32	88	24.192
3.789	0.264	72	19	53	14.483
3.818	0.262	84	22	62	16.870
3.840	0.260	96	25	71	19.258
3.900	0.256	156	40	116	31.194
4.000	0.250	40	10	30	7.958
		48	12	36	9.549
		60	15	45	11.937
		72	18	54	14.324
		96	24	72	19.099
		120	30	90	23.873
4.200	0.238	84	20	64	16.552
4.235	0.236	72	17	55	14.165
4.286	0.233	60	14	46	11.777
		120	28	92	23.555
4.333	0.231	156	36	120	30.558
4.364	0.229	48	11	37	9.390
		96	22	74	18.780
4.421	0.226	84	19	65	16.393
4.500	0.222	72	16	56	14.006
4.615	0.217	60	13	47	11.618
4.667	0.214	84	18	66	16.234
4.800	0.208	48	10	38	9.231
		72	15	57	13.846
		96	20	76	18.462
		120	25	95	23.077
4.875	0.205	156	32	124	29.921
4.941	0.202	84	17	67	16.075
5.000	0.200	60	12	48	11.459
		120	24	96	22.918
5.053	0.198	96	19	77	18.303
5.143	0.194	72	14	58	13.687
5.200	0.192	156	30	126	29.603
5.250	0.190	84	16	68	15.915
5.333	0.188	96	18	78	18.144
5.455	0.183	60	11	49	11.300
		120	22	98	22.600
5.538	0.181	72	13	59	13.528
5.571	0.179	156	28	128	29.285

N1/N2	N2/N1	N1	N2	N1-N2	C MIN
5.600	0.179	84	15	69	15.756
5.647	0.177	96	17	79	17.985
6.000	0.167	60	10	50	11.141
		72	12	60	13.369
		84	14	70	15.597
		96	16	80	17.825
		120	20	100	22.282
6.240	0.160	156	25	131	28.807
6.316	0.158	120	19	101	22.123
6.400	0.156	96	15	81	17.666
6.462	0.155	84	13	71	15.438
6.500	0.154	156	24	132	28.648
6.545	0.153	72	11	61	13.210
6.667	0.150	120	18	102	21.963
6.857	0.146	96	14	82	17.507
7.000	0.143	84	12	72	15.279
7.059	0.142	120	17	103	21.804
7.091	0.141	156	22	134	28.330
7.200	0.139	72	10	62	13.051
7.385	0.135	96	13	83	17.348
7.500	0.133	120	16	104	21.645
7.636	0.131	84	11	73	15.120
7.800	0.128	156	20	136	28.011
8.000	0.125	96	12	84	17.189
		120	15	105	21.486
8.211	0.122	156	19	137	27.852
8.400	0.119	84	10	74	14.961
8.571	0.117	120	14	106	21.327
8.667	0.115	156	18	138	27.693
8.727	0.115	96	11	85	17.030
9.176	0.109	156	17	139	27.534
9.231	0.108	120	13	107	21.168
9.600	0.104	96	10	86	16.870
9.750	0.103	156	16	140	27.375
10.000	0.100	120	12	108	21.008
10.400	0.096	156	15	141	27.215
10.909	0.092	120	11	109	20.849
11.143	0.090	156	14	142	27.056
12.000	0.083	120	10	110	20.690
		156	13	143	26.897
13.000	0.077	156	12	144	26.738
14.182	0.071	156	11	145	26.579
15.600	0.064	156	10	146	26.420