7.2 Center distance between sprockets

7.2.1 The center to center distance between sprockets, as a general rule, should not be less than 1.5 times the diameter of the larger sprocket and not less than thirty times the pitch nor more than 50 times the pitch. In certain cases, a center distance equivalent to 80 pitches may be considered an approved maximum. The chain should extend around at least 120 degrees of the pinion circumference, and this minimum amount of contact is obtained for all center distances provided the ratio is less than 3.5 to one.

7.2.2 Other things being equal, a longer center distance is recommended.

7.2.3 If possible, the center distance should be adjustable in order to take care of the slack due to elongation from wear and this range of adjustments should be at least one and one-half pitches.

7.2.4 A little slack is desirable as it allows the chain links to take the best position on the sprocket teeth and reduces the wear on the bearings. Too much sag or an excessive distance between the sprockets may cause the chain to whip up and down, a condition detrimental to smooth running and very destructive to the chain.

7.2.5 The sprockets should run in a vertical plane, the sprocket axes being approximately horizontal, unless an idler is used on the slack side to keep the chain in position. The most satisfactory results are obtained when the slack of the chain is on the bottom.

7.3 Center distance for a given length

When the distance between the driving and the driven sprockets can be varied to suit the length of the chain, this center distance for tight chain may be determined by the following formula:

$$C = \frac{P}{8}\left[2L_P - N - n + \sqrt{(2L - N - n)^2 - 0.810(N - n)^2} \right] \quad \text{.....[Eq. 1]}$$

Where: C = center to center distance in millimeters
L_P = the length of chain in pitches
P = pitch of the chain
N = the number of teeth in the large sprocket
n = number of teeth in small sprockets

NOTE:
The length L in pitches should be an even number for roller chain, so that the use of a cranked (offset) connecting link will not be necessary.

7.4 Length of driving chain

The total length of a roller chain should be given in multiples of twice the pitch, because the ends must be connected with an outside and inside link. The length of a chain can be calculated accurately enough for ordinary practice by the use of the following formula in which the variables used are defined in the previous equation:

$$L_P = 2C_P + \frac{N}{2} + \frac{n}{2} + \left(\frac{N-n}{2\pi}\right)^2 \left(\frac{1}{C_P}\right) \quad \text{[Eq. 2]}$$

Where: L_P = the length of chain in pitches
C_P = the center to center distance in pitches

7.5 Idler sprockets

When sprockets have a fixed center distance or are non-adjustable, it may be advisable to use an idler sprocket for taking up the slack. The idler should preferably be placed against the slack side between the two strands of the chain. When an idler sprocket is applied to the tight side of the chain to reduce vibration, it should be on the lower side and so located that the chain will run on a straight line between the two main sprockets. An idler sprocket will wear excessively if the number of teeth is too small and the speed too high, because there is impact between the teeth and rollers even though the idler carries practically no load.

7.6 Power rating

7.6.1 The power rating of chains may be computed by the equation:

$$Design\ power = \frac{Power\ to\ be\ transmitted \times Service\ factor}{Multiple\ strand\ factor} \quad \text{[Eq. 3]}$$

The power rating, multiple strand factor, and service factors are given in Tables 10 - 17, 18, and 19, respectively. The tables for power rating are divided into four zones (as illustrated by the boundary lines), each zone corresponds to the type of lubrication.

Table 11 – Power ratings for standard single strand roller chain – No. 25, watts

No. of teeth small sprocket	Revolutions per minute of small sprocket																							
	50	100	300	500	700	900	1,200	1,500	1,800	2,100	2,500	3,000	3,500	4,000	4,500	5,000	5,500	6,000	6,500	7,000	7,500	8,000	8,500	9,000
11	22	37	104	172	231	291	373	462	544	619	731	858	984	1,029	865	738	641	559	500	447	403	365	336	306
12	22	45	119	186	254	321	410	507	597	686	798	940	1,081	1,171	984	835	723	641	567	507	455	418	380	350
13	30	45	127	201	276	350	447	552	649	746	872	1,029	1,178	1,320	1,111	947	820	716	641	574	515	470	425	395
14	30	52	142	224	298	373	485	597	701	805	947	1,111	1,275	1,439	1,238	1,059	917	805	716	641	574	522	477	440
15	30	52	149	239	321	403	522	641	753	872	1,014	1,201	1,380	1,551	1,372	1,171	1,014	895	790	708	641	582	529	485
16	30	60	164	254	350	433	567	686	813	932	1,089	1,283	1,476	1,663	1,514	1,290	1,119	984	872	783	701	641	582	537
17	37	60	172	276	373	462	604	738	865	992	1,163	1,372	1,573	1,775	1,655	1,417	1,223	1,074	954	850	768	701	641	589
18	37	67	186	291	395	492	641	783	925	1,059	1,,238	1,462	1,678	1,887	1,805	1,544	1,335	1,171	1,037	932	835	761	694	641
19	37	67	194	306	418	522	679	828	977	1,119	1,312	1,544	1,775	2,006	1,954	1,670	1,447	1,,268	1,126	1,007	910	828	753	694
20	45	75	209	328	440	552	716	872	1,029	1,186	1,387	1,633	1,879	2,118	2,110	1,805	1,566	1,372	1,215	1,044	984	895	813	746
21	45	82	216	343	462	582	753	925	1,089	1,253	1,462	1,723	1,984	2,230	2,274	1,939	1,685	1,476	1,312	1,171	1,059	962	872	805
22	45	82	231	358	492	611	798	969	1,141	1,312	1,536	1,812	2,081	2,349	2,438	2,081	1,805	1,581	1,402	1,260	1,133	1,029	940	865
23	45	89	239	380	515	641	835	1,022	1,201	1,380	1,611	1,902	2,185	2,461	2,610	2,222	1,931	1,693	1,499	1,342	1,208	1,096	1,007	925
24	52	97	254	395	537	671	872	1,066	1,260	1,447	1,693	1,991	2,289	2,580	2,781	2,371	2,058	1,805	1,603	1,432	1,290	1,171	1,074	984
25	52	97	261	418	559	701	910	1,119	1,312	1,506	1,767	2,081	2,394	2,692	2,953	2,520	2,185	1,916	1,700	1,521	1,372	1,245	1,141	1,044
26	52	104	276	433	589	731	954	1,163	1,372	1,573	1,842	2,170	2,491	2,811	3,124	2,677	2,319	2,036	1,805	1,618	1,454	1,320	1,208	1,111
28	60	112	298	470	634	798	1,029	1,260	1,484	1,708	1,998	2,349	2,699	3,050	3,385	2,990	2,588	2,274	2,013	1,805	1,626	1,476	1,350	1,238
30	60	119	321	507	686	858	1,111	1,357	1,603	1,834	2,148	2,535	2,908	3,281	3,646	3,318	2,871	2,520	2,237	1,998	1,805	1,641	1,499	1,372
32	67	127	343	544	731	917	1,193	1,454	1,715	1,969	2,304	2,714	3,117	3,520	3,915	3,654	3,169	2,781	2,461	2,207	1,991	1,805	1,648	1,514
35	75	142	380	597	805	1,014	1,312	1,603	1,887	2,170	2,543	2,990	3,438	3,878	4,310	4,176	3,624	3,177	2,819	2,520	2,274	2,066	1,887	1,730
40	89	164	433	686	932	1,171	1,514	1,849	2,185	2,506	2,931	3,460	3,967	4,474	4,981	5,108	4,422	3,885	3,445	3,080	2,781	2,520	2,304	2,110
45	97	186	492	783	1,059	1,327	1,723	2,103	2,476	2,849	3,333	3,922	4,511	5,086	5,593	6,092	5,280	4,631	4,109	3,676	3,318	3,013	2,752	2,520
	A				B								C											

Type A: Manual or drip lubrication
Type B: Bath or disc lubrication
Type C: Oil or stream lubrication

Table 12 – Power ratings for standard single strand roller chain – No. 35, watts

No. of teeth small sprocket	Revolutions per minute of small sprocket																							
	50	100	300	500	700	900	1,200	1,500	1,800	2,100	2500	3,000	3,500	4,000	4,500	5,000	5,500	6,000	6,500	7,000	7,500	8,000	8,500	9,000	10,000
11	75	134	365	574	783	977	1,268	1,551	1,827	2,103	2,461	2,192	1,737	1,424	1,193	1,022	880	776	686	611	552	500	462	425	358
12	82	149	403	634	858	1,074	1,394	1,708	2,013	2,312	2,699	2,498	1,984	1,618	1,357	1,163	1,007	880	783	701	634	574	522	477	410
13	89	164	440	694	940	1,171	1,521	1,857	2,192	2,520	2,946	2,811	2,237	1,827	1,529	1,305	1,133	992	880	790	708	649	589	544	462
14	97	179	470	753	1,019	1,275	1,648	2,013	2,371	2,729	3,192	3,147	2,498	2,043	1,715	1,462	1,268	1,111	984	880	798	723	656	604	515
15	104	186	507	805	1,096	1,372	1,775	2,170	2,558	2,938	3,438	3,490	2,767	2,267	1,902	1,618	1,402	1,230	1,096	977	880	798	731	671	574
16	112	201	544	865	1,171	1,469	1,902	2,327	2,744	3,147	3,684	3,840	3,050	2,498	2,095	1,790	1,551	1,357	1,208	1,081	969	880	805	738	634
17	119	216	582	925	1,253	1,566	2,036	2,483	2,931	3,363	3,937	4,206	3,341	2,737	2,759	1,954	1,693	1,491	1,320	1,178	1,066	969	880	813	694
18	127	231	619	984	1,327	1,670	2,170	2,640	3,117	3,579	4,183	4,586	3,639	2,975	2,498	2,133	1,849	1,618	1,439	1,290	1,163	1,051	962	887	753
19	134	246	656	1,044	1,409	1,767	2,289	2,804	3,303	3,796	4,437	4,974	3,945	3,229	2,707	2,312	2,006	1,760	1,559	1,394	1,260	1,141	1,044	954	820
20	142	261	694	1,104	1,491	1,872	2,424	2,960	3,490	4,012	4,690	5,369	4,265	3,490	2,923	2,498	2,163	1,902	1,685	1,506	1,357	1,230	1,126	1,037	880
21	149	276	731	1,163	1,573	1,969	2,550	3,124	3,676	4,228	4,944	5,779	4,586	3,751	3,147	2,685	2,327	2,043	1,812	1,618	1,462	1,327	1,208	1,111	947
22	157	283	768	1,223	1,655	2,073	2,685	3,281	3,870	4,444	5,198	6,122	4,914	4,027	3,371	2,878	2,498	2,192	1,946	1,737	1,566	1,424	1,298	1,193	1,022
23	164	298	805	1,283	1,737	2,177	2,819	3,445	4,057	4,661	5,451	6,428	5,257	4,303	3,602	3,080	2,670	2,341	2,081	1,857	1,678	1,521	1,387	1,275	1,089
24	172	313	850	1,342	1,820	2,274	2,953	3,609	4,250	4,884	5,712	6,726	5,332	4,586	3,840	3,281	2,841	2,498	2,215	1,976	1,790	1,618	1,484	1,357	1,163
25	179	328	887	1,402	1,902	2,379	3,080	3,766	4,437	5,101	5,966	7,032	5,958	4,877	4,086	3,490	2,274	2,655	2,356	2,103	1,902	1,723	1,573	1,447	1,230
26	186	343	925	1,462	1,984	2,483	3,214	3,930	4,631	5,324	6,227	7,338	6,316	5,168	4,333	3,699	3,207	2,811	2,498	2,237	2,013	1,827	1,670	1,529	1,305
28	201	373	999	1,581	2,148	2,692	3,482	4,258	5,019	5,764	6,749	7,979	7,062	5,779	4,840	4,139	3,587	3,147	2,789	2,498	2,252	2,043	1,864	1,715	1,387
30	216	403	1,081	1,708	2,312	2,901	3,751	4,586	5,406	6,212	7,263	8,576	7,830	6,406	5,369	4,586	3,975	3,490	3,095	2,767	2,498	2,267	2,066	1,902	1,618
32	231	433	1,156	1,827	2,476	3,110	4,027	4,922	5,794	6,659	7,755	9,172	8,650	7,062	5,913	5,048	4,377	3,840	3,408	3,050	2,752	2,498	2,282	2,095	-
35	254	477	1,275	2,013	2,729	3,423	4,437	5,421	6,383	7,338	8,576	10,142	9,843	8,054	6,734	5,779	5,011	4,400	3,900	3,490	3,147	2,856	2,610	2,394	-
40	291	544	1,469	2,327	3,154	3,952	5,123	6,264	7,375	8,501	9,918	11,707	12,080	9,843	8,277	7,062	6,122	5,369	4,765	4,265	3,840	3,490	-	-	-
45	336	619	1,670	2,647	3,579	4,489	5,816	7,107	8,352	9,620	11,260	12,751	14,392	11,782	9,843	8,426	7,300	6,406	5,682	5,086	-	-	-	-	-
	A		B							C															

Type A: Manual or drip lubrication
Type B: Bath or disc lubrication
Type C: Oil or stream lubrication