



4 Inverness Court East
Suite 250
Englewood, CO 80112
Office: (303) 770-7878
Fax: (303) 770-7667

LETTER OF TRANSMITTAL

TO: Steamboat Structures
Denver Metro, CO

DATE: 6/17/2021

FILE NO. 001-01

ATTN: Heather Reed

RE: Forest Lakes Bridges

WE ARE SENDING YOU:

- | | | |
|---|---|----------------------------------|
| <input type="checkbox"/> Shop Drawings | <input type="checkbox"/> Copy of Letter | <input type="checkbox"/> Samples |
| <input type="checkbox"/> Specifications | <input type="checkbox"/> Reports | <input type="checkbox"/> _____ |
| <input type="checkbox"/> Plans | <input checked="" type="checkbox"/> Submittal Information | |

SUBMITTED BY: Structures

COPIES	DESCRIPTION	CONTRACTOR
1	Pile Driving Package	Structures

THESE ARE TRANSMITTED:

- | | | |
|--|---|---|
| <input checked="" type="checkbox"/> For Approval | <input type="checkbox"/> For Review and Comment | <input type="checkbox"/> Returned for Corrections |
| <input type="checkbox"/> For Your Use | <input type="checkbox"/> Approved As Submitted | <input type="checkbox"/> _____ |
| <input type="checkbox"/> As Requested | <input type="checkbox"/> Approved As Noted | |

REMARKS:

cc: File

SHOP DRAWING REVIEW

- ☐ NO EXCEPTIONS ☒ REVISE AS NOTED
☐ REVISE AND RESUBMIT ☐ REJECTED

This review is for general conformance with the design intent of the project and general compliance with the information provided in the contract documents. Review, corrections, or comments made concerning the shop drawings during this review do not relieve the contractor from compliance with the requirements of the drawings and specifications, nor relieve the contractor of contractual responsibility for any error or deviation from the contract documents.

The contractor is responsible for, but not limited to: confirming all quantities, dimensions, and structural capabilities; selecting fabrication and construction techniques; coordinating work with that of all other trades; and performing work in a safe and satisfactory manner.

STEAMBOAT STRUCTURES, LLC

By: Heather Reed

DATE: 06/30/21

If welding is required, please provide current welding logs



Pile Driving Method Statement

RE: Forest Lake Bridges (REV. 3 – 6/17/2021 County Submittal)

Crane: Link-Belt LS-218H (100 ton)

Pile Hammer: Delmag 19-42 (21,390 – 48,680 ft-lbs) for HP 12x53 pile.

Cushion Material: Micarta and Aluminum

Piling Material: See attached.

Mobilization:

Structures will offload the crane and support trucks at the staging area near one of the abutments and build the crane. The approach roadway be utilized depending on available space. The crane will drive piling at one abutment. Once the first abutment pile driving is complete, if Structures is able to drive piling from that previously completed abutment they will do so otherwise the crane will be broken down and mobilized to the other abutment to complete driving there.

Pile Numbering & Sequence:

Pile driving will be occur starting on one abutment going from North to South or vice versa and will occur similarly at the other abutment until completed.

Pile Splicing:

While splices are not anticipated, splices will be done per CDOT Standard Specifications 502.12, they will be conducted as follows:

For H Pile, a square-groove butt-joint weld using 1/8" root opening that will be made with 2 passes around the perimeter of the pile. The first pass shall be made from one side of the part being welded and shall penetrate one half the thickness of the member. The second pass shall be made on the side opposite from the first. The slag left by the first pass shall be completely removed before making the second pass.

See attached welding procedures for additional information.

Pile Testing:

Dynamic load testing by a third party contracted by the General Contractor will occur on pile locations determined by the engineer and agreed upon by Structures, Inc. PDA will be performed on one (1) pile per abutment, per bridge.

List the third party by name

Pile Final Cut-Off:

Once each pile has been driven to the minimum specified load or refusal, the piles will be cut at the specified cut-off elevation utilizing a torch. The excess pile cut-off lengths will be removed and properly disposed of by Structures, Inc. Piles may be cut once several piles have been completed or as field supervision deems most efficient.



Logs:

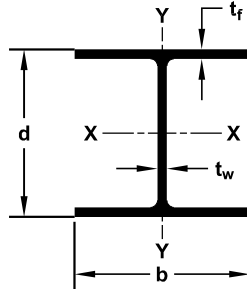
Once driving and cutoff have been completed, a log for all piles will be submitted to the engineer for record indicating final tip and cutoff elevation, total length, and splice location, if applicable.

Certifications:

The NCCO certifications for the crane operators and the welder certification for the welder is attached for reference.

HP

Steel H-Pile



SECTION	Weight lb/ft (kg/m)	Area in² (cm²)	Depth d in (mm)	Flange Width b in (mm)	THICKNESS		Coating Area ft²/ft (m²/m)	PROPERTIES							
					Flange (t _f) in (mm)	Web (t _w) in (mm)		AXIS X-X				AXIS Y-Y			
								I in⁴ (cm⁴)	S in³ (cm³)	Z in³ (cm³)	r in (cm)	I in⁴ (cm⁴)	S in³ (cm³)	Z in³ (cm³)	r in (cm)
HP 8 HP 200	36 54	10.6 68.4	8.02 204	8.16 207	0.445 11.3	0.445 11.3	3.92 1.19	119 4953	29.8 488	33.6 550.6	3.36 8.53	40.3 1677	9.88 162	15.2 249.1	1.95 4.95
HP 10 HP 250	42 63	12.4 80.0	9.70 246	10.10 257	0.420 10.7	0.415 10.5	4.83 1.47	210 8741	43.4 711	48.3 791.5	4.13 10.5	71.7 2984	14.2 233	21.8 357.2	2.41 6.12
	57 85	16.7 108	9.99 254	10.20 259	0.565 14.4	0.565 14.4	4.91 1.50	294 12237	58.8 964	66.5 1089.7	4.18 10.6	101 4204	19.7 323	30.3 496.5	2.45 6.22
HP 12 HP 310	53 79	15.5 100	11.80 300	12.00 305	0.435 11.0	0.435 11.0	5.82 1.77	393 16358	66.7 1093	74.0 1212.6	5.03 12.8	127 5286	21.1 346	32.2 527.7	2.86 7.26
	63 94	18.4 119	11.90 302	12.10 307	0.515 13.1	0.515 13.1	5.86 1.79	472 19646	79.1 1296	88.3 1447.0	5.06 12.9	153 6368	25.3 415	38.7 634.2	2.88 7.32
	74 110	21.8 141	12.10 307	12.20 310	0.610 15.5	0.605 15.4	5.91 1.80	569 23683	93.8 1537	105 1720.6	5.11 13.0	186 7742	30.4 498	46.6 763.6	2.92 7.42
	84 125	24.6 159	12.30 312	12.30 312	0.685 17.4	0.685 17.4	5.97 1.82	650 27055	106 1737	120 1966.4	5.14 13.1	213 8866	34.6 567	53.2 871.8	2.94 7.47
	89 132	25.9 167	12.36 314	12.32 313	0.720 18.3	0.720 18.3	6.04 1.84	689 28700	111.6 1830	126.3 2070	5.16 13.1	225 9370	36.5 599	56.2 922	2.94 7.48
	102 152	29.9 193	12.56 319	12.64 321	0.819 20.8	0.819 20.8	6.17 1.88	811 33800	129.3 2120	147.6 2420	5.20 13.2	276 11500	43.7 716	67.1 1100	3.04 7.71
	117 174	34.4 222	12.76 324	12.87 327	0.929 23.6	0.929 23.6	6.26 1.91	946 39400	148.2 2430	170.8 2800	5.24 13.3	331 13800	51.4 843	79.3 1300	3.11 7.89
HP 14 HP 360	73 109	21.4 138	13.60 345	14.60 371	0.505 12.8	0.505 12.8	6.96 2.12	729 30343	107 1753	118 1933.7	5.84 14.8	261 10864	35.8 587	54.6 894.7	3.49 8.86
	89 132	26.1 168	13.80 351	14.70 373	0.615 15.6	0.615 15.6	7.02 2.14	904 37627	131 2147	146 2392.5	5.88 14.9	326 13569	44.3 726	67.7 1109.4	3.53 8.97
	102 152	30.1 194	14.00 356	14.80 376	0.705 17.9	0.705 17.9	7.06 2.15	1050 43704	150 2458	169 2769.4	5.92 15.0	380 15817	51.4 842	78.8 1291.3	3.56 9.04
	117 174	34.4 222	14.20 361	14.90 378	0.805 20.4	0.805 20.4	7.12 2.34	1220 50780	172 2819	194 3179.1	5.96 15.1	443 18439	59.5 975	91.4 1497.8	3.59 9.12
HP 16 HP 410	88 131	25.8 167	15.30 389	15.70 399	0.540 13.7	0.540 13.7	7.52 2.29	1110 46201	145 2376	161 2638.3	6.56 16.7	349 14526	44.5 729	68.2 1117.6	3.68 9.35
	101 150	29.9 193	15.50 394	15.80 401	0.625 15.9	0.625 15.9	7.56 2.30	1300 54110	168 2753	187 3064.4	6.59 16.7	412 17149	52.2 855	80.1 1312.6	3.71 9.42
	121 180	35.8 231	15.80 401	15.90 404	0.750 19.1	0.750 19.1	7.62 2.32	1590 66180	201 3294	226 3703.5	6.66 16.9	504 20978	63.4 1039	97.6 1599.4	3.75 9.53
	141 210	41.7 269	16.00 406	16.00 406	0.875 22.2	0.875 22.2	7.69 2.34	1870 77835	234 3835	264 4326.2	6.70 17.0	599 24932	74.9 1227	116 1900.9	3.79 9.63
	162 241	47.7 308	16.30 414	16.10 409	1.000 25.4	1.000 25.4	7.75 2.36	2190 91154	269 4408	306 5014.4	6.78 17.2	697 29011	86.6 1419	134 2195.9	3.82 9.70
	183 272	54.1 349	16.50 419	16.30 414	1.130 28.7	1.130 28.7	7.81 2.38	2510 104473	304 4982	349 5719.1	6.81 17.3	818 34047	100.0 1639	156 2556.4	3.89 9.88
HP 18 HP 460	135 201	39.9 257	17.50 445	17.80 452	0.750 19.1	0.750 19.1	8.54 2.60	2200 91570	251 4113	281 4604.7	7.43 18.9	706 29386	79.3 1299	122 1999.2	4.21 10.7
	157 234	46.2 298	17.70 450	17.90 455	0.870 22.1	0.870 22.1	8.60 2.62	2570 106971	290 4752	327 5358.5	7.46 18.9	833 34672	93.1 1526	143 2343.3	4.25 10.8
	181 269	53.2 343	18.00 457	18.00 457	1.000 25.4	1.000 25.4	8.66 2.64	3020 125701	336 5506	379 6210.7	7.53 19.1	974 40541	108.0 1770	167 2736.6	4.28 10.9
	204 304	60.2 388	18.30 465	18.10 460	1.130 28.7	1.130 28.7	8.73 2.66	3480 144847	380 6227	433 7095.6	7.60 19.3	1120 46618	124.0 2032	191 3129.9	4.31 11.0

HP

Steel H-Pile

Available Steel Grades

AMERICAN			CANADIAN			EUROPEAN**		
ASTM	YIELD STRENGTH		CSA G40.21	YIELD STRENGTH		EN 10034	YIELD STRENGTH	
	ksi	MPa		ksi	MPa		ksi	MPa
A36	36	250	Grade 300 W	44	300	HISTAR 355	51	355
A572 Grade 50	50	345	Grade 350 W	50	350	HISTAR 420	61	420
A572 Grade 60	60	415				HISTAR 460	67	460
A588	50	345						
A690	50	345						
A709	50	345						

Highlighted fields represent the most commonly used and readily available steel grades. ** HISTAR only available in some sizes.

Splicer and H-Pile Point



Splicer



H-Pile Point

Delivery Conditions & Tolerances

	ASTM A6	
Mass	± 2.5%	
Length [§]		
30 Feet and Under	± 0.375 inches	
Over 30 Feet	+ (0.375 inches + (length - 30)/80)	- 0.375 inches
Depth	± 0.125 inches	- 0.1875 inches
Flange Width	+ 0.25 inches	
Flanges out of Square		
HP 8 x 42 - HP 12 x 84	≤ 0.25 inches	
HP 14 x 73 - HP 14 x 117	≤ 0.3125 inches	
Web off Center	≤ 0.1875 inches	
Greatest Depth over Theoretical	≤ 0.25 inches	
Camber and Sweep***		
45 Feet and Under	(0.125")(Length in feet/10) but not over 0.375"	
Over 45 Feet	(0.375") + (0.125" (Length in feet - 45)/10)	

[§]For HP ordered as bearing piles, length tolerances are +5 in. and -0 in.

***For the HP 10 x 42, 12 x 53, 12 x 63, 14 x 73, and 14 x 89 ordered as columns, tolerances are subject to negotiation with manufacturer.

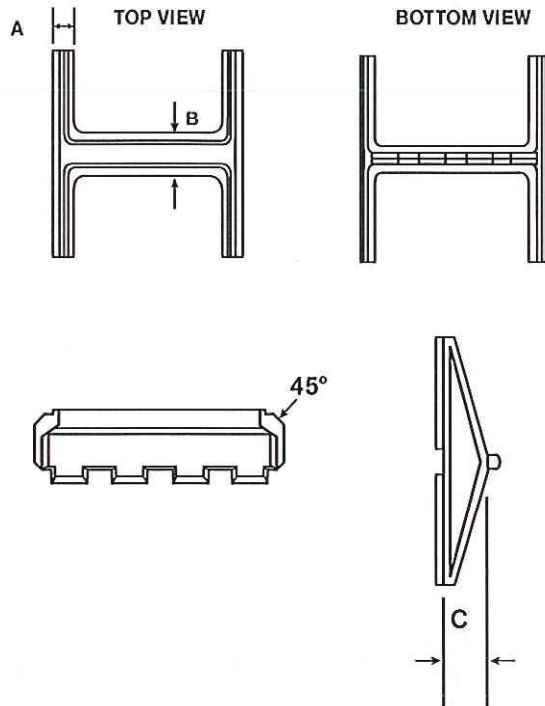
Maximum Rolled Lengths[†]

HP	130'	39.6 m
----	------	--------

[†] Longer lengths may be possible upon request.

SUPER BITE POINT – Series PAR-T

Dimensions



ASTM A148 90/60 - Heat Treated

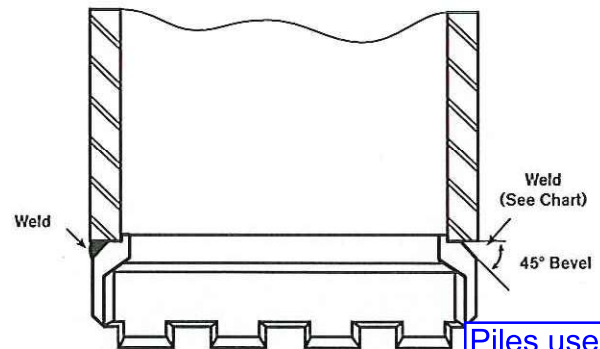
	10"	12"	14"
A	1"	1-1/4"	1-1/4"
B	1-1/4"	1-7/16"	1-3/4"
C	2-9/16"	2-5/8"	2-15/16"
WT	14	23	30

NORMAL FOUNDRY TOLERANCES APPLY

Installation Instructions

Super Bite Point Series PAR-T

1. Fit point onto the end of the square cut pile end.
2. Weld point to the pile in either flat or vertical position using AN E70XX electrodes.
3. Weld across full width of flange following chart below for minimum size weld.



Piles used are
HP12x53

Pile Size	Flange Thickness	Min. Size Groove Weld
HP 14 x 117	.805	7/16
x 102	.705	3/8
x 89	.615	3/8
x 73	.505	5/16
HP 12 x 84	.685	3/8
x 74	.610	3/8
x 63	.515	5/16
x 53	.435	5/16
HP 10 x 57	.565	5/16
x 42	.420	5/16



**ASSOCIATED PILE
& FITTING**

45 Samworth Road, Clifton, NJ 07014

Tel: 973-773-8400

Fax: 973-773-8442

email: apf@associatedpile.com

www.associatedpile.com

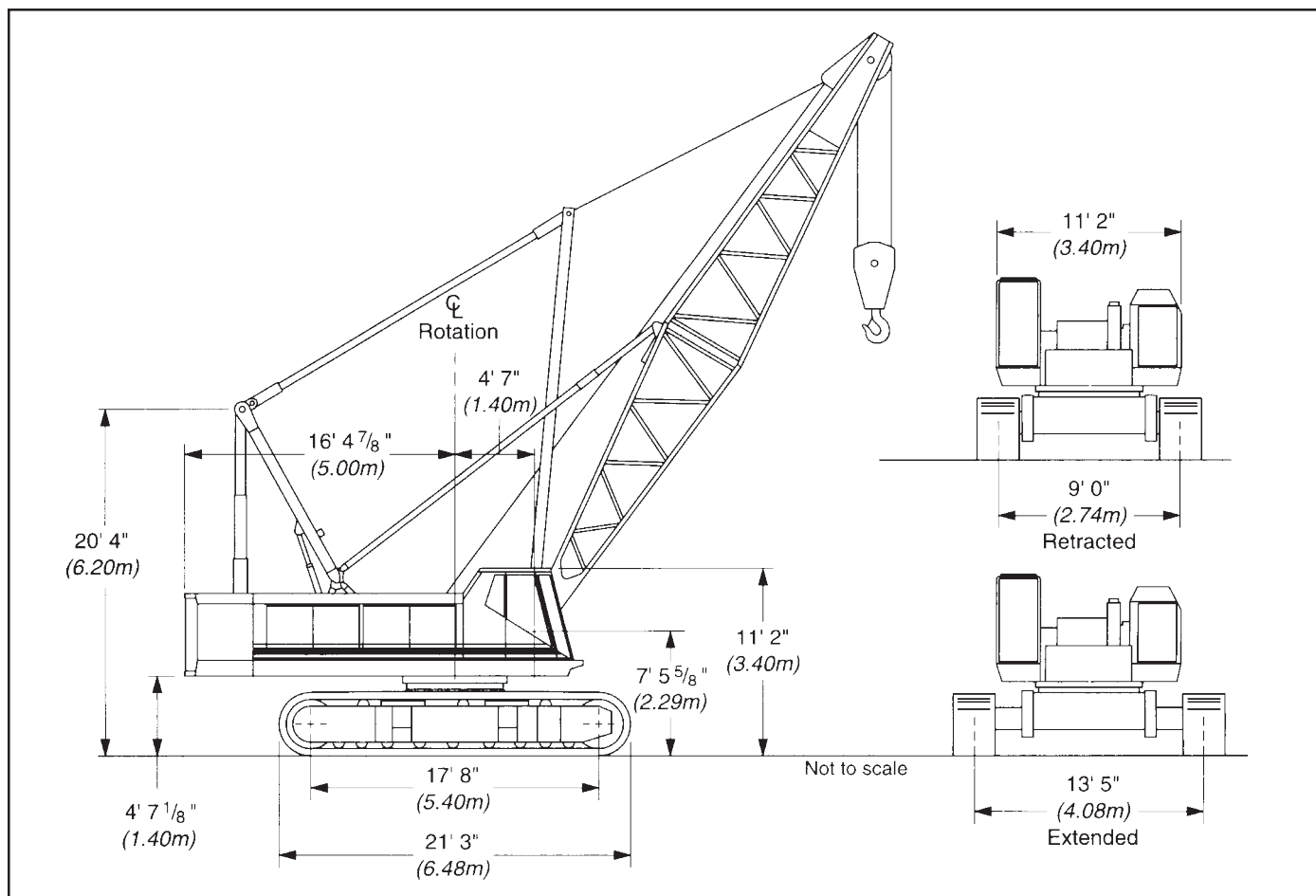
Call Toll Free: 800-526-9047

Specifications

Hydraulic Lattice Boom Crawler Crane

LS-218H

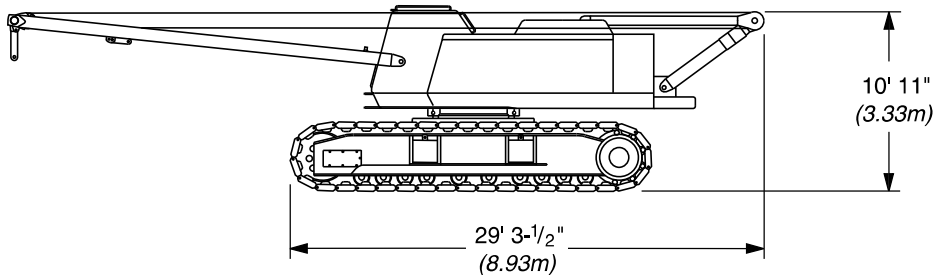
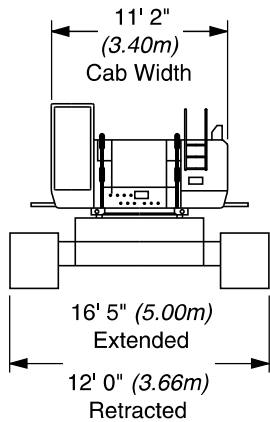
100-Ton (90 metric ton)



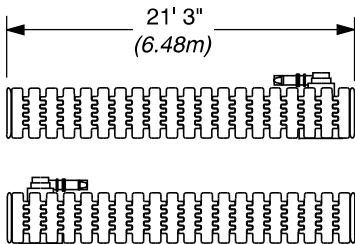
General dimensions	Feet	meters
Basic boom length	40' 0"	12.20
Overall width side frames extended - 36" (.91 m) track shoes	16' 5"	5.00
Overall width side frames retracted - 36" (.91 m) track shoes	12' 0"	3.66
Minimum ground clearance	21"	0.53

General dimensions	Feet	meters
Ground clearance - cwt. "A"	4' 7-1/8"	1.40
Ground clearance - cwt. "AB"	4' 7-1/8"	1.40
Overall width of counterweight	11' 1-3/8"	3.40
Tailswing of counterweight "A"	15' 7-3/8"	4.76
Tailswing of counterweight "AB"	16' 4-7/8"	5.00
Overall width less catwalks	11' 2"	3.40
Overall height for transport, gantry lowered	11' 2"	3.40

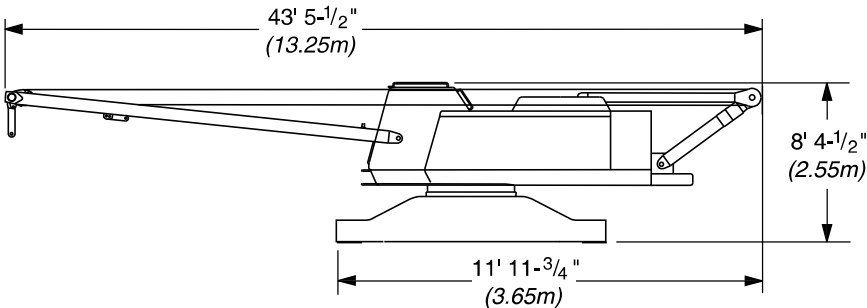
LS-218H Machine Transport Weights - approximate



Assembly Weight - as shown
117,560 lbs. (53 325 kg)



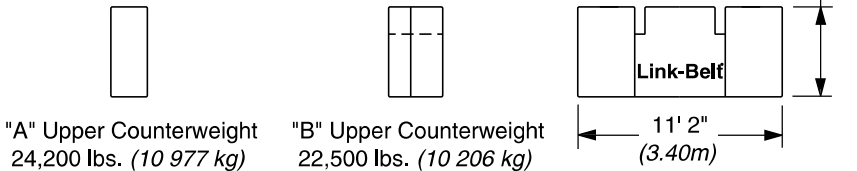
Tread Member w/36" (.91m) Shoes
23,800 lbs. (10 796 kg) Each



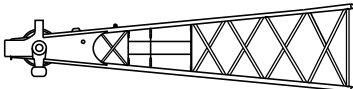
Upper & Carbody Shipping Weight
69,930 lbs. (31 720 kg)



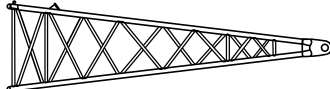
Front Mount Third Drum
1,850 lbs. (839 kg) w/Rope



20' (6.10m) Basic Jib Assembly
1,340 lbs. (608 kg) Tube Jib



20' (6.10m) Peak Section
3,240 lbs. (1 470 kg) Tube Boom
3,090 lbs. (1 402 kg) Angle Boom



20' (6.10m) Base Section
2,170 lbs. (984 kg) Tube Boom
2,360 lbs. (1 070 kg) Angle Boom

Optional Boom Sections	Weight	Cross Section Size
10' (3.05 m) tube boom extension	770 lbs. (349 kg)	60" (1.52 m) wide x 50" (1.27 m) deep
20' (6.10 m) tube boom extension	1,270 lbs. (576 kg)	60" (1.52 m) wide x 50" (1.27 m) deep
30' (9.14 m) tube boom extension	1,750 lbs. (794 kg)	60" (1.52 m) wide x 50" (1.27 m) deep
10' (3.05 m) angle boom extension	1,040 lbs. (472 kg)	48" (1.22 m) wide x 48" (1.22 m) deep
20' (6.10 m) angle boom extension	1,680 lbs. (762 kg)	48" (1.22 m) wide x 48" (1.22 m) deep
30' (9.14 m) angle boom extension	2,400 lbs. (1 089 kg)	48" (1.22 m) wide x 48" (1.22 m) deep

Machine Working Weight - approximate

Complete basic machine with Mitsubishi 6D24-TEB diesel engine, turntable bearing, hydraulic independent swing and travel, 36" (0.91 m) track shoes, main operating drums and boomhoist, 40' (12.19 m) tubular boom w/live mast, no bucket or hook block but with 900' (274.3 m) of 1" (25 mm) dia. hoist rope.

With 46,700 lb. (21 183 kg) counterweight "AB"

169,650 lbs. (76 953 kg)

Performance Specifications - Wire rope and rope drum data

Main load hoist wire rope length - using 1" (25 mm) diameter wire rope

Parts of line	Boom lengths													
	40' (12.19 m)		50' (15.24 m)		60' (18.29 m)		70' (21.34 m)		80' (24.38 m)		90' (27.43 m)		100' (30.48 m)	
	Feet	meters	Feet	meters	Feet	meters	Feet	meters	Feet	meters	Feet	meters	Feet	meters
1	105	32.00	125	38.10	145	44.20	165	50.29	185	56.39	205	62.48	225	68.58
2	150	45.72	180	54.86	210	64.01	240	73.15	270	82.30	300	91.44	330	100.58
3	195	59.44	235	71.63	275	83.82	315	96.01	355	108.20	395	120.40	435	132.59
4	240	73.15	290	88.39	340	103.63	390	118.87	440	134.11	490	149.35	540	164.59
5	285	86.87	345	105.16	405	123.44	465	141.73	525	160.02	585	178.31	645	196.60
6	330	100.58	400	121.92	470	143.26	540	164.59	610	185.93	680	207.26	750	228.60
7	375	114.30	455	138.68	535	163.07	615	187.45	695	211.84	775	236.22	855	260.60
8	420	128.02	510	155.45	600	182.88	690	210.03	780	237.74	870	265.18	960	292.61
9	465	141.73	565	172.21	665	202.69	765	233.17	865	263.65	965	294.13		
10	510	155.45	620	188.98	730	222.50	840	256.03	950	289.56				

Parts of line	Boom lengths															
	110' (33.53 m)		120' (38.58 m)		130' (39.62 m)		140' (42.67 m)		150' (45.72 m)		160' (48.77 m)		180' (54.86 m)		200' (60.96 m)	
	Feet	meters	Feet	meters	Feet	meters	Feet	meters	Feet	meters	Feet	meters	Feet	meters	Feet	meters
1	245	74.68	265	80.77	285	86.87	305	92.96	325	99.06	345	105.16	385	117.35	420	128.02
2	360	109.73	390	118.87	420	128.02	450	137.16	480	146.30	510	155.45	570	173.74	630	192.02
3	475	144.78	515	156.97	555	169.16	595	181.36	635	193.55	675	205.74	755	230.12	840	256.03
4	590	179.83	640	195.07	690	210.31	740	225.55	790	240.79	840	256.03	940	286.51	1,050	320.04
5	705	214.88	765	233.17	825	251.46	885	269.75	945	288.04						
6	820	249.94	890	271.27												
7	935	284.99														

Clamshell wire rope lengths - using one part of line

Attachment	Function	Boom Lengths									
		40' (12.12 m)		50' (15.24 m)		60' (18.29 m)		70' (21.34 m)		80' (24.38 m)	
		Feet	meters	Feet	meters	Feet	meters	Feet	meters	Feet	meters
Clamshell	Holding Closing	110	33.53	130	39.62	150	45.72	170	51.82	190	57.91
		160	48.77	180	54.86	200	60.96	220	67.06	240	73.16

Drum wire rope capacities:

Wire rope layer	Front or rear drum - 21-1/2" (0.54 m) root diameter grooved lagging, 1" (25 mm) wire rope				Front mounted third drum - 12-3/4" (0.32 m) root diameter smooth lagging, 5/8" (16 mm) wire rope				Boomhoist drum - 16-1/2" (0.41 m) root diameter grooved lagging, 3/4" (19 mm) wire rope			
	Rope per layer		Total wire rope		Rope per layer		Total wire rope		Rope per layer		Total wire rope	
	Feet	meters	Feet	meters	Feet	meters	Feet	meters	Feet	meters	Feet	meters
1	138	42.18	138	42.18	72	21.9	72	21.9	56	17.24	56	17.24
2	149	45.52	287	87.70	80	24.4	153	46.6	60	18.57	117	35.81
3	160	48.85	448	136.55	88	26.8	242	73.8	65	19.90	182	55.71
4	171	52.19	619	188.74	96	29.3	339	103.3	69	21.23	252	76.94
5	182	55.51	801	244.25	104	31.7	444	135.3	74	22.56	326	99.50
6	193	58.85	994	303.10	113	34.4	557	169.8	78	23.89	404	123.39
7	204	62.18	1,198	365.28					82	25.22	487	148.61
8	214	65.51	1,413	430.79								

LS-218H Load Hoisting Performance

Available line speed and line pull - based on Mitsubishi 6D24-TEB at 2,000 rpm full load speed.

Line pulls are not based on wire rope strength. See wire rope chart for maximum permissible single part of line working loads.

Rope Layer	21-1/2" (.55 m) Front or Rear Drum					12-3/4" (.32 m) Third Drum - Front Mounted			
	speed	fpm	m/min	pounds	kilograms	fpm	m/min	pounds	kilograms
1	Low High	102 204	31.1 62.3	54,012 26,340	24 500 11 947	212	64.6	15,015	6 811
2	Low High	110 220	33.4 67.1	49,603 24,190	22 500 10 972	236	71.9	13,513	6 129
3	Low High	117 236	35.8 71.9	45,855 22,360	20 800 10 142	260	79.2	12,285	5 572
4	Low High	125 252	38.2 76.7	42,769 20,850	19 400 9 457	283	86.3	11,261	5 108
5	Low High	133 267	40.6 81.5	39,903 19,460	18 100 8 826	307	93.6	10,395	4 715
6	Low High	141 283	43.0 86.3	37,478 18,270	17 000 8 287	331	100.9	9,652	4 378
7	Low High	149 299	45.4 91.1	35,273 17,200	16 000 7 801	--	--	--	--
8	Low High	157 315	47.8 95.9	33,289 16,230	15 100 7 361	--	--	--	--

Wire rope: size, type and working strength

Wire rope application	Size: diameter		Type	Maximum permissible load	
	inches	mm		pounds	kilograms
Main Hoist	1	25	N	29,500	13 381
Auxiliary Hoist	1	25	N	29,500	13 381
Boomhoist	3/4	19	W	11,700	5 307
Third Drum	5/8	16	RB	12,900	5 851
Boom Pendants	1-3/8	35	N	n/a	n/a
Jib Pendants	3/4	19	N	n/a	n/a

Wire rope: types available

- Type "RB" – 18 x 19 rotation resistance, extra extra improved plow steel, preformed, right lay, regular lay, swaged.
- Type "N" – 6 X 25 (6 X 19 class), filler wire, extra improved plow steel, preformed, independent wire rope center, right lay, regular lay.
- Type "W" – 6 X 26 (6 X 19 class), extra improved plow steel, preformed, independent wire rope center, right lay, alternate lay.

Crawler Lower

Lower frame

All welded, box construction, precision machined; 13' 5" (4.08 m) extended or 9' 0" (2.74 m) retracted gauge X 21' 3" (6.48 m) track length.

Turntable bearing

Outer race is bolted to upper frame, inner race with internal ring gear is bolted to lower frame.

Crawler side frames

All welded, precision machined and removable; hydraulically extended or retracted by a cylinder mounted inside the lower frame.

Track drive sprockets and idler wheels

Cast steel, heat treated; sealed for lifetime lubrication.

Track rollers

Nine per side. Tractor type, oil filled for lifetime lubrication.

Track carrier rollers

Three tractor type rollers mounted on top of each crawler side frame. Oil filled for lifetime lubrication.

Tracks

Heat treated, self cleaning, multiple hinged track shoes joined by one piece full floating pins; 46 shoes per side frame; 36" (.91 m) wide.

Track tension adjustment - Track adjusted by hydraulic cylinders at the idler block.

Tracks automatically release during excessive tension condition.

Independent travel & steering

Axial piston motor with reduction gear is located at inner drive end of each crawler side frame. Each track is driven simultaneously or individually for straight-line, gradual turn, or pivot turn. The tracks can be counterrotated for spin turns.

Brakes - Spring applied, hydraulically released multiple disc brakes are applied automatically when the control lever is in the neutral position.

Travel speed - 0.8 mph (1.3 km/h)

Gradeability - 30%

Jacking system

Four ground controlled, power hydraulic jacks, mounted on the lower carbody frame, raise the machine to facilitate removal or installation of the crawler sideframes.

Note: Counterweights must be removed prior to machine jacking.

Ground bearing pressure

Track shoes		Ground contact areas		Ground bearing pressure	
inches	meters	in ²	cm ²	psi	kg/cm ²
36	0.91	16,300	105,180	10.41	.73

Revolving Upperstructure

Frame

All-welded, precision machined unit.

Fuel tank

119 gallon (450 L) capacity.

Power transmission

All functions hydraulically powered allowing positive, precise control, with independent or simultaneous operation of all crane functions.

Engine Specifications

Mitsubishi 6D24-TEB with oil filter, oil cooler, air cleaner, fuel filter, water separator, hour meter, tachometer and electrical shutdown.

Number of cylinders	6
Bore and stroke - inch - (mm)	5.12" X 5.91" (130 X 150)
Piston displacement - (in ³) - (cm ³)	729 (11 945)
Engine rpm at full load speed	2,000
Net engine horsepower at full load speed, (HP)	263 (196 kw)
Peak torque - foot pounds - (joule)	746 1 011
Peak torque - rpm	1,400
Electrical system	24 volt
Batteries	2 - 12 volt

Hydraulic System

■ Hydraulic pumps

Two variable displacement piston pumps operating at 4,000 psi (*281 kg/cm²*) power travel, main drum, auxiliary drum, third drum and boomhoist functions. One fixed displacement gear pump operating at 3,000 psi (*211 kg/cm²*) powers swing. One fixed displacement gear pump operating at 3,600 psi (*250 kg/cm²*) powers jacking cylinders or swing. One fixed displacement gear pump operating at 1,200 psi (*85 kg/cm²*) powers pilot control system, clutches, brakes and pump controls.

■ Hydraulic reservoir

79 US gallon (*300 L*), equipped with sight level gauge.

■ Relief valves

Each function is equipped with relief valves to protect the circuit from overload or shock.

■ Brake valves

Travel circuit is provided with brake valves for all terrain travel capability.

■ Hydraulic filtration

Ten micron, full flow line filter furnished in control circuit. All oil is filtered prior to return to sump tank.

■ Hydraulic motors

Main, auxiliary and third hoist drums, boom hoist, swing and travel are powered by axial piston motors.

■ Counterbalance valves

Hoist motors are equipped with counterbalance valves to provide positive load lowering and prevent accidental load drop when hydraulic power is suddenly reduced.

Principal Operating Functions

■ Control system

Remote controlled hydraulic servo for main drum, auxiliary drum, third drum and travel. Mechanical linkage controls swing. Function speed is proportional to lever movement. Levers are adjustable for operator comfort.

■ Load hoisting and lowering

Main and auxiliary hoist drums are driven by individual axial piston motors and reduction gearing. Load hoisting or lowering is provided by actuating or reversing a hydraulic motor. Smooth, precise, power load lowering is attained with automatic hydraulic brake. The control lever provides two speeds for hoisting and lowering. Hoisting or lowering speeds are proportional to lever movement.

Freefall - The incorporation of power hydraulic controlled, two shoe clutches allows freefall operation of the main and auxiliary hoist drums for high cycle crane and duty cycle application. Mode selection switch on control panel allows operator to select the most productive operation mode.

■ Load hoist drums

Main (front) and auxiliary (rear) hoist drums are 21-1/2" (*.55 m*) root diameter grooved for 1" (*25 mm*) wire rope and mounted on anti-friction bearings.

■ Third operating drum

Optional; Pinned to front of main frame, 12-3/4" (*.32 m*) root diameter. Hydraulic winch type power up and down standard.

Optional; Same as third drum above but with controlled free spooling for use in pile driving applications.

■ Drum clutches

Speed-o-Matic® power hydraulic two-shoe clutches; internal expanding, lined shoes. Clutch spiders are splined to shafts; clutch drums are integral with hoist drums.

Load hoist clutches - Front and rear main drums - clutch drums 37" (*.94 m*) diameter, 5-1/2" (*140 mm*) face width. Swept area is 638 square inches (*4 116 cm²*).

■ Drum brakes

External contracting band type; operated by foot pedal equipped with a locking latch. Operator may select automatic brake mode (spring applied, hydraulically released), which will apply brakes when the hoist control lever is in the neutral position.

■ Drum rotation indicators

Standard for front and rear drums. Audible-type indicators.

■ Drum locking pawl

Standard for front and rear drums; electrically actuated and prevents drum rotation in a lowering direction.

■ Load indicator

Standard: PAT EI-65 load indicator for main drum. See Auxiliary Equipment on page 8 for description and other available load indicators.

■ Anti two-block system

Standard: A switch mounted on the boom peak activates a buzzer to warn the operator of a two-block condition and simultaneously disengages hoist function while applying the hoist brakes.

Swing system

Independent, hydraulic swing is driven by two axial piston motors through a gear reduction system.

Swing brake - Spring applied, hydraulically released; controlled by button on swing control lever.

Swing lock - Mechanically controlled, drop pin.

Swing speed - Two-speed, 1.3 / 2.5 rpm

Boomhoist/lowering system

Independent, hydraulic boomhoist is driven by an axial piston motor through a gear reduction system. Boom hoisting or lowering is performed by actuating or reversing the motor.

Boomhoist drum

Single grooved lagging 16-1/2" (.42 m) root diameter.

Boomhoist drum locking pawl

Electrically operated.

Boomhoist brake

Spring applied, hydraulically released, multiple disc type brake. Brake is automatically applied when control lever is in neutral position.

Boomhoist limiting device - Restricts hoisting boom beyond recommended minimum radius.

Electrical system

24 volt negative ground system, with two 12-volt batteries. Standard lighting system includes: two 70 watt headlights mounted on machine front and one interior cab light.

Operator's cab

Full vision, modular compartment with safety glass panels. The completely independent cab is insulated against noise and vibration. Sliding operator's door, swing up roof window. Standard equipment includes: heater, defroster, windshield wiper, dry chemical fire extinguisher, sun visor, bubble-type level, fuel gauge, tachometer, hydraulic temperature gauge, engine oil pressure gauge, coolant temperature gauge, service monitor system, and EI-65 load indicator system.

Machinery cab

Hinged doors (four on right side, three on left side) for machinery access. Equipped with rooftop access ladder and electric warning horn.

Catwalks

Standard on both sides. Catwalks fold up for reduced travel width.

Gantry

Retractable high gantry is power lowered to reduce height for transport. May also be used for power raising or lowering of counterweight.

Gantry bail

Pinned to retractable high gantry. Four sheaves are provided for 10-part boomhoist wire rope reeving. Sheaves mounted on anti-friction bearings, sealed for lifetime lubrication.

Counterweight

Removable, held in position by bolts. Standard counterweight lowering system consists of retractable high gantry and hydraulic cylinders.

Counterweight "A" - 24,200 lbs. (10 977 kg)

Counterweight "B" - optional - 22,500 lbs. (10 206 kg) Required for maximum lift crane capacities.

Booms and Jibs

Booms

Angle - Two piece basic boom 40' (12.19 m) long with open throat top section. Boom 48" (1.22 m) wide, 48" (1.22 m) deep at centerline of connections. Main chord angles are high strength, low alloy steel, 4" x 4" x 3/8" (101.6 mm x 101.6 mm x 9.53 mm).

Base section - 20' (6.10 m) long. Boom feet on 61" (1.55 m) centers. Lifting lugs on top side of base section to attach carrying links for boom assembly.

Boom extensions - Available in 10', 20', and 30' (3.05 m, 6.10 m, and 9.14 m) lengths with appropriate length pendants.

Boom connections - In-line tapered pin.

Boom top section - Open throat, 20' (6.10 m) long.

Boompoin machinery - Four 18" (.46 m) root diameter head sheaves mounted on anti-friction bearings with rope and sheave guards standard for lift crane use.

Tubular - Two piece basic boom 40' (12.19 m) long with open throat top section. Boom 60" (1.52 m) wide, 50" (1.27 m) deep at centerline of connections. Alloy steel, round tubular chords 3" (76 mm) outside diameter.

Base section - 20' (6.10 m) long. Boomfeet on 61" (1.55 m) centers. Lifting lugs on top side of base section to attach carrying links for boom assembly.

Boom extensions - "H" wall chord. Available in 10', 20', and 30' (3.05 m, 6.10 m, and 9.14 m) lengths with appropriate length pendants.

Boom connections - In-line tapered pins.

Boom top section - Open throat; 20' (6.10 m) long.

Boompoin machinery - Five 21" (.53 m) root diameter head sheaves mounted on anti-friction bearings. Rope and sheave guards are standard.

Tubular jib

Tubular - basic two-piece 30' (9.14 m) long, 32" (.81 m) wide and 24" (.61 m) deep at connections. Alloy steel tubular chords 2" (51 mm) outside diameter. Offsettable 0, 15, or 30 degrees relative to main boom angle.

Base section - 15' (4.57 m) long.

Jib extensions - available in 15' (4.57 m) lengths with appropriate length pendants.

Jib connections - In-line, tapered pin connections.

Tip section - 15' (4.57 m) long, one 18-1/2" (.47 m) root diameter sheave mounted on anti-friction bearings.

Jib mast

11' 6" (3.51 m) high, mounted on jib base section. Two deflector sheaves mounted within mast to guide whipline; mounted on anti-friction bearings. Two equalizer sheaves mounted on top of mast - one for jib frontstay line, one for jib backstay line.

Jib staylines - Front and rear staylines vary in length depending on degree of jib offset from boom center line: backstay lines attached at bottom end of boom top section.

Jib stops - Dual, tubular telescoping type.



Boom stops

Dual, tubular telescoping type.



Boom live mast

26' (7.92 m) long rectangular structure which supports boomhoist bridle, boom pendants and midpoint suspension pendants. Boom live mast may be used as a short crane boom for machine assembly or dismantling. Standard with tubular boom attachment; *optional* for angle boom attachment.



Boomhoist bridle and spreader bar

Serves as connection for boom suspension system. Bridle contains five 12" (.30 m) root diameter sheaves mounted on anti-friction bearings for 10-part boomhoist wire rope reeving. Auxiliary bail may be attached to bridle and contains two 15-7/8" (.40 m) root diameter bronze bushed sheaves to permit reeving wire rope suspension for use of boom live mast as short boom. Spreader bar provides attachment for boom main pendants and boom midpoint suspension pendants.



Deflector rollers

Deflector rollers deflect main and auxiliary load hoist wire rope over top side of boom. Rollers are mounted on anti-friction bearings. One roller on top section of basic boom and one roller per boom extension is standard for both angle and tube booms.

Auxiliary Equipment



Boom angle indicator

Pendulum type, mounted on operator's side of boom base section.



Load indicator

The **standard** PAT EI-65 load indicator for the main drum provides the operator with: main boom length, main boom angle, jib angle, jib length, operating mode, load radius, boom tip height, and anti-two block indicator.

Optional; PAT EI-65 load indicator for auxiliary drum. (Additional line rider required.)

Rated Capacity Limiters (Optional)

Optional; PAT DS-350 rated capacity limiter for main and auxiliary drums. (Additional line rider required for auxiliary drum.)

The optional rated capacity limiter system (RCL) provides the same information as the load indicator plus the crane's rated capacity at a particular setup with function kickout. Includes a pre-warning light, audible alarm, and overload light.



Fairlead

Optional; full revolving type with barrel, sheaves and guide rollers mounted on anti-friction bearings.



Tagline

Rud-o-Matic® model 648; spring wound, drum-type.

Link-Belt Construction Equipment Company

A unit of Sumitomo Construction Machinery Co., Ltd.

© Link-Belt is a registered trademark. Copyright 1997. All rights reserved. We are constantly improving our products and therefore reserve the right to change designs and specifications.

LS-218H Angle Boom Lift Crane/Clamshell/Dragline Capacities

Boom — Angle; Pin or Bolt connected,
 48" (1.22 m) wide, 48" (1.22 m) deep with
 open throat top section; with or without 26'
 (7.92 m) live mast.

Mounting — crawler:
 extended gauge: 13' 5" (4.08 m)

Counterweights —
 Cwt. "A" - 24,409 lbs. (11 072 kg)
 Cwt. "AB" - 46,962 lbs. (21 302 kg)

PCSA Class 12-416
 Refer to notes page 5

Maximum angle boom or boom + jib ① machine can lift off ground unassisted - without load

	Counterweight "A"				Counterweight "AB"			
	Boom		Boom + Jib		Boom		Boom + Jib	
	Feet	meters	Feet	meters	Feet	meters	Feet	meters
Over End								
Side frames extended	150	45.72	130 + 60	39.62 + 18.29	150	45.72	150 + 60	45.72 + 18.29
Side frames retracted	150	45.72	130 + 60	39.62 + 18.29	②		②	
Over Sides								
Side frames extended	150	45.72	130 + 60	39.62 + 18.29	150	45.72	150 + 60	45.72 + 18.29
Side frames retracted	130	39.62	100 + 60	30.48 + 18.29	②		②	

① With or without boom live mast and 1-3/8" (35 mm) diameter pendants and hook block on ground.

Maximum angle boom or boom + jib machine can lift off ground unassisted and travel without load with boom horizontal ③ - minimum travel speed on firm level supporting surface.

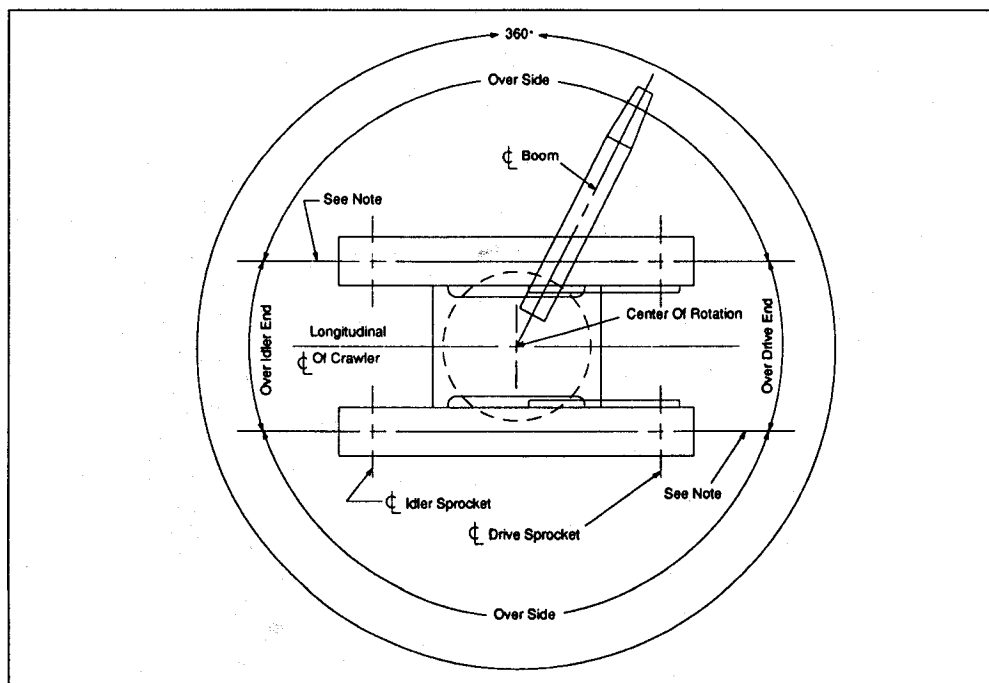
	Counterweight "A"				Counterweight "AB"			
	Boom		Boom + Jib		Boom		Boom + Jib	
	Feet	meters	Feet	meters	Feet	meters	Feet	meters
Over End								
Side frames extended	130	39.62	100 + 60	30.48 + 18.29	140	42.67	100 + 60	30.48 + 18.29
Side frames retracted	130	39.62	100 + 60	30.48 + 18.29	②		②	
Over Sides								
Side frames extended	120	36.58	90 + 60	27.43 + 18.29	140	42.67	100 + 60	30.48 + 18.29
Side frames retracted	110	33.53	80 + 60	24.38 + 18.29	②		②	

② With counterweight AB, machine must not be operated with side frames retracted.

③ Hook blocks carried at boom/jib point. Based on 100-ton (90.7 metric ton) three sheave hook block.

Working Areas

- These lines determine the limiting position of any load for operation within working areas indicated.



Caution: This material is for reference only. Operator must refer to in-cab capacity plate to determine allowable machine lifting capacities and operating procedures.

LS-218H Angle Boom Lift Crane/Dragline/Clamshell Capacities

Boom Length (ft.)	Load Radius (ft.)	Boom Angle (deg.)	Capacities - Side Frames Extended					
			Ctwt. A	Ctwt. AB	Dragline Ctwt. A	Clamshell & Magnet Ctwt. A	Dragline Ctwt. AB	Clamshell & Magnet Ctwt. AB
40' (12.19 m)	12	79.3	200,000*	200,000*	29,500	29,500	29,500	29,500
	13	77.9	178,100	200,000*	29,500	29,500	29,500	29,500
	14	76.4	152,400	200,000*	29,500	29,500	29,500	29,500
	15	74.9	133,100	179,100	29,500	29,500	29,500	29,500
	16	73.4	118,100	159,000	29,500	29,500	29,500	29,500
	17	71.9	106,000	142,900	29,500	29,500	29,500	29,500
	18	70.4	96,100	129,600	29,500	29,500	29,500	29,500
	19	68.9	87,900	118,600	29,500	29,500	29,500	29,500
	20	67.3	80,900	109,300	29,500	29,500	29,500	29,500
	25	59.3	57,500	78,100	29,500	29,500	29,500	29,500
	30	50.6	44,400	60,400	29,500	29,500	29,500	29,500
	35	40.5	35,800	49,000	29,500	26,900	29,500	29,500
	40	27.7	29,600	36,600	—	19,800	—	27,600
50' (15.24 m)	12	81.5	200,000*	200,000*	29,500	29,500	29,500	29,500
	13	80.3	178,100	200,000*	29,500	29,500	29,500	29,500
	14	79.2	152,400	200,000*	29,500	29,500	29,500	29,500
	15	78.0	133,100	179,100	29,500	29,500	29,500	29,500
	16	76.8	118,100	159,000	29,500	29,500	29,500	29,500
	17	75.6	106,000	142,900	29,500	29,500	29,500	29,500
	18	74.4	96,100	129,600	29,500	29,500	29,500	29,500
	19	73.3	87,900	118,600	29,500	29,500	29,500	29,500
	20	72.1	80,900	109,300	29,500	29,500	29,500	29,500
	25	65.9	57,600	78,100	29,500	29,500	29,500	29,500
	30	59.5	44,400	60,400	29,500	29,500	29,500	29,500
	35	52.5	35,800	49,100	29,500	29,500	29,500	29,500
	40	44.9	29,900	41,600	29,500	26,900	29,500	29,500
	50	24.8	22,100	30,700	—	19,800	—	27,600
60' (18.29 m)	13	81.9	178,100	200,000*	29,500	29,500	29,500	29,500
	14	81.0	152,400	200,000*	29,500	29,500	29,500	29,500
	15	80.0	133,100	179,000	29,500	29,500	29,500	29,500
	16	79.0	118,000	158,900	29,500	29,500	29,500	29,500
	17	78.1	105,900	142,800	29,500	29,500	29,500	29,500
	18	77.1	96,000	129,500	29,500	29,500	29,500	29,500
	19	76.1	87,800	118,500	29,500	29,500	29,500	29,500
	20	75.1	80,800	109,200	29,500	29,500	29,500	29,500
	25	70.1	57,400	77,900	29,500	29,500	29,500	29,500
	30	64.9	44,200	60,200	29,500	29,500	29,500	29,500
	35	59.6	35,600	48,800	29,500	29,500	29,500	29,500
	40	53.8	29,700	40,900	29,500	26,700	29,500	29,500
	50	40.8	21,900	30,500	21,900	19,700	29,500	27,400
	60	22.6	17,000	24,000	—	15,300	—	21,600
70' (21.34 m)	15	81.5	133,000	179,000	29,500	29,500	29,500	29,500
	16	80.6	117,900	158,800	29,500	29,500	29,500	29,500
	17	79.8	105,800	142,600	29,500	29,500	29,500	29,500
	18	79.0	95,900	129,400	29,500	29,500	29,500	29,500
	19	78.1	87,600	118,400	29,500	29,500	29,500	29,500
	20	77.3	80,600	109,000	29,500	29,500	29,500	29,500
	25	73.1	57,200	77,700	29,500	29,500	29,500	29,500
	30	68.7	43,900	60,000	29,500	29,500	29,500	29,500
	35	64.3	35,400	48,600	29,500	29,500	29,500	29,500
	40	59.6	29,400	40,600	29,400	26,400	29,500	29,500
	50	49.6	21,600	30,300	21,600	19,400	29,500	27,200
	60	37.7	16,800	23,800	16,800	15,100	23,800	21,400
	70	20.9	13,400	19,300	—	12,000	—	17,300
80' (24.38 m)	17	81.1	105,700	142,500	29,500	29,500	29,500	29,500
	18	80.4	95,700	129,300	29,500	29,500	29,500	29,500
	19	79.6	87,500	118,200	29,500	29,500	29,500	29,500

GENERAL INFORMATION ONLY

Boom Length (ft.)	Load Radius (ft.)	Boom Angle (deg.)	Capacities - Side Frames Extended					
			Ctwt. A	Ctwt. AB	Dragline Ctwt. A	Clamshell & Magnet Ctwt. A	Dragline Ctwt. AB	Clamshell & Magnet Ctwt. AB
80' (24.28 m) con't	20	78.9	80,400	108,800	29,500	29,500	29,500	29,500
	25	75.2	57,000	77,500	29,500	29,500	29,500	29,500
	30	71.5	43,700	59,800	29,500	29,500	29,500	29,500
	35	67.7	35,100	48,400	29,500	29,500	29,500	29,500
	40	63.7	29,200	40,400	29,200	26,200	29,500	29,500
	50	55.4	21,400	30,000	21,400	19,200	29,500	27,000
	60	46.2	16,500	23,500	16,500	14,800	23,500	21,100
	70	35.2	13,200	19,100	13,200	11,800	19,100	17,100
	80	19.5	10,700	15,800	—	9,600	—	14,200
90' (27.43 m)	18	81.4	95,600	129,100	29,500	29,500	29,500	29,500
	19	80.8	87,300	118,000	29,500	29,500	29,500	29,500
	20	80.1	80,200	108,600	29,500	29,500	29,500	29,500
	25	76.9	56,800	77,300	29,500	29,500	29,500	29,500
	30	73.6	43,500	59,500	29,500	29,500	29,500	29,500
	35	70.3	34,900	48,100	29,500	29,500	29,500	29,500
	40	66.8	28,900	40,100	28,900	26,000	29,500	29,500
	50	59.7	21,500	29,700	21,500	19,300	29,500	26,700
	60	52.0	16,200	23,200	16,200	14,500	23,200	20,800
	70	43.4	12,900	18,300	12,900	11,600	18,300	16,400
	80	33.1	10,500	15,500	—	9,400	—	13,900
	90	18.4	8,600	13,100	—	7,700	—	11,700
100' (30.48 m)	20	81.1	80,100	108,400	29,500	29,500	29,500	29,500
	25	78.2	56,500	77,100	29,500	29,500	29,500	29,500
	30	75.3	43,200	59,300	29,500	29,500	29,500	29,500
	35	72.3	34,600	47,800	29,500	29,500	29,500	29,500
	40	69.3	28,600	39,900	28,600	25,700	29,500	29,500
	50	63.0	20,800	29,400	20,800	18,700	29,400	26,400
	60	56.4	15,900	22,900	15,900	14,300	22,900	20,600
	70	49.2	12,600	18,500	12,600	11,300	18,500	16,600
	80	41.1	10,200	15,300	10,200	9,100	15,300	13,700
	90	31.3	8,300	12,800	—	7,400	—	11,500
	100	17.4	6,900	10,900	—	6,200	—	9,800
110' (33.35 m)	25	79.3	56,300	76,800	—	—	—	—
	30	76.6	43,000	59,000	—	—	—	—
	35	74.0	34,400	47,600	—	—	—	—
	40	71.2	28,400	39,600	—	—	—	—
	50	65.6	20,500	29,100	—	—	—	—
	60	59.8	15,700	22,600	—	—	—	—
	70	53.5	12,300	18,200	—	—	—	—
	80	46.7	9,900	15,000	—	—	—	—
	90	39.1	8,000	12,500	—	—	—	—
	100	29.8	6,600	10,600	—	—	—	—
	110	16.6	5,400	9,000	—	—	—	—
120' (36.58 m)	25	80.2	56,100	76,600	—	—	—	—
	30	77.8	42,700	58,800	—	—	—	—
	35	75.3	34,100	47,300	—	—	—	—
	40	72.8	28,100	39,300	—	—	—	—
	50	67.8	20,200	28,900	—	—	—	—
	60	62.5	15,400	22,300	—	—	—	—
	70	57.0	12,000	17,900	—	—	—	—
	80	51.1	9,600	14,700	—	—	—	—
	90	44.6	7,700	12,200	—	—	—	—
	100	37.3	6,300	10,300	—	—	—	—
	110	28.6	5,100	8,700	—	—	—	—
	120	15.9	4,100	7,400	—	—	—	—
130' (39.62 m)	25	81.0	55,800	76,400	—	—	—	—
	30	78.7	42,400	58,500	—	—	—	—

Boom Length (ft.)	Load Radius (ft.)	Boom Angle (deg.)	Capacities - Side Frames Extended					
			Cwt. A	Cwt. AB	Dragline Cwt. A	Clamshell & Magnet Cwt. A	Dragline Cwt. AB	Clamshell & Magnet Cwt. AB
130' (39.62 m) con't	35	76.5	33,800	47,000	—	—	—	—
	40	74.2	27,800	39,000	—	—	—	—
	50	69.6	20,000	28,600	—	—	—	—
	60	64.8	15,100	22,000	—	—	—	—
	70	59.8	11,700	17,600	—	—	—	—
	80	54.5	9,300	14,400	—	—	—	—
	90	48.9	7,400	11,900	—	—	—	—
	100	42.8	6,000	10,000	—	—	—	—
	110	35.8	4,800	8,400	—	—	—	—
	120	27.4	3,800	7,100	—	—	—	—
	130	15.3	3,000	6,000	—	—	—	—
140' (42.67 m)	30	79.5	42,200	55,800*	—	—	—	—
	35	77.5	33,500	46,800	—	—	—	—
	40	75.4	27,500	38,700	—	—	—	—
	50	71.1	19,700	28,300	—	—	—	—
	60	66.7	14,800	21,700	—	—	—	—
	70	62.1	11,400	17,300	—	—	—	—
	80	57.4	9,000	14,000	—	—	—	—
	90	52.4	7,100	11,600	—	—	—	—
	100	47.0	5,700	9,600	—	—	—	—
	110	41.2	4,500	8,100	—	—	—	—
	120	34.5	3,500	6,800	—	—	—	—
	130	26.4	2,700	5,700	—	—	—	—
	140	14.7	2,000	4,500	—	—	—	—
150' (45.72 m)	30	80.2	41,900	46,800*	—	—	—	—
	35	78.3	33,300	40,400*	—	—	—	—
	40	76.3	27,200	34,800*	—	—	—	—
	50	72.4	19,400	26,100*	—	—	—	—
	60	68.3	14,500	20,200*	—	—	—	—
	70	64.1	11,100	15,700*	—	—	—	—
	80	59.8	7,800	12,700*	—	—	—	—
	90	55.3	6,800	10,500*	—	—	—	—
	100	50.5	5,300	8,600*	—	—	—	—
	110	45.4	4,200	7,100*	—	—	—	—
	120	39.7	3,200	6,000*	—	—	—	—
	130	33.3	2,400	5,100*	—	—	—	—
	140	25.5	—	4,400*	—	—	—	—
	150	14.2	—	3,200*	—	—	—	—

LS-218H Angle Boom Lift Crane/Dragline/Clamshell Notes

General:

1. Rated lifting capacities in pounds as shown on lift charts pertain to the crane as originally manufactured and normally equipped. Modifications to the crane or use of optional equipment other than that specified can result in a reduction of capacity.
2. Construction equipment can be dangerous if improperly operated or maintained. Operation and maintenance of the crane must be in compliance with the information in the Operator's, Parts and Safety Manuals supplied with the crane. If these manuals are missing, order replacements through the distributor.
3. The operator and other personnel associated with the crane shall read and fully understand the latest applicable American National Standards Institute (ANSI) safety standards for cranes.
4. The maximum allowable lifting capacities are based on crane standing level on firm supporting surface.

Lift Crane Operation:

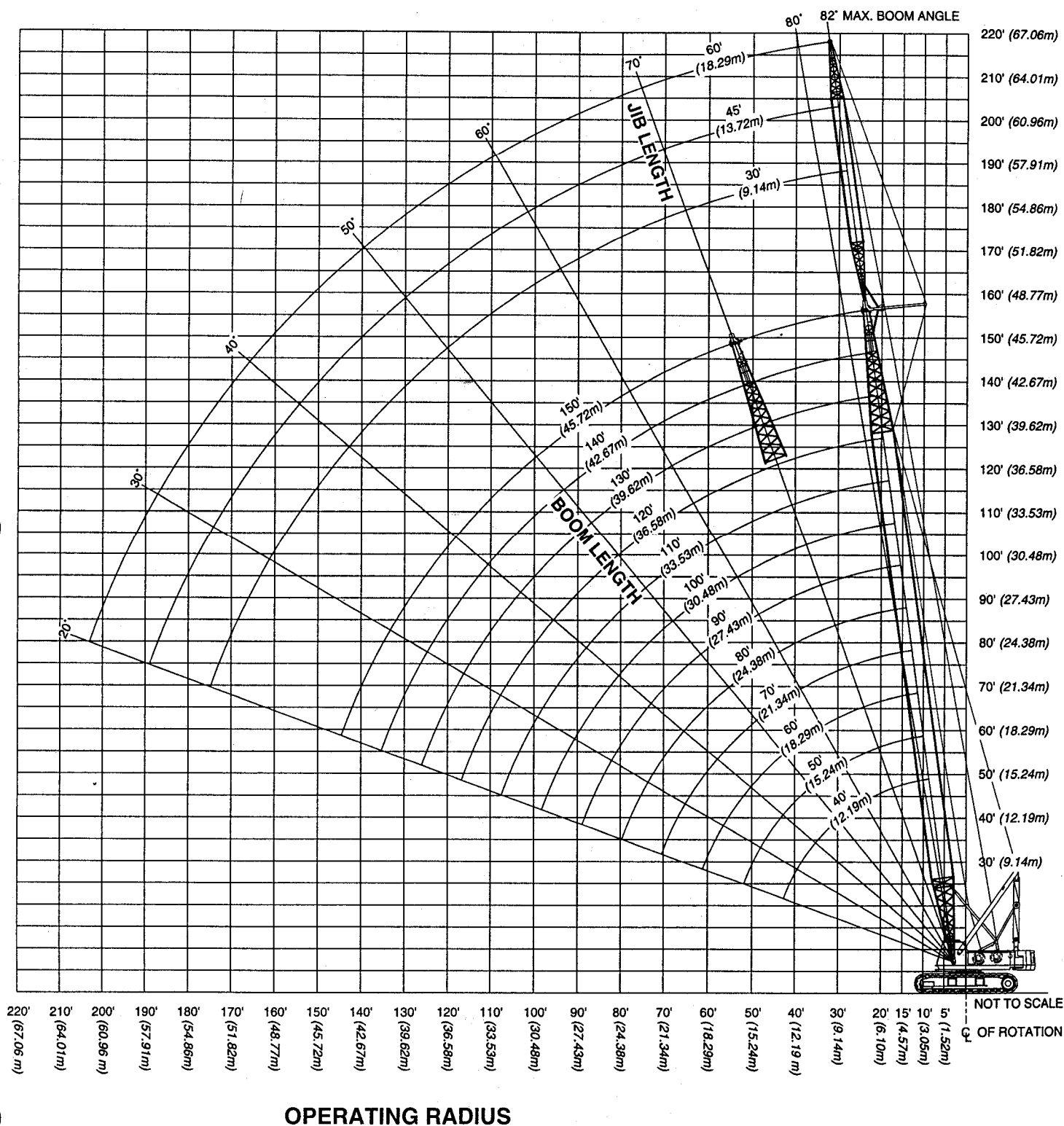
1. Capacities shown are in pounds and are not more than 75% of the tipping loads with the crane standing level on firm supporting surface. A deduction must be made from these capacities for weight of hook block, hook, sling, grapple, load weighing device, etc. When using main hook while jib is attached, reduce capacities by values shown on jib capacity chart. See Operator's Manual for all limitations when raising or lowering attachment.

2. The capacities marked with an asterisk (*) are based on factors other than those which would cause a tipping condition.
3. Retractable high gantry must be used in the elevated position for all capacities on this chart.
4. For recommended reeving, parts of line, wire rope type and wire rope inspection, see wire rope strength chart, Operator's Manual and Parts Manual.
5. Load ratings are based on freely suspended loads and make no allowances for such factors as the effect of the wind, ground conditions, and operating speeds. The operator shall therefore reduce load ratings in order to take these conditions into account.
6. The least stable rated condition is over the side.
7. Boom lengths exceeding 120' (36.58 m) must be erected and lowered over the end. Adequate blocking must be placed under the tread member sprockets to prevent the machine from rocking.
8. Machine with "AB" counterweight - do not swing over side until side frames are extended.
9. When machine is equipped with carbody jack cylinders, cylinders must be fully retracted when machine is operated.
10. These capacities apply only to the crane as originally manufactured and normally equipped by Link-Belt Construction Equipment Company.

Dragline/Clamshell Operation:

1. Capacities shown are the maximum allowable and are based on the machine standing level on firm supporting surface under ideal job conditions.
2. Weight of bucket, plus load should not exceed these capacities.
3. Capacities are maximum recommended by PCSA Standard #4. User must make allowances for soft or uneven supporting surfaces, rapid cycle operations, bucket suction or other unfavorable conditions which may require smaller buckets for efficient operation.
4. Dragline operation with boom angle less than 35° is not recommended.
5. Boom length for dragline/clamshell attachment operation should not exceed 100' (30.48 m).

LS-218H Angle Boom Working Range



Link-Belt Construction Equipment Company Lexington, Kentucky

A unit of Sumitomo Construction Machinery Co., Ltd.

© Link-Belt is a registered trademark. Copyright 1996. All rights reserved. We are constantly improving our products and therefore reserve the right to change designs and specifications.



Diesel Pile Hammers

Metric Units - US Units



Diesel Pile Hammers

Technical Data

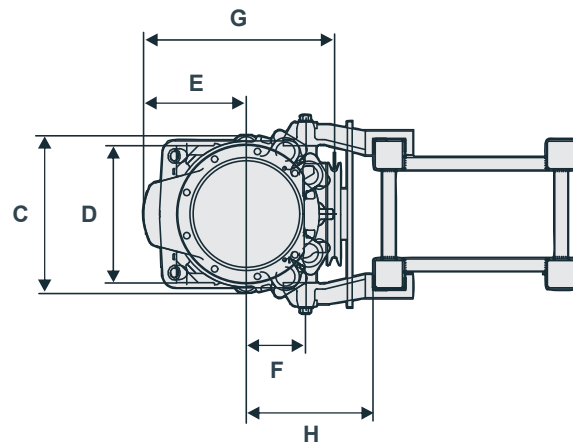
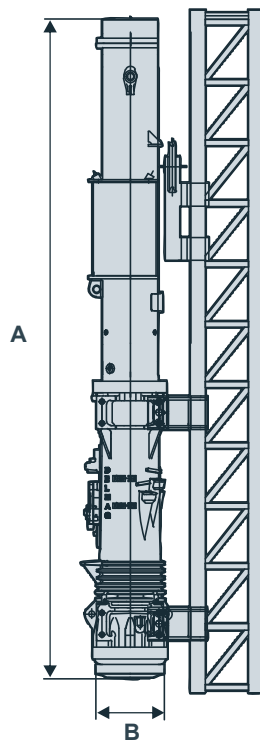
		D6-32	D8-22	D12-42	D16-32
Impact weight (piston)	kg	600	800	1280	1600
	lbs	1,320	1,765	2,820	3,530
Energy per blow max. - min.	kNm	19-9	27-13	46-20	54-25
	ft-lbs	14,015-6,640	19,915-9,590	33,930-14,750	39,830-18,440
Number of blows	min-1	38-52	36-52	35-52	36-52
Suitable for driving piles (depending on soil and pile)	kg	300 - 2000	500-3000	800-5000	1000-6000
	lbs	660-4,400	1,100-6,600	1,760-11,000	2,200-13,200
Consumption					
Diesel oil	l/h	3,7	4	4,5	5
	gal/h	0.81	0.88	1	1.1
Lubricant	l/h	0,25	0,5	0,5	0,5
	gal/h	0.05	0.11	0.11	0.11
Tank capacity					
Diesel oil tank	l	19	20	25	32
	gal	5	5.3	6.6	8.45
Lube tank	l	5	6	6,5	9
	gal	1.3	1.58	1.7	2.4
Max. rope diameter for deflector sheave of tripping device	mm	20	20	20	20
	in	0.78	0.78	0.78	0.78
Max. inclined pile driving without / with extension		1:3 / -	1:2 / -	1:5 / 1:1	1:5 / 1:1
Weight					
Diesel pile hammer	kg	1620	1935	2735	3620
	lbs	3,570	4,265	6,030	7,980
Tripping device	kg	114	114	114	114
	lbs	250	250	250	250

Technical Data

		D19-42	D25-32	D30-32
Impact weight (piston)	kg	1820	2500	3000
	lbs	4,010	5,510	6,610
Energy per blow max. - min.	kNm	66-29	90-40	103-48
	ft-lbs	48,680-21,390	66,380-29,500	75,970-35,400
Number of blows	min-1	35-52	35-52	36-52
Suitable for driving piles (depending on soil and pile)	kg	1100-6000	1600-7500	2000-9000
	lbs	2,420-13,200	3,530-16,535	4,410-19,840
Consumption				
Diesel oil	l/h	7,5	7,5	10
	gal/h	1.65	1.65	2.2
Lubricant	l/h	0,5	0,6	1
	gal/h	0.11	0.13	0.22
Tank capacity				
Diesel oil tank	l	32	67	67
	gal	8.45	17.7	17.7
Lube tank	l	9	19	19
	gal	2.4	5	5
Max. rope diameter for deflector sheave of tripping device	mm	20	22	22
	in	0.78	0.87	0.87
Max. inclined pile driving without / with extension		1:5 / 1:1	1:5 / 1:1	1:5 / 1:1
Weight				
Diesel pile hammer	kg	3840	5670	6170
	lbs	8,465	12,500	13,600
Tripping device	kg	114	186	186
	lbs	250	410	410

Dimensions

		D6-32	D8-22	D12-42	D16-32	D19-42	D25-32	D30-32
A	mm	4300	4700	4770	5160	5160	5500	5500
B	mm	350	350	400	440	440	560	560
C	mm	465	410	440	480	480	670	670
D	mm	320	320	320	320	320	540	540
E	mm	310	315	335	345	345	405	405
F	mm	245	245	245	280	280	235	235
G	mm	590	590	610	700	700	780	780
H	mm	320	320	340	355	360	435	435



Dimensions

		D6-32	D8-22	D12-42	D16-32	D19-42	D25-32	D30-32
A	in	170	185	188	203	203	216.5	216.5
B	in	13.8	13.8	15.8	17.3	17.3	22	22
C	in	18.3	16.15	17.3	18.9	18.9	26.4	26.4
D	in	12.6	12.6	12.6	12.6	12.6	21.3	21.3
E	in	12.2	12.4	13.2	13.6	13.6	16	16
F	in	9.7	9.7	9.7	11	11	9.3	9.3
G	in	23.3	23.3	24	27.5	27.5	30.7	30.7
H	in	12.6	12.6	13.4	14	14.2	17.1	17.1

Diesel Pile Hammers

Technical Data

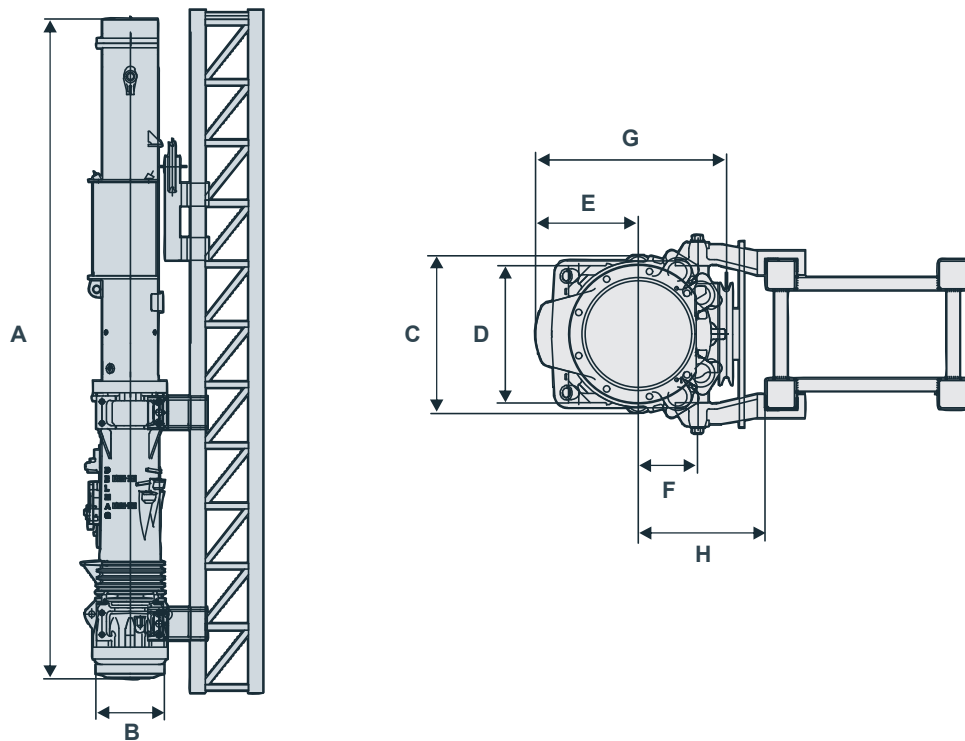
		D36-32	D46-32	D62-22	D80-23
Impact weight (piston)	kg	3600	4600	6200	8000
	lbs	7,940	10,140	13,640	17,600
Energy per blow max. - min.	kNm	123-56	166-71	224-107	288-171
	ft-lbs	90,720-41,300	122,435-52,370	165,215-78,920	212,420-126,125
Number of blows	min-1	36-53	35-53	35-50	35-45
Suitable for driving piles (depending on soil and pile)	t	2,5-12	3-16	4-30	6-60
	US tons	2.2-13.2	3.3-17.6	4.4-33.1	6.6-66.1
Consumption					
Diesel oil	l/h	11,5	16	20	25
	gal/h	2.53	3.52	4.4	5.5
Lubricant	l/h	1,5	1,5	2	2,6
	gal/h	0.33	0.33	0.44	0.57
Tank capacity					
Diesel oil tank	l	89	89	98	155
	gal	23.5	23.5	25.9	40.9
Lube tank	l	17	17	31,5	32
	gal	4.5	4.5	8.3	8.5
Max. rope diameter for deflector sheave of tripping device (* reeved twice)	mm	38	38	38	30*
	in	1.5	1.5	1.5	1.2*
Max. inclined pile driving without / with extension		1:5 / 1:1	1:5 / 1:1	1:2 / 1:1	1:5 / 1:2
Weight					
Diesel pile hammer	kg	8200	9300	12250	16905
	lbs	18,060	20,485	26,950	37,190
Tripping device	kg	450	450	450	750
	lbs	992	992	992	1,650

Technical Data

		D100-13	D150-42	D200-42
Impact weight (piston)	kg	10000	15000	20000
	lbs	22,000	33,000	44,000
Energy per blow max. - min.	kNm	360-214	512-329	682-436
	ft-lbs	265,520-157,840	377,630-242,660	503,036-321,580
Number of blows	min-1	35-45	36-45	36-45
Suitable for driving piles (depending on soil and pile)	t	7-100	12-160	14-250
	US tons	7.7-110.2	13.2-176.4	15.4-275.6
Consumption				
Diesel oil	l/h	30	50	60
	gal/h	6.6	11	13.2
Lubricant	l/h	2,6	4,8	5,8
	gal/h	0.57	1	1.3
Tank capacity				
Diesel oil tank	l	155	310	430
	gal	40.9	81.9	113.6
Lube tank	l	32	45	80
	gal	8.5	11.9	21.1
Max. rope diameter for deflector sheave of tripping device (* reeved twice)	mm	30*	36*	36*
	in	1.2*	1.4*	1.4*
Max. inclined pile driving without / with extension		1:5 / 1:2	1:5 / 1:2	1:5 / 1:3
Weight				
Diesel pile hammer	kg	20720	28450	51800
	lbs	45,585	62,590	113,960
Tripping device	kg	750	1850	1850
	lbs	1,650	4,070	4,070

Dimensions

		D36-32	D46-32	D62-22	D80-23	D100-13	D150-42	D200-42
A	mm	5470	5470	5910	7200	7358	7490	8175
B	mm	660	660	710	820	820	990	1250
C	mm	800	800	800	890	890	1280	1425
D	mm	640	640	560	800	800	1110	1425
E	mm	445	445	490	550	550	720	730
F	mm	275	275	380	350	350	375	580
G	mm	950	950	970	1110	1110	1450	1890
H	mm	500	500	500	660	660	900	1050



Dimensions

		D36-32	D46-32	D62-22	D80-23	D100-13	D150-42	D200-42
A	in	215.4	215.4	232.7	283.7	289.9	294.9	322.1
B	in	26	26	28	32.3	32.3	39	49.3
C	in	31.4	31.4	31.5	35.1	35.1	50.4	56.2
D	in	25.2	25.2	22	31.5	31.5	43.7	56.2
E	in	17.5	17.5	19.3	21.7	21.7	28.4	28.8
F	in	10.8	10.8	15	13.8	13.8	14.8	22.9
G	in	37.4	37.4	38.2	43.7	43.7	57.1	74.5
H	in	19.7	19.7	19.7	26	26	35.5	41.4

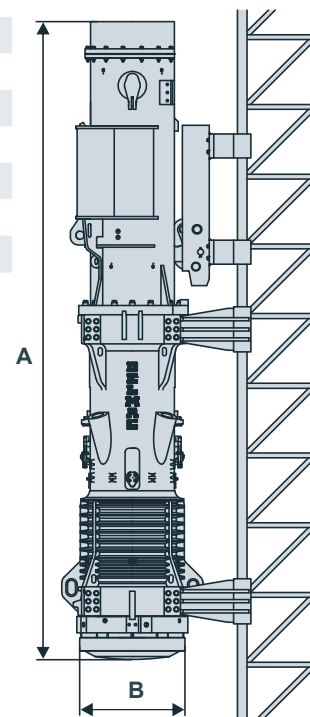
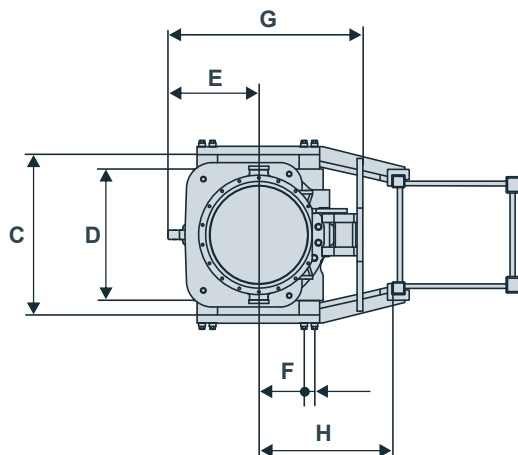
Diesel Pile Hammers

Technical Data

		D260-32	D300-32	D400-32
Impact weight (piston)	kg	26000	30000	40000
	lbs	57,320	66,140	88,190
Energy per blow max. - min.	kNm	865-556	1002-641	1335-855
	ft-lbs	638,000 - 410,100	739,000 - 472,800	984,600 - 630,600
Number of blows	min-1	36-45	36-45	36-45
Suitable for driving piles (depending on soil and pile)	t	26-280	28-320	45-420
	US tons	28.7 - 308.6	30.9 - 352.7	49.6 - 463.0
Consumption				
Diesel oil	l/h	72	85	112
	gal/h	19.0	22.5	29.6
Lubricant	l/h	6	6	6
	gal/h	1.6	1.6	1.6
Tank capacity				
Diesel oil tank	l	550	550	800
	gal	145.3	145.3	211.3
Lube tank	l	80	80	90
	gal	21.1	21.1	23.8
Max. rope diameter for deflector sheave of tripping device (* reeved twice)	mm	40*	40*	40*
	in	1.6*	1.6*	1.6*
Max. inclined pile driving without / with extension		1:5 / -	1:5 / -	1:5 / -
Weight				
Diesel pile hammer	kg	53500	59500	79500
	lbs	117,950	131,180	175,270
Tripping device	kg	2450	2450	2450
	lbs	5,400	5,400	5,400

Dimensions

		D260-32	D300-32	D400-32		D260-32	D300-32	D400-32
A	mm	7890	7965	8205	in	310.6	313.6	323.0
B	mm	1300	1320	1495	in	51.2	52.0	58.9
C	mm	1400	1445	1785	in	55.1	56.9	70.3
D	mm	1275	1275	1560	in	50.2	50.2	61.4
E	mm	875	895	1055	in	34.4	35.2	41.5
F	mm	445/545	445/545	505/605/705	in	17.5/21.5	17.5/21.5	19.9/23.8/27.8
G	mm	1880	1945	2240	in	74.0	76.6	88.2
H	mm	1300	1400	1500	in	51.2	55.1	59.1



Technical Data

Diesel pile hammer with hydraulic starting device

		D12-52	D19-52	D25-52	D30-52
Impact weight (piston)	kg	1280	1820	2500	3000
	lbs	2,820	4,010	5,510	6,610
Energy per blow max. - min.	kNm	46-20	66-29	90-40	103-48
	ft-lbs	33,930-14,750	48,680-21,390	66,380-29,500	75,970-35,400
Number of blows	min-1	35-52	35-52	35-52	36-52
Suitable for driving piles (depending on soil and pile)	kg	800-5000	1100-6000	1600-7500	2000-9000
	lbs	1,760-11,000	2,420-13,200	3,530-16,535	4,410-19,840

Consumption

Diesel oil	l/h	4,5	7,5	7,5	10
	gal/h	1	1.65	1.65	2.2
Lubricant	l/h	0,5	0,5	0,6	1
	gal/h	0.11	0.11	0.13	0.22

Tank capacity

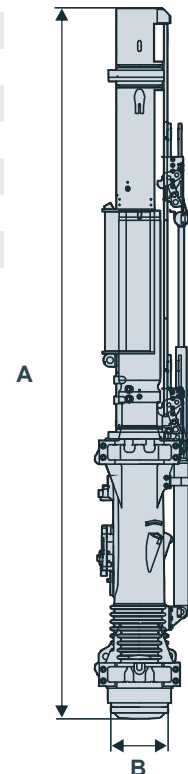
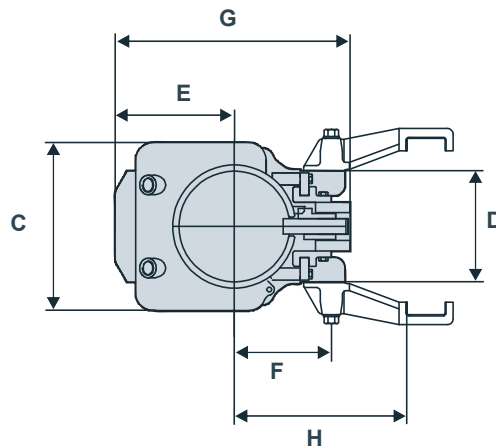
Diesel oil tank	l	25	32	67	67
	gal	6.6	8.45	17.7	17.7
Lube tank	l	6,5	9	19	19
	gal	1.7	2.4	5	5
Max. rope diameter for deflector sheave of tripping device	mm	20	20	22	22
	in	0.78	0.78	0.87	0.87
Max. inclined pile driving without / with extension		1:5 / 1:1	1:5 / 1:1	1:5 / 1:1	1:5 / 1:1

Weight

Diesel pile hammer with hydraulic starting device, without guidings	kg	3500	4100	6380	6880
	lbs	7,720	9,040	14,070	15,170

Dimensions

		D12-52	D19-52	D25-52	D30-52		D12-52	D19-52	D25-52	D30-52
A	mm	5500	5500	5650	5650	in	216.5	216.5	222.4	222.4
B	mm	440	440	560	560	in	17.3	17.3	22	22
C	mm	485	485	640	640	in	19.1	19.1	25.2	25.2
D	mm	320	320	540	540	in	12.6	12.6	21.3	21.3
E	mm	345	345	405	405	in	13.6	13.6	15.9	15.9
F	mm	280	280	235	235	in	11	11	9.3	9.3
G	mm	730	680	880	880	in	28.7	26.8	34.6	34.6
H	mm	500	500	500	500	in	19.7	19.7	19.7	19.7



Marken der
Brands of **ABI Gruppe**



For further informations please contact your DELMAG sales assistant. Or you visit us on the Internet at www.delmag.de. Design subject to modifications. The details in this leaflet have to be regarded as approximate. The illustrations also can contain special outfits which are not part of the standard scope of supply. Not represented equipment variants can lead to modifications of the technical data. The reproduction and utilization of this document, even in form of excerpts, without express authorization is prohibited. Offenders will be held liable for the payment of damages.

DELMAG GmbH & Co. KG
Max-Planck-Str. 3
73730 Esslingen
Germany

Telefon: +49 (0) 711 3100-0
Telefax: +49 (0) 711 3100-119
eMail: info@delmag.de
Web: www.delmag.de



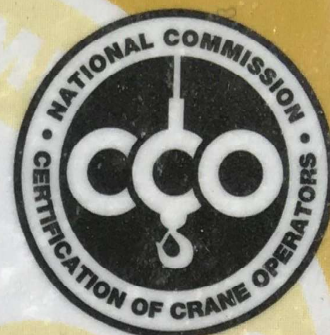


NCCCO CERTIFIED

Operator

Certification #: 130386449R

**Certification Designations:
LBC**



Issued to: MARK WORKMAN

Issued: 03/31/2018

Expires: 03/31/2023

Thom Sickelsteel, President, NCCCO Board of Directors

Graham Brent, Chief Executive Officer, NCCCO

Verify cardholder status at www.verifycco.org. Subject to provisions of suspension or revocation.

National Commission for the Certification of Crane Operators



PQR No: SI-18-AWS-D1.1-SMAW-(1) Revision: 0 Date: 2/2/2018 By: Chris Mohrbach
 Authorized By: Mark Workman Date: 2/2/2018
 Welding Process(es): SMAW Type: Manual X Machine Auto Semi-Auto
 Reference WPS No.: SI-18-AWS-D1.1-SMAW-(1)A

JOINT

Type: Single "V" Groove

Backing: Yes No X Single Weld X Double Weld

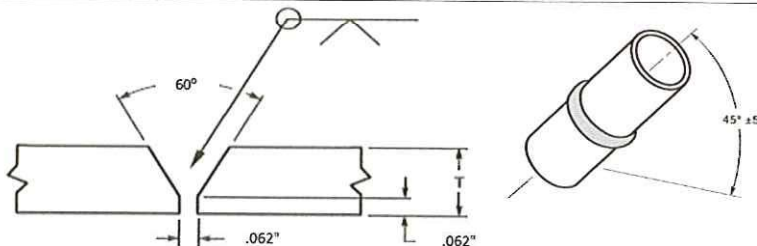
Backing Material: n/a

Root Opening (R): .062" Root Face Dimension: .062"

Groove Angle (a): 60 Degr. Radius (J-U):

Back Gouge Yes No X

Method: n/a



BASE MATERIAL

Material Spec: ASTM A106 To ASTM A106
 Type or Group: Group I To Group I
 Thickness (T): Groove (in) .710"
 Fillet (in) n/a
 Diameter (Pipe, in): 4.5" Sch DBL E.H. (XXH)

POSITION

Position of Groove: 6G Fillet: n/a
Weld Progression Down X(E6010) Up X(E7018)

FILLER METALS

AWS Specification: AWS A5.1
AWS Classification: E6010(F3) & E7018(F4)
Dia. Of Filler Metal: E6010(3/32"), E7018(3/32" & 1/8")

ELECTRICAL CHARACTERISTICS

Transfer Mode (GMAW) n/a
Short-Circuiting Globular Spray
Current: AC DCEP X DCEN Pulsed
Other: n/a
Tungsten Electrode (GTAW)
Size: n/a Type: n/a

SHIELDING

Flux:	Gas:
<u>n/a</u>	<u>n/a</u>
Electrode-flux (class):	Composition:
<u>n/a</u>	<u>n/a</u>
	Flow Rate:
	<u>n/a</u>
	Gas Cup Size:
	<u>n/a</u>

TECHNIQUE

Stringer or Weave Bead: **Stringer**

Multi-pass or Single Pass (per side): **Multi-Pass**

Number of Electrodes: **2**

Electrode Spacing: Longitudinal: **n/a**

Lateral: **n/a**

Angle: **n/a**

Contact Tube to Work Distance: **n/a**

Peening: **n/a**

Interpass Cleaning: **Wire Brush / Mechanical Grind**

PREHEAT

Preheat Temp. Min: 70 Deg F.
Interpass Temp. Min: 32 Deg F. Max: n/a

POSTWELD HEAT TREATMENT

POSTWELD HEAT TREATMENT PWHT: n/a
Temp: n/a Time: n/a

WELDING PROCEDURE

[illegible]

If welding is required, please provide current welding logs



STRUCTURES, INC.

Procedure Qualification Record (PQR)

Page 2 of 2

SI-18-AWS-D1.1-SMAW-(1)

TENSILE TEST(S)

Specimen No.	Width	Thickness	Area	Ultimate tensile load, lb	Ultimate unit stress, psi	Character of failure & location
T1	.750"	.710"	0.5325	39,000	73,239	Base material
T2	.748"	.710"	0.531	41,000	77,212	Base material

GUIDED BEND TEST(S)

Specimen No.	Type of Bend	Result	Remarks
S1	Side	Pass	n/a
S2	Side	Pass	n/a
S3	Side	Pass	n/a
S4	Side	Pass	n/a

VISUAL INSPECTION

Appearance: Satisfactory
Undercut: None
Piping porosity: None
Convexity: None
Test Date: 2/2/2018
Witnessed by: n/a

RADIOGRAPHIC-ULTRASONIC EXAMINATION X(RT)

RT Report No.: ITC-2-8-18 Result: Pass
UT Report No.: _____ Result: _____

FILLET WELD TEST RESULTS n/a

Minimum size multiple pass _____ Minimum size single pass _____

Macro Etch:

1 _____ 3 _____ 1 _____ 3 _____
2 _____ 4 _____ 2 _____ 4 _____

Macro Etch:

ALL-WELD METAL TENSION TEST n/a

Tensile strength, psi: _____

Yield point/strength, psi: _____

Elongation in 2 in., %: _____

Laboratory test no.: _____

OTHER TESTING

n/a

Welder's name: Mark Workman

Clock no.: _____


Stamp no.: MW

Test conducted by: Western States Inspection Company

Laboratory Test No.: 87-18

Per: Chris Mohrbach (AWS-CWI)

AWS-CWI #02110871

 **Christopher J Mohrbach**
CWI 02110871
SC1 EXP. 11/1/2020

We, the undersigned, certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Clause 4 & 9 of AWS D1.1 (2015) *Structural Welding Code-Steel*.

Manufacturer: STRUCTURES, INC.

By: Mark Workman

Date: February 2, 2018

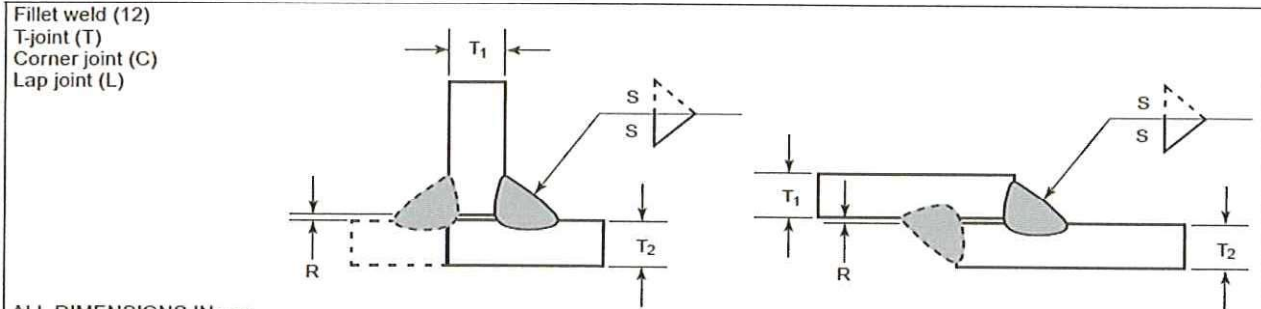
WSIC
(303-929-5750)

STRUCTURES, INC.

Welding Procedure Specification (WPS)

SI-18-AWS-D1.1-SMAW-(2)

Page 2 of 2



ALL DIMENSIONS IN mm

Welding Process	Joint Designation	Base Metal Thickness	Joint Design/Geometry			Allowed Welding Positions	Notes
		T ₁ or T ₂	Root Opening	Tolerances			
				As Detailed	As Fit-Up		
SMAW	TC-F12	<3	R = 0	+1/16, -0	3/16 max.	All	a, b, d
	TC-F12a	≥3			5/16 max.		a, b, d
	L-F12	<3			3/16 max.		a, b, c
	L-F12a	≥3			5/16 max.		a, b, c

Notes for Figure 3.5

^a Fillet weld size ("S"). See 2.4.2.8 and Clause 5.14 for minimum fillet weld sizes. See Table 3.7 for maximum single pass size.

^b See 5.22.1 for additional fillet weld assembly requirements or exceptions.

^c See 2.4.2.9 for maximum weld size in lap joints.

^d Perpendicularity of the members shall be within $\pm 10^\circ$.

Memo


* If base material is below 32 Degrees F., the base metal shall be preheated to a minimum of 70 Degrees F. and the minimum interpass temperature shall be maintained during welding.

This WPS applies to joints where the minimum angle between the joined pieces is 60 degrees and the maximum angle is 135 degrees. The provisions of weld sizes and base metal thickness can be found in AWS D1.1-2015, Section 2.9 & 3.9. Acceptable weld profiles are defined in Figure 5.4.

Fillet Weld Assembly Joint Dimension Tolerance (5.21.1)

"The parts to be joined by fillet welds shall be brought into close contact as practicable. The root opening shall not exceed 3/16" except in cases involving either shapes or plates 3" or greater in thickness if, after straightening and in assembly, the root opening cannot be closed sufficiently to meet this tolerance. In such cases, a maximum root opening of 5/16" may be used, provided suitable backing is used. Backing may be flux, glass tape, iron powder, or similar materials, or welds using a low-hydrogen process compatible with the filler metal deposited. If the separation is greater than 1/16", the legs of the fillet weld shall be increased by the amount of root opening, or the contractor shall demonstrate that the required effective throat has been obtained."

WSIC
(303-929-5750)

 Christopher J Mohrbach
CWI 02110871
QC1 EXP. 11/1/2020

[illegible]

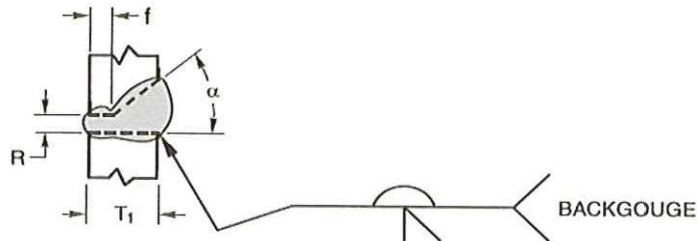
STRUCTURES, INC.

Welding Procedure Specification (WPS)

SI-18-AWS-D1.1-SMAW-(3)

Page 2 of 2

Single-bevel-groove weld (4)
Butt joint (B)



Welding Process	Joint Designation	Base Metal Thickness (U = unlimited)		Groove Preparation			Allowed Welding Positions	Gas Shielding for FCAW	Notes
				Root Opening Root Face Groove Angle	Tolerances				
		T ₁	T ₂		As Detailed (see 3.13.1)	As Fit-Up (see 3.13.1)			
SMAW	B-U4b	U	—	R = 0 to 1/8 f = 0 to 1/8 α = 45°	+1/16, -0 +1/16, -0 +10°, -0°	+1/16, -1/8 Not limited 10°, -5°	All	—	c, d, e, j
							All	Not required	a, c, d, j

Memo

* If base material is below 32 Degrees F., the base metal shall be preheated to a minimum of 70 Degrees F. and the minimum interpass temperature shall be maintained during welding.

Notes for Figures 3.2 and 3.3

^a Not prequalified for GMAW-S nor GTAW.

^b Joint shall be welded from one side only.

^c Cyclic load application places restrictions on the use of this detail for butt joints in the flat position (see 2.18.2).

^d Backgouge root to sound metal before welding second side.

^e SMAW detailed joints may be used for prequalified GMAW (except GMAW-S) and FCAW.

^f Minimum weld size (E) as shown in Table 3.5. S as specified on drawings.

^g If fillet welds are used in statically loaded structures to reinforce groove welds in corner and T-joints, these shall be equal to T₁/4, but need not exceed 3/8 in [10 mm]. Groove welds in corner and T-joints of cyclically loaded structures shall be reinforced with fillet welds equal to T₁/4, but need not exceed 3/8 in [10 mm].

^h Double-groove welds may have grooves of unequal depth, but the depth of the shallower groove shall be no less than one-fourth of the thickness of the thinner part joined.

ⁱ Double-groove welds may have grooves of unequal depth, provided these conform to the limitations of Note f. Also the weld size (E) applies individually to each groove.

^j The orientation of the two members in the joints may vary from 135° to 180° for butt joints, or 45° to 135° for corner joints, or 45° to 90° for T-joints.

^k For corner joints, the outside groove preparation may be in either or both members, provided the basic groove configuration is not changed and adequate edge distance is maintained to support the welding operations without excessive edge melting.

^l Weld size (E) shall be based on joints welded flush.

^m For flare-V-groove welds and flare-bevel-groove welds to rectangular tubular sections, r shall be as two times the wall thickness.

ⁿ For flare-V-groove welds to surfaces with different radii r, the smaller r shall be used.

^o For corner and T-joints the member orientation may vary from 90° to less than or equal to 170° provided the groove angle and root opening are maintained, and the angle between the groove faces and the steel backing is at least 90°. See Figure 3.6

WSIC
(303-929-5750)

 Christopher J Mohrbach
CWI 02110871
QC1 EXP. 11/1/2020



STRUCTURES, INC.

Welder Qualification Test Record (WQTR)

WQTR No: 87-18Welder name: Mark WorkmanWelder ID: MWWPS No: SI-18-AWS-D1.1-SMAW-(1)ARevision: 0Date: 2/2/2018**Variables: (Record actual Values Used In Qualification)**Process: SMAWTransfer Mode (GMAW): Short-cir Globular Spray Type: Manual X Machine Semi-Auto Auto Number of Electrodes: Single Multiple XCurrent/Polarity: AC DCEP X DCEN Pulsed Position: 6GWeld Progression: Up X Down XBacking: Use Backing n/aConsumable Insert (GTAW): Use Insert n/aMaterial/Spec: ASTM A106 to ASTM A106Thickness (Plate): Groove (in) n/aFillet (in) n/aThickness (Pipe/Tube): Groove (in) .710Fillet (in) n/aDiameter (Pipe): Groove (in) 4.5" Sch XXHFillet (in) n/aNotes: n/a

Filler Metal:

Spec.: AWS A5.1Class: E6010 / E7018F-No.: E6010(F3) / E7018(F4)Gas/Flux Type: n/aOther: **Qualification Range:**SMAWShort-Circuiting Globular Spray Manual X Machine Semi-Auto Auto Single X Multiple XAC DCEP X DCEN Pulsed All PositionsUp X Down XWith Backing X Without Backing XWith Insert Without Insert Any AWS D1.1 Group I & II Materials.187 - Unlimited In.125 - Unlimited In.187 - Unlimited In.125 - Unlimited In4" - Unlimited InAll - Unlimited InAWS A5.1E6010 / E7018 and per Table 4.13F-No. 1, 2, 3 & 4n/aVISUAL INSPECTION Acceptable Yes**GUIDED BEND TEST RESULTS**

Type	Result	Type	Result
Side 1 (6G)	Pass	Side 3 (6G)	Pass
Side 2 (6G)	Pass	Side 4 (6G)	Pass

FILLET TEST RESULTSAppearance: Fillet Size: Macroetch: Fracture Test Root Penetration: Description: Inspected By: Chris Mohrbach (AWS/CWI)
CWI #02110871Test No.: 87-18Organization: Western States Inspection Company**RADIOGRAPHIC TEST RESULTS**

Film Identification No.	Result	Remark	Interpreted by:
			Organization: <u>Christopher J Mohrbach</u> Test No.: <u>CWI 02110871</u> Date: <u>QCT EXP. 11/1/2020</u>

We, the undersigned, certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Clause 4 & 9 of AWS D1.1 (2015) *Structural Welding Code-Steel*.

Manufacturer: STRUCTURES, INC.Authorized By: Mark WorkmanDate: February 2, 2018WSIC
(303-929-5750)