ASME B29.12M-1997

[Revision of ANSI/ASME B29.12M-1983 (R1988)]

REAFFIRMED 2004

FOR CURRENT COMMITTEE PERSONNEL
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STEEL BUSHED ROLLERLESS CHAINS, ATTACHMENTS, AND SPROCKET TEETH

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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Date of Issuance: September 1, 1997

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The American Society of Mechanical Engineers
345 East 47th Street, New York, NY 10017

FOREWORD

(This Foreword is not part of ASME B29.12M-1997.)

Chains of the type covered by this Standard were introduced early in the 20th century. The chains met with considerable success on material conveyors and elevators, and manufacturers developed and marketed many sizes and types in the next several years.

The American Sprocket Chain Manufacturers Association (now the American Chain Association) recognized the need for standards which would provide for interchangeability by intercoupling chains of various manufacture. In November 1960, a working group of producers of the bushed rollerless chains was formed to accomplish standardization. This Standard is the result of the work of that group.

This Standard was presented to the USA (now ANSI) Standards Committee B29 on December 12, 1967, and, upon approval by the USA Standards Institute (now American National Standards Institute, Inc.), on October 18, 1968, was adopted and published. The 1974 revision included minor changes in metric units and the addition of caution notes to Table 1.

To facilitate the use of this Standard in the international market, the metric equivalents of all dimensions are given.

The current revision includes the addition of chain numbers S-856, S-857, S-859, and S-864 and attachments K-24, K-3, K-35, K-44, and K-443 for these chains. Also added is minimum bolt hole diameter required for the bolt diameter for a particular attachment. The Minimum Ultimate Tensile Strength definition (para. 2.1) has also been modified.

This revision was approved by the American National Standards Institute, Inc., on March 25, 1997.

ASME STANDARDS COMMITTEE B29

Chains, Attachments, and Sprockets for Power Transmission and Conveying

(The following is the roster of the Committee at the time of approval of this Standard.)

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STEEL BUSHED ROLLERLESS CHAINS, ATTACHMENTS, AND SPROCKET TEETH

1 NOMENCLATURE

steel bushed rollerless chains: a series of block links having steel bushings to contact the sprocket teeth, alternating with links composed of sidebars and pins which articulate in the steel bushings of the block link.

Pins and bushings are fixed against rotation in sidebar pitch holes by mechanical locks such as flats, interference fits, or both.

Assembly of pins may be from either side or alternated at the manufacturer's option.

See Figs. 1 and 2.

2 GENERAL CHAIN PROPORTIONS AND DESIGNATIONS

2.1 Minimum Ultimate Tensile Strength (M.U.T.S.)

Minimum Ultimate Tensile Strength (M.U.T.S.) for chain covered by this Standard is the minimum force at which an unused, undamaged chain could fail when subjected to a single tensile loading test.

WARNING: The Minimum Ultimate Tensile Strength is NOT a "working load!" The M.U.T.S. greatly exceeds the maximum force that may be safely applied to the chain.

(*a*) Test Procedure: A tensile force is slowly applied, in uniaxial direction, to the ends of the chain sample.

(*b*) The tensile test is a destructive test. Even though the chain may not visibly fail when subjected to the "Minimum Ultimate Tensile Force," it will have been damaged and will be unfit for service!

2.2 Measuring Load

The measuring load in pounds or newtons listed in Table 1 is the load under which a dry or lightly lubricated chain should be measured for length.

2.3 Strand Length Tolerance

New chains under measuring load may be over theoretical length up to 0.38 in. in 120 in. (9.7 mm in 3048 mm), but must not be under the theoretical length.

Maximum and minimum strand lengths for each chain are listed in Table 1.

2.4 Dimensions of Chain Links

To assure interchangeability of either block links or connecting links as produced by different makers of chain, standard maximum and minimum dimensions are adopted. They are not actual dimensions used in manufacturing but limiting dimensions, maximum or minimum, required to assure the desired interchangeability. In addition to the sprocket tooth form in this Standard, these chains can operate over sprockets designed to ASME B29.11M-1994 or combination chains, provided consideration is given to strength and additional sidebar clearance required for chain sizes S 111 and S 150.

Dimensions are given in a decimal inch system essentially in accordance with ANSI B87.1-1965. The metric equivalent dimensions are for reference only in ANSI Z210.1-1972.

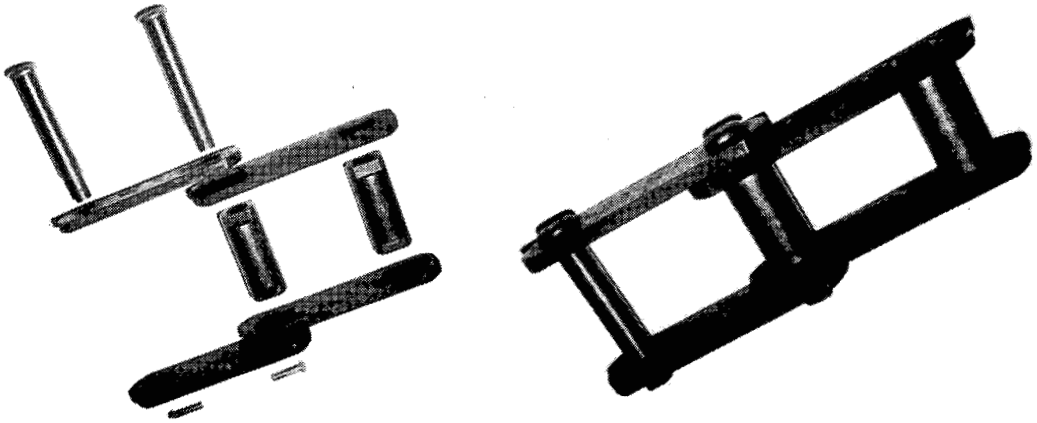


FIG. 1 STEEL BUSHED ROLLERLESS CHAIN

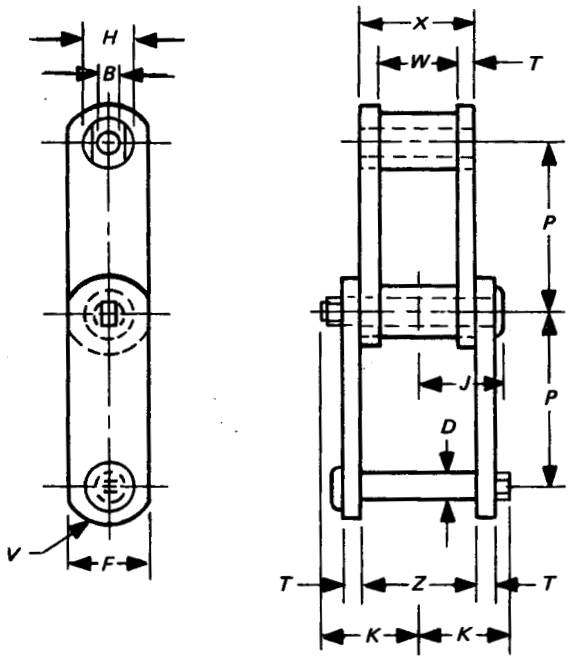


FIG. 2 STEEL BUSHED ROLLERLESS CHAIN NOMENCLATURE

3 CHAIN DIMENSIONS

TABLE 1 GENERAL CHAIN DIMENSIONS, M.U.T.S., STRAND LENGTH, AND MEASURING LOAD

Dimensions, in.

Chain Number	S 102B	S 110	S 111	S 131	S 150	S 188	S 856	S 857	S 859	S 864
P-Chain pitch	4.000	6.000	4.760	3.075	6.050	2.609	6.000	6.000	6.000	7.000
D-Pin diameter	0.625	0.625	0.750	0.625	1.000	0.500	1.000	1.000	1.250	1.250
F-Overall chain height	1.50	1.50	2.00	1.50	2.50	1.12	2.50	3.25	4.00	4.00
H-Bushing diameter	1.00	1.26	1.44	1.26	1.76	0.88	1.75	1.75	2.38	2.38
T-Sidebar thickness	0.38	0.38	0.38	0.38	0.50	0.25	0.50	0.50	0.63	0.63
W-Inside width	2.13	2.13	2.63	1.32	3.32	1.06	3.00	3.00	3.75	3.75
M.U.T.S., lb (see 2.1)	36.000	36.000	48.000	36.000	85.000	23.000	82.000	97.000	155.000	155.000
Number of pitches/ nominal 120 in. strand	30	20	26	40	20	46	20	20	20	18
Max. measuring length of nominal 120 in. strand	120.38	120.38	124.14	123.38	121.38	120.39	120.38	120.38	120.38	126.38
Min. measuring length of nominal 120 in. strand	120.00	120.00	123.76	123.00	121.00	120.00	120.00	120.00	120.00	126.00
Measuring load, lb	300	300	500	400	800	200	800	1000	1700	1500

Dimensions, mm

Chain Number	S 102B	S 110	S 111	S 131	S 150	S 188	S 856	S 857	S 859	S 864
P-Chain pitch	101.60	152.40	120.90	78.11	153.67	66.27	152.40	152.40	152.40	177.80
D-Pin diameter	15.88	15.88	19.05	15.88	25.40	12.70	25.40	25.40	31.75	31.75
F-Overall chain height	38.1	38.1	50.8	38.1	63.5	28.4	63.5	82.6	101.6	101.6
H-Bushing diameter	25.4	32.0	36.6	32.0	44.7	22.4	44.4	44.4	60.4	60.4
T-Sidebar thickness	9.7	9.7	9.7	9.7	12.7	6.4	12.7	12.7	16.0	16.0
W-Inside width	54.1	54.1	66.8	33.5	84.3	26.9	76.2	76.2	95.3	95.3
M.U.T.S.k*N* (see 2.1)	160	160	214	160	378	102	365	432	690	690
Number of pitches/ nominal 3048 mm strand	30	20	26	40	20	46	20	20	20	18
Max. measuring length of nominal 3048 mm strand	3057.7	3057.7	3153.2	3138.9	3083.1	3057.9	3057.7	3057.7	3057.7	3220.0
Min. measuring length of nominal 3048 mm strand	3048.0	3048.0	3143.5	3124.2	3073.4	3048.3	3048.0	3048.0	3048.0	3200.0
Measuring load, k*N*	1.3	1.3	2.2	1.8	3.6	0.9	3.5	4.5	7.7	6.8

TABLE 2 MAXIMUM AND MINIMUM CONTROLLING DIMENSIONS FOR INTERCHANGEABLE CHAIN LINKS

	Dimensions, in.									
Chain Number	**S 102B**	**S 110**	**S 111**	**S 131**	**S 150**	**S 188**	**S 856**	**S 857**	**S 859**	**S 864**
P-Chain pitch	4.000	6.000	4.760	3.075	6.050	2.609	6.000	6.000	6.000	7.000
D-Pin diameter (max.)	0.626	0.626	0.751	0.626	1.001	0.501	1.001	1.001	1.251	1.251
B-Inside diameter of bushing (min.)	0.631	0.631	0.756	0.631	1.006	0.506	1.006	1.006	1.256	1.256
H-Bushing diameter (max.)	1.00	1.26	1.44	1.26	1.76	.88	1.75	1.75	2.38	2.38
Z-Width between outer sidebars (min.)	2.94	2.94	3.44	2.13	4.40	1.62	4.03	4.03	5.08	5.08
X-Width of block link (max.)	2.92	2.92	3.42	2.11	4.38	1.60	4.06	4.06	5.06	5.06
W-Inside width between sidebars block link (min.)	2.02	2.02	2.49	1.25	3.15	1.01	2.85	2.85	3.56	3.56

	Dimensions, mm									
Chain Number	**S 102B**	**S 110**	**S 111**	**S 131**	**S 150**	**S 188**	**S 856**	**S 857**	**S 859**	**S 864**
P-Chain pitch	101.60	152.40	120.90	78.11	153.67	66.27	152.40	152.40	152.40	177.80
D-Pin diameter (max.)	15.87	15.87	19.13	15.87	25.43	12.73	25.43	25.43	31.77	31.77
B-Inside diameter of bushing (min.)	16.03	16.03	19.25	16.03	25.55	12.85	25.55	25.55	31.90	31.90
H-Bushing diameter (max.)	25.40	32.50	36.60	32.50	44.70	22.40	44.45	44.45	60.45	60.45
Z-Width between outer sidebars (min.)	74.68	74.68	87.38	54.10	111.76	41.15	102.36	102.36	129.03	129.03
X-Width of block link (max.)	74.17	74.17	86.87	53.59	111.25	40.64	103.12	103.12	128.52	128.52
W-Inside width between sidebars block link (min.)	51.30	51.30	63.20	31.70	80.00	25.60	72.39	72.39	90.42	90.42

TABLE 3 CHAIN CLEARANCE DIMENSIONS

Dimensions, in.										
Chain Number	**S 102B**	**S 110**	**S 111**	**S 131**	**S 150**	**S 188**	**S 856**	**S 857**	**S 859**	**S 864**
F-Chain height (max.)	1.56	1.56	2.06	1.56	2.62	1.18	2.62	3.37	4.09	4.09
V-Sidebar end clearance radius (max.)	0.94	0.94	1.34	0.94	1.78	0.67	1.40	1.90	2.38	2.38
R-Attachment clearance radius (min.)	0.96	0.96	1.36	0.96	1.80	0.69	1.42	1.92	2.26	2.26
J-Pin head to centerline (max.)	2.07	2.07	2.41	1.65	3.10	1.26	2.91	2.91	3.57	3.57
K-Pin end to centerline (max.)	2.31	2.31	2.75	1.91	3.38	1.44	3.19	3.19	3.85	3.85

Dimensions, mm										
Chain Number	**S 102B**	**S 110**	**S 111**	**S 131**	**S 150**	**S 188**	**S 856**	**S 857**	**S 859**	**S 864**
F-Chain height (max.)	39.6	39.6	52.3	39.6	66.5	30.0	66.5	85.6	103.9	103.9
V-Sidebar end clearance radius (max.)	23.9	23.9	34.0	23.9	45.2	17.0	35.6	48.3	60.5	60.5
R-Attachment clearance radius (min.)	24.4	24.4	34.5	24.4	45.7	17.5	36.1	48.8	57.4	57.4
J-Pin head to centerline (max.)	52.6	52.6	61.3	41.9	78.7	32.0	73.9	73.9	90.7	90.7
K-Pin end to centerline (max.)	58.7	58.7	69.9	48.6	85.9	36.6	81.0	81.0	97.8	97.8

4 ATTACHMENT DIMENSIONS

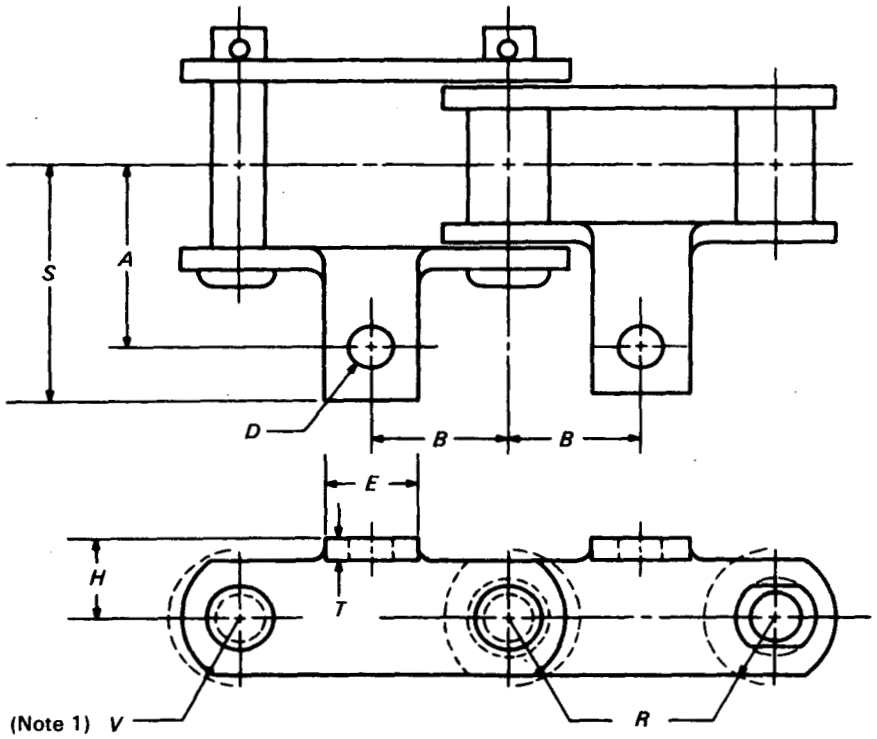


TABLE 4 A-1 ATTACHMENT

Dimensions, in.									
Chain Number	*A*	*B*	*E*, Max.	*H*	*S*, Max.	*T*, Max.	*R*, Min.	Bolt Size	*D*, Min. Hole
S 102 B	2.38	2.00	3.03	1.00	3.56	0.41	0.96	.38	.40
S 131	2.06	1.54	2.91	1.00	3.09	0.41	0.96	.50	.53
S 188	1.88	1.30	2.15	0.81	2.59	0.28	0.69	.33	.40

Dimensions, mm									
Chain Number	*A*	*B*	*E*, Max.	*H*	*S*, Max.	*T*, Max.	*R*, Min.	Bolt Size	*D*, Min. Hole
S 102 B	60.5	50.8	77.0	25.4	90.4	10.4	24.4	9.7	10.2
S 131	52.3	39.1	73.9	25.4	78.5	10.4	24.4	12.7	13.5
S 188	47.8	33.1	54.6	20.6	65.8	7.1	17.5	9.7	10.2

NOTE:
(1) For *V* dimension, see Table 3.

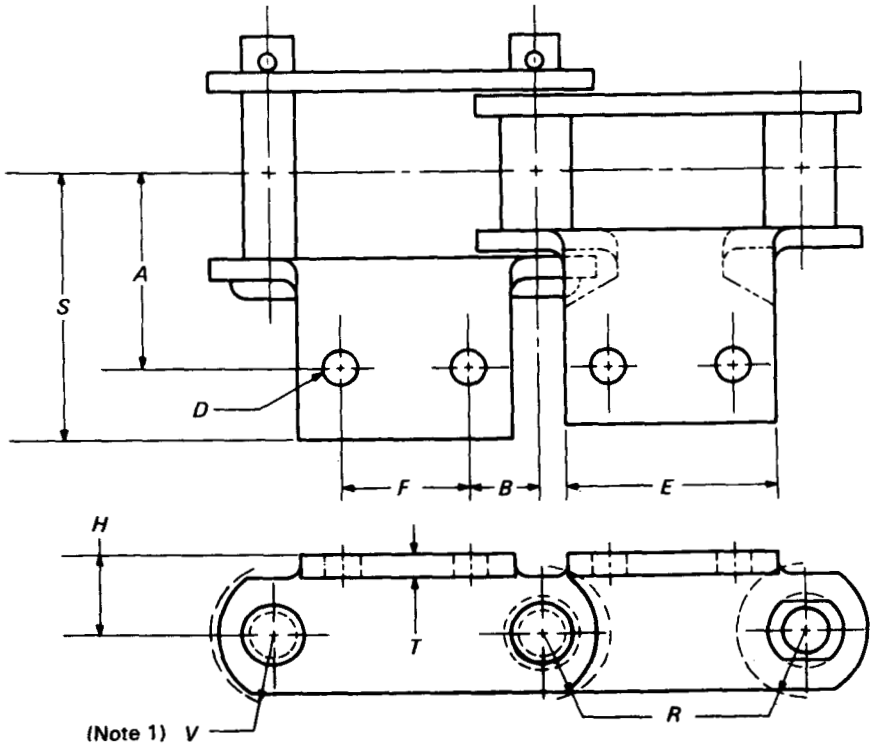


TABLE 5 A-2 ATTACHMENT

Chain Number	A	B	E, Max.	F	H	S, Max.	T, Max.	R, Min.	Bolt Size	D, Min. Hole
Dimensions, in.										
S 102 B	2.65	1.12	3.03	1.75	1.00(3)	3.56	0.41	0.96	.38	.40
S 110	2.65	2.12	3.53	1.75	1.00(3)	3.56	0.41	0.96	.38	.40
S 111	3.13	1.22	3.65(2)	2.31	1.50	4.15	0.41	1.36	.50	.53
S 131	2.06	0.79	2.91	1.50	1.00(3)	3.09	0.41	0.96	.50	.53
S 150	3.75	1.66	4.28	2.75	1.88	4.91	0.53	1.80	.50	.53
S 188	2.10	0.68	2.15	1.25	0.81	2.59	0.28	0.69	.31	.34
Dimensions, mm										
S 102 B	67.3	28.4	77.0	44.5	25.4(3)	90.4	10.4	24.4	9.70	10.2
S 110	67.3	53.8	89.7	44.5	25.4(3)	90.4	10.4	24.4	9.70	10.2
S 111	79.5	31.0	92.7(2)	58.7	38.1	105.4	10.4	34.5	12.70	13.5
S 131	52.3	20.1	73.9	38.1	25.4(3)	78.5	10.4	24.4	12.70	13.5
S 150	95.3	42.2	108.7	69.9	47.8	124.72	13.5	45.7	12.70	13.5
S 188	53.3	17.3	54.6	31.8	20.6	65.8	7.1	17.5	7.90	10.2

NOTES:
(1) For *V* dimension, see Table 3.
(2) 5.21 in. (132.3 mm) maximum for alternate wide A-2 attachment for S 111. Use as outer sidebar attachment only.
(3) 1.12 in. (28.4 mm) maximum for alternate attachment height for S 102 B, S 110, and S 131.

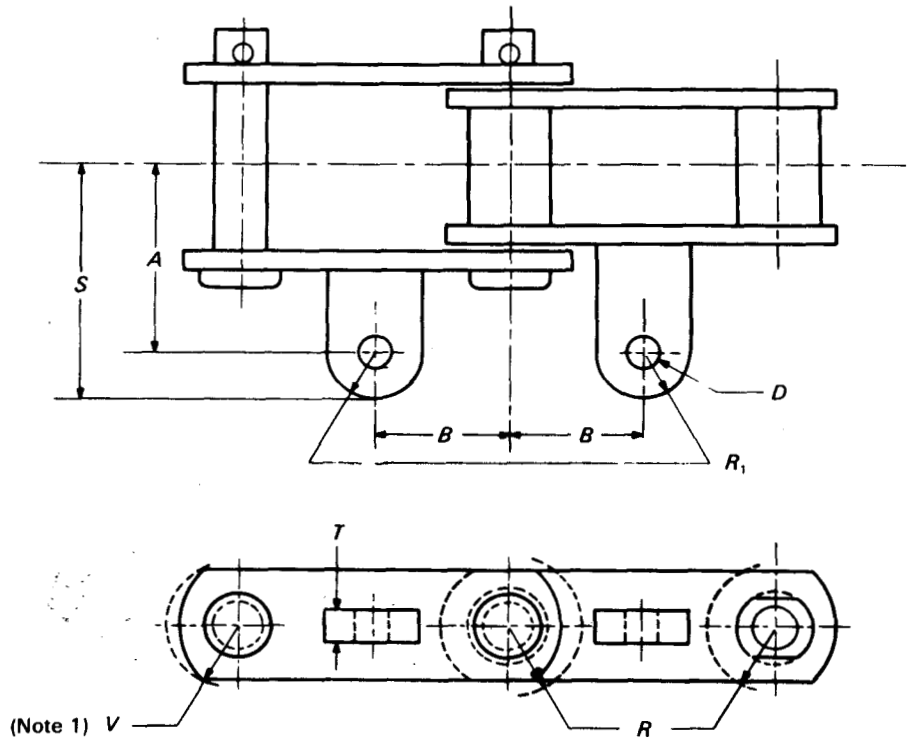


TABLE 6 A-22 ATTACHMENT

Dimensions, in.								
Chain Number	*A*	*B*	*S*, Max.	*T*, Max.	*R*, Min.	R_1, Max.	Bolt Size	*D*, Min. Hole
S 188	1.78	1.30	2.41	0.41	0.69	0.97	.38	.40

Dimensions, mm								
Chain Number	*A*	*B*	*S*, Max.	*T*, Max.	*R*, Min.	R_1, Max.	Bolt Size	*D*, Min. Hole
S 188	45.2	33.1	61.2	10.4	17.5	24.6	9.7	10.2

NOTES:
(1) For *V* dimension, see Table 3.

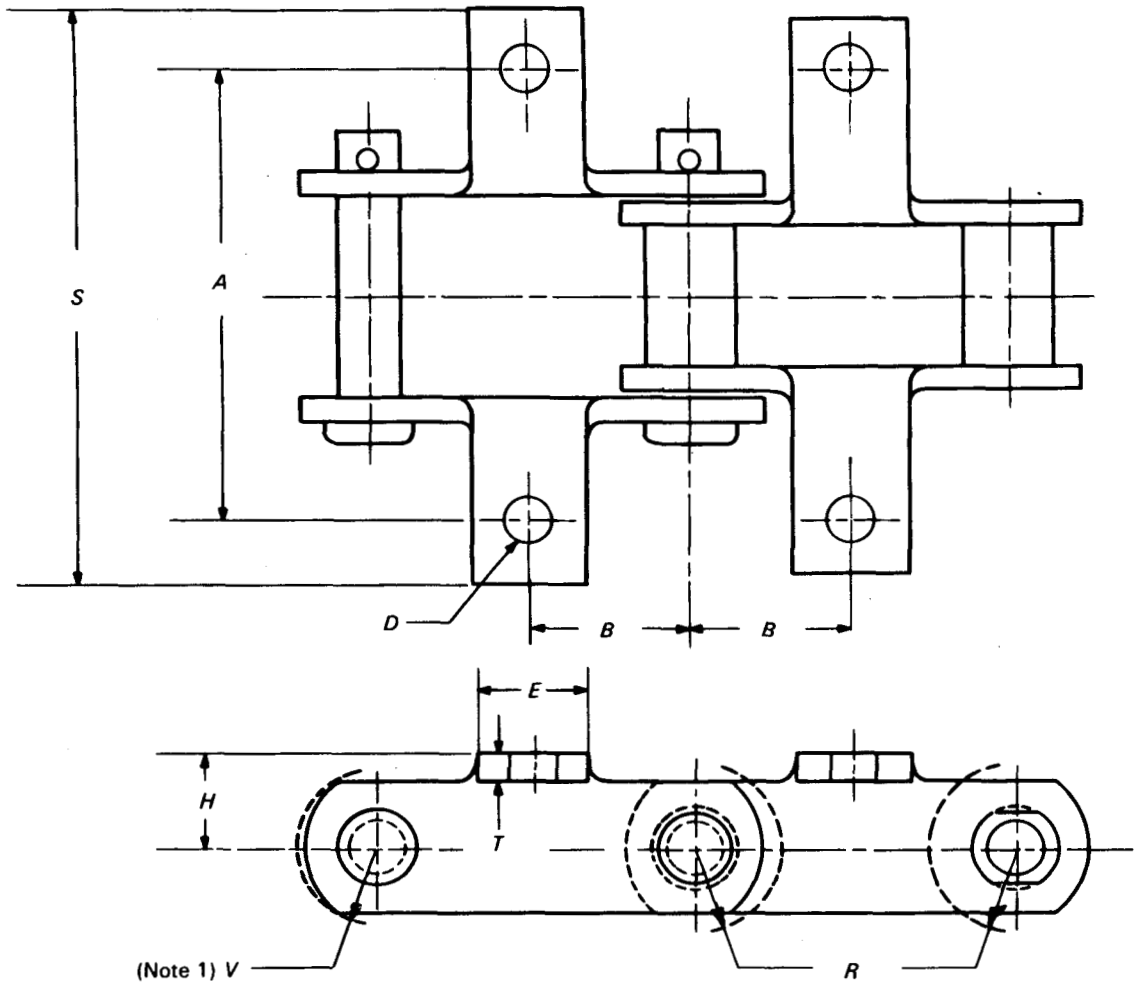


TABLE 7 K-1 ATTACHMENT

Dimensions, in.									
Chain Number	*A*	*B*	*E*, Max.	*H*	*S*, Max.	*T*, Max.	*R*, Min.	Bolt Size	*D*, Min. Hole
S 131	4.12	1.54	2.91	1.00	6.18	0.41	0.96	.50	.53
S 188	3.75	1.30	2.15	0.81	5.18	0.28	0.69	.38	.40

Dimensions, mm									
Chain Number	*A*	*B*	*E*, Max.	*H*	*S*, Max.	*T*, Max.	*R*, Min.	Bolt Size	*D*, Min. Hole
S 131	104.6	39.1	73.9	25.4	157.0	10.4	24.4	12.70	13.5
S 188	95.2	33.1	54.6	20.6	131.6	7.1	17.5	9.7	10.2

NOTES:
(1) For *V* dimension, see Table 3.

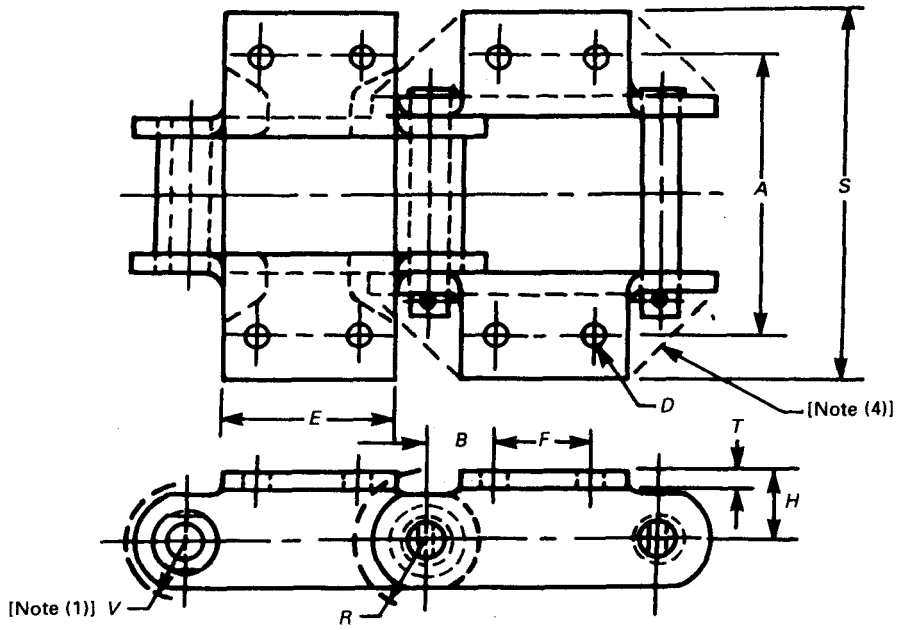


TABLE 8 K-2 ATTACHMENT (NOTE 5)

Dimensions, in.

Chain Number	A	B	E, Max.	F	H	S, Max.	T, Max.	R, Min.	Bolt Size	D, Min. Hole
S 102B	5.31	1.12	3.03	1.75	1.00(3)	7.12	0.41	0.96	0.38	0.40
S 110	5.31	2.12	3.53	1.75	1.00(3)	7.12	0.41	0.96	0.38	0.40
S 111	6.25	1.22	3.65(2)	2.31	1.50	8.30	0.41	1.36	0.50	0.53
S 131	4.12	0.79	2.91	1.50	1.00(3)	6.18	0.41	0.96	0.50	0.53
S 150	7.50	1.65	4.28	2.75	1.88	9.82	0.53	1.80	0.50	0.53
S 188	4.12	0.68	2.15	1.25	0.81	5.18	0.28	0.69	0.31	0.34
S 856	7.25	1.75	4.06(4)	2.50	1.88	9.50	0.53	1.42	0.63	0.66

Dimensions, mm

Chain Number	A	B	E, Max.	F	H	S, Max.	T, Max.	R, Min.	Bolt Size	D, Min. Hole
S 102B	134.9	28.4	69.9	44.5	25.4(3)	180.8	10.4	24.4	9.7	10.2
S 110	134.9	53.8	89.6	44.5	25.4(3)	180.8	10.4	24.4	9.7	10.2
S 111	158.8	31.0	92.7(2)	58.7	38.1	210.8	10.4	34.5	12.7	13.5
S 131	104.6	20.1	73.9	38.1	25.4(3)	157.0	10.4	24.4	12.7	13.5
S 150	190.5	41.9	108.7	69.9	47.8	249.4	13.5	45.7	12.7	13.5
S 188	106.4	17.3	54.6	31.8	20.6	131.6	7.1	17.5	7.9	8.6
S 856	184.2	44.5	103.1(4)	63.5	47.8	241.3	13.5	36.1	16.0	16.8

NOTES:
(1) For *V* dimension, see Table 3.
(2) 5.21 in. (132.3 mm) maximum for alternate wide K-2 attachment for S 111. Use as outer sidebar attachment only.
(3) 1.12 in. (28.4 mm) maximum for alternate attachment height for S 102B, S 110, and S 131.
(4) Alternate full width attachment. Use as outer sidebar attachment only.
(5) S 856, K-24 Attachment

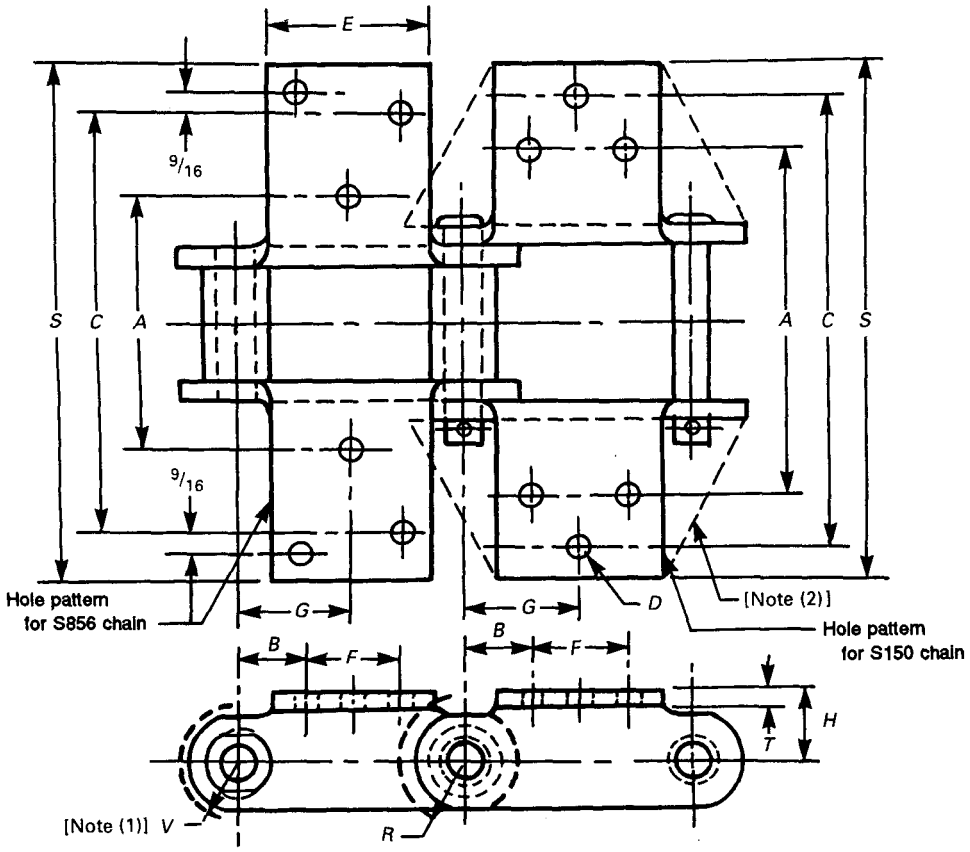


TABLE 9 K-3 ATTACHMENT

Dimensions, in.												
Chain Number	*A*	*B*	*C*	*E*, Max.	*F*	*G*	*H*	*S*, Max.	*T*, Max.	*R*, Min.	Bolt Size	*D*, Min. Hole
S 150	7.50	1.66	11.50	4.31	2.75	3.03	1.88	13.68	0.53	1.80	0.500	0.531
S 856	6.56	1.63	10.94	6.00	2.75	3.0	1.88	13.75	0.53	1.42	0.500	0.531

Dimensions, mm												
Chain Number	*A*	*B*	*C*	*E*, Max.	*F*	*G*	*H*	*S*, Max.	*T*, Max.	*R*, Min.	Bolt Size	*D*, Min. Hole
S 150	190.5	42.2	292.1	109.5	69.9	77.0	47.8	347.5	13.5	45.7	12.7	13.5
S 856	166.6	41.3	277.9	152.4	69.9	76.2	47.8	349.3	13.5	36.1	12.7	13.5

NOTES:
(1) For *V* dimension, see Table 3.
(2) Alternate full width attachment. Use as outer sidebar attachment only.

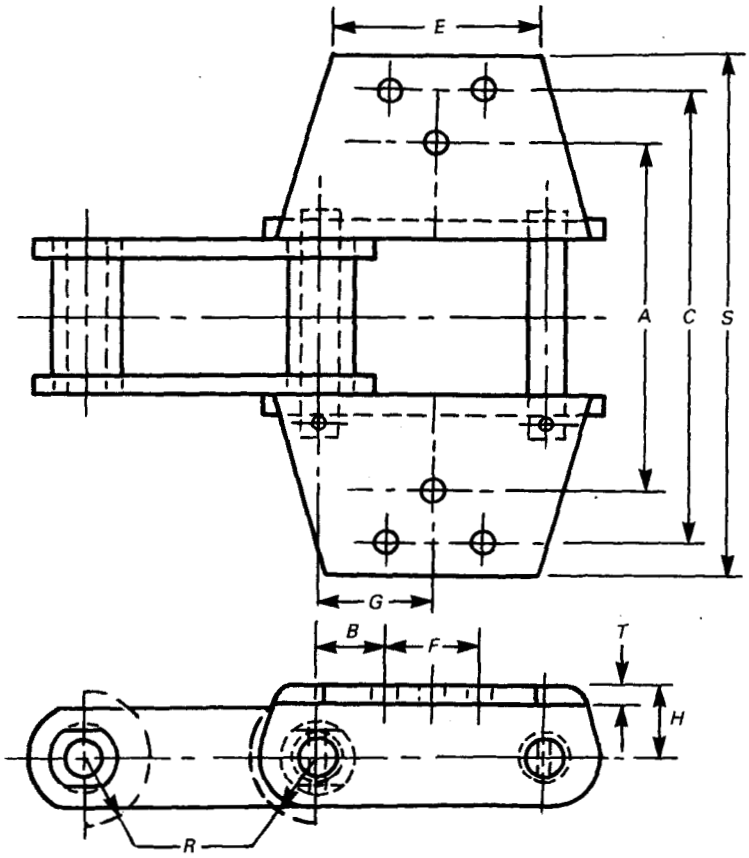


TABLE 10 K-35 ATTACHMENT

Dimensions, in.												
Chain Number	*A*	*B*	*C*	*E*, Max.	*F*	*G*	*H*	*S*, Max.	*T*, Max.	*R*, Min.	Bolt Size	*D*, Min. Hole
S 856	7.25	1.75	11.75	5.75	2.50	3.0	1.88	13.75	0.53	1.42	0.63	0.66

Dimensions, mm												
Chain Number	*A*	*B*	*C*	*E*, Max.	*F*	*G*	*H*	*S*, Max.	*T*, Max.	*R*, Min.	Bolt Size	*D*, Min. Hole
S 856	184.2	44.5	298.5	146.1	63.5	76.2	47.8	349.3	13.5	36.1	16.0	16.8

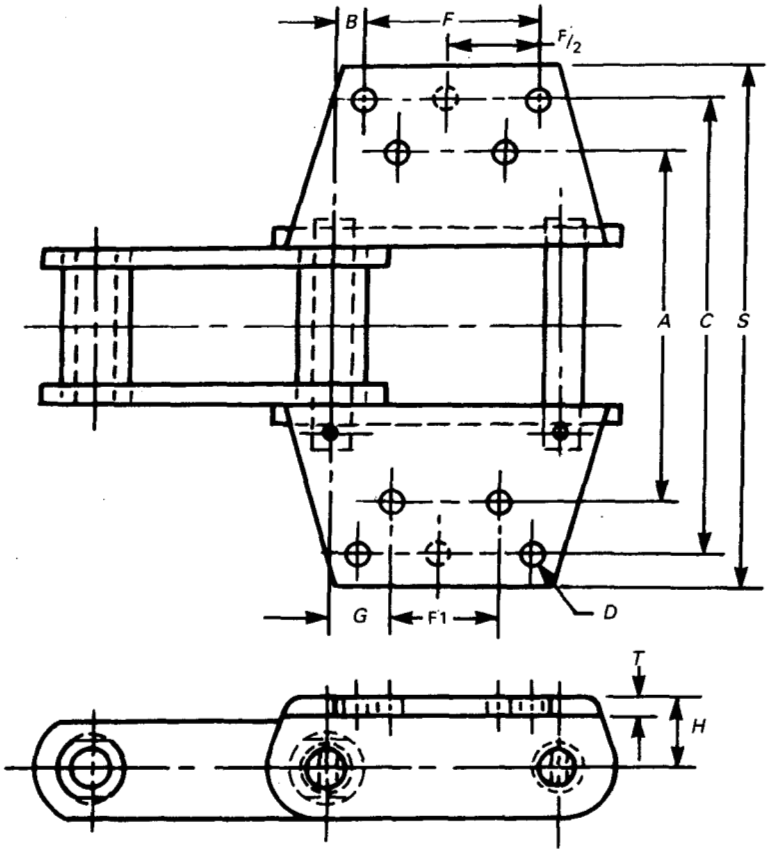


TABLE 11 K-44 AND K-443 ATTACHMENTS

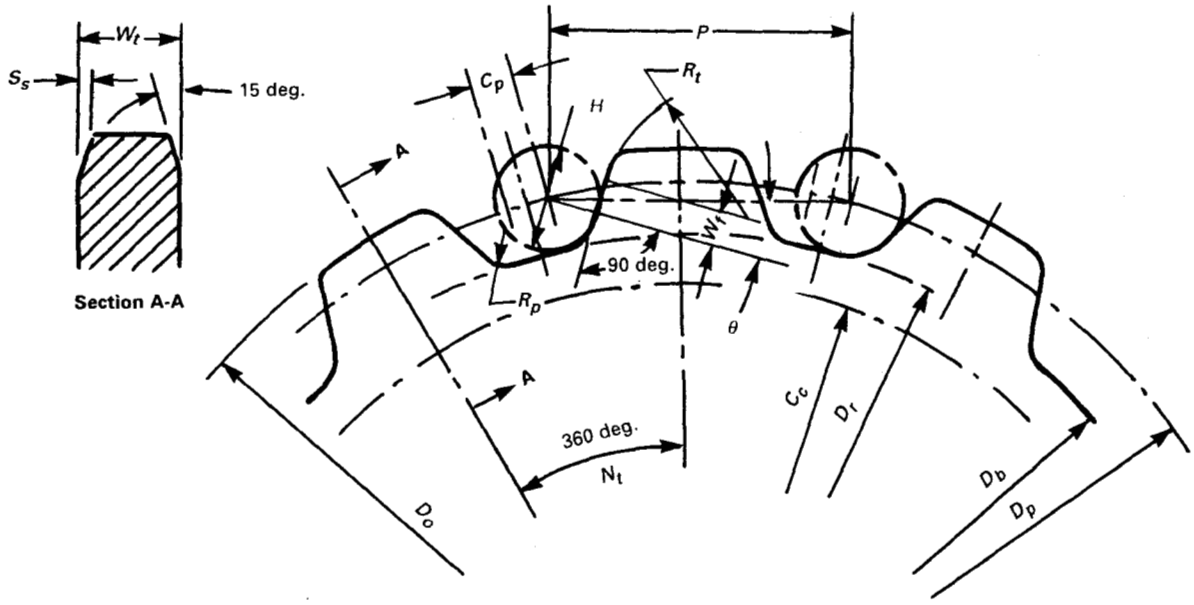
Dimensions, in.

Chain Number	*A*	*B*	*C*	*F*	*F1*	*G*	*H*	*S*, Max.	*T*, Max.	Att. and No. of Holes	Bolt Size	*D*, Min. Hole
S 857	7.00	1.25	12.00	3.50	3.50	1.25	2.50	14.00	0.53	K-44 8 holes	0.50	0.53
S 859	9.00	.75	13.00	4.50	2.75	1.63	3.00	15.00	0.66	K-44 8 holes	0.63	0.66
S 864	9.00	.75	13.00	5.50	3.75	1.63	3.00	15.00	0.66	K-443 10 holes	0.63	0.66

Dimensions, mm

Chain Number	*A*	*B*	*C*	*F*	*F1*	*G*	*H*	*S*, Max.	*T*, Max.	Att. and No. of Holes	Bolt Size	*D*, Min. Hole
S 857	177.8	31.8	304.8	88.9	88.9	31.8	63.5	355.6	13.5	K-44 8 holes	12.7	13.5
S 859	228.6	19.1	330.2	114.3	69.9	41.4	76.2	381.0	16.8	K-44 8 holes	16.0	16.8
S 864	228.6	19.1	330.2	139.7	95.3	41.4	76.2	381.0	16.8	K-443 10 holes	16.0	16.8

5 SPROCKET TOOTH FORM



The elements of a chain sprocket and the tooth form may be determined by the following:

C_b = undersize compensation
C_c = chain clearance circle [Note (1)] = $P(C_{cf} - 0.05) - F$ max
C_{cf} = clearance circle and outside diameter factor (see Table 13) = cot $(180/N_t)$
C_p = pitch line clearance = $P \times 0.10$ to $P \times 0.15$
D_b = bottom diameter [Note (2)] = $D_r - C_b$
D_o = outside diameter [Note (3)] = $(P \times C_{cf}) + F$ max
D_p = pitch diameter = $P \times D_{pf}$
D_{pf} = pitch diameter factor (see Table 13) = $csc\ (180/N_t)$
D_r = root diameter [Note (2)] = $(P \times D_{pf}) - H$ max
F = max chain height (see Table 3)
H = max chain barrel height (see Table 2)
N_t = number of teeth
P = chain pitch
R_p = pocket radius [Note (2)], $< H/2$
R_t = topping radius = $0.5 \times P$
S_s = side slope = approximately $0.12 \times W_t$, not to exceed 0.38 in. (9.6 mm)
W_f = working face [Note (4)] = $0.01 \times P \times N_t$
W_t = max tooth width = $0.95A$, min. of chain
θ = pressure angle (see Table 13)
W = inside chain width

NOTES:
(1) No portion of hub, beads, lugs, or fillets shall extend beyond this circle in the sidebar zone.
(2) The bottom diameter should be smaller than the root diameter, and the pocket radius should be smaller than $H/2$. Oversize dimensions cause improper chain and sprocket action and excessive chain loads.
(3) Outside diameter may be increased to give a full height tooth when the top of the chain is clear of flights, pans, buckets, etc. Tooth working face length provides for approximately 6% chain pitch elongation.
(4) Limitation on length of working face—the working face shall not extend beyond the line through the adjacent pitch point that is perpendicular to the working face.

FIG. 3 SPROCKET TOOTH FORM

TABLE 12 SPROCKETS — MAXIMUM ECCENTRICITY AND FACE RUNOUT TOLERANCES

Pitch Diameter						Max. Face Runout TIR		Max. Eccentricity TIR	
in.			mm						
Over		Including	Over		Including				
0	up to	12	0	up to	305	0.06	1.52	0.09	2.29
12	up to	24	305	up to	610	0.12	3.05	0.15	3.81
24	up to	36	610	up to	915	0.20	5.08	0.21	5.33
	Over 36			Over 915		Consult Mfr.		Consult Mfr.	

TABLE 13 SPROCKET TOOTH FORM FACTORS

N_t	D_{pf}	θ, deg.	C_{cf}	N_t
6	2.000	9	1.73	6
7	2.304	10	2.07	7
8	2.613	11	2.41	8
9	2.923	12	2.74	9
10	3.236	13	3.07	10
11	3.549	14	3.40	11
12	3.863	15	3.73	12
13	4.178	16	4.05	13
14	4.494	17	4.38	14
15	4.809	18	4.70	15
16	5.125	19	5.03	16
17	5.442	20	5.35	17
18	5.758	20	5.67	18
19	6.075	21	5.99	19
20	6.392	21	6.31	20
21	6.709	22	6.63	21
22	7.026	22	6.95	22
23	7.343	22	7.27	23
24	7.661	23	7.59	24
25	7.978	23	7.91	25
26	8.296	23	8.23	26
27	8.613	23	8.55	27
28	8.931	24	8.87	28
29	9.249	24	9.19	29
30	9.566	24	9.51	30
31	9.884	24	9.83	31
32	10.202	24	10.15	32
33	10.520	25	10.47	33
34	10.837	25	10.79	34
35	11.155	25	11.11	35
36	11.473	25	11.43	36

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