NATIONAL COMMISSION FOR THE
CERTIFICATION OF CRANE OPERATORS (NCCCO)

TOWER CRANE REFERENCE MANUAL

TC RM REV 03/14

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Preface

This manual has been provided as a reference source for candidates preparing to take the NCCCO Tower Crane Certification Exam. The materials contained within provide technical information, specifications, load charts, and general information regarding tower cranes. The information obtained herein is not specific to any single manufacturer. In addition, none of the information is to be used for the actual erecting, dismantling, climbing, operating, or maintenance of any tower crane. This information must be obtained from the manufacturer's operating manual specific to the type of crane involved.

This reference guide is not intended to supersede or replace manufacturers' operator's manuals, OSHA 29 CFR 1926 Subpart CC, nor the current ASME B30 standard for tower cranes.

The material contained herein is not to be used for any other purpose than reference material in association with preparing or the NCCCO exam. No part of this manual is to be copied or used in any manner other than by individual candidates preparing for the NCCCO tower crane examination.

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NCCCO TOWER CRANE REFERENCE MANUAL

Chapter 1: Metric Conversions

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Conversions Table

AREA

MULTIPLY		BY		TO OBTAIN
square inches	x	6.451 6	=	square centimeters
square feet	x	0.092 903 04	=	square meters
square centimeters	x	0.155 000 310	=	square inches
square meters	x	10.763 910 42	=	square feet

DENSITY

MULTIPLY		BY		TO OBTAIN
pounds per cubic foot	x	16.018 463 37	=	kilograms per cubic meter
	x	0.016 018 46	=	metric tons per cubic meter
kilograms per cubic meter	x	0.062 427 960 58	=	pounds per cubic foot
metric tons per cubic meter	x	62.427 960 58	=	pounds per cubic foot

TORQUE

MULTIPLY		BY		TO OBTAIN
foot-pounds (ft-lbs)	x	0.138 254 954	=	kilogram-meters (kg-m)
kilogram-meters	x	7.233 013 851	=	foot-pounds

PRESSURE

MULTIPLY		BY		TO OBTAIN
bars	x	14.503 773 77	=	pounds per square inch (psi)
pounds per square inch	x	6.894 757 293	=	kilopascals (kpa)
	x	0.703 069 579 6	=	metric tons per square meter
	x	0.070 306 957 96	=	kilograms per sq centimeter
pounds per sqaure foot (psf)	x	0.047 880 258 98	=	kilopascals (or kN/m^2)
kilopascals	x	0.145 037 737 7	=	pounds per square inch
	x	20.885 434 23	=	pounds per square foot

FORCE

MULTIPLY		BY		TO OBTAIN
pounds-force (lbs)	x	0.004 448 221	=	kilonewtons (kN)
foot-pounds (ft-lbs)	x	0.001 355 817	=	kilonewton-meters (kNm)
kilonewtons	x	101.971 621 3	=	kilograms-force (kg)
	x	224.808 943 1	=	pounds-force
kilonewton-meters	x	737.562 149 3	=	foot-pounds
kip	x	1 000.000	=	pounds-force
	x	4 448.221 615 260 5	=	newtons

POWER

MULTIPLY		BY		TO OBTAIN
horsepower (hp)(electric)	x	0.745 699 871	=	kilowatts (kW)
kilowatts	x	1.340 482 574	=	horsepower

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Conversions Table (cont'd)

LENGTH

MULTIPLY		BY		TO OBTAIN
inches (in)	x	25.4	=	millimeters (mm)
	x	2.54	=	centimeters (cm)
feet (ft)	x	0.304 8	=	meters (m)
miles (mi)	x	1.609 344	=	kilometers (km)
millimeters	x	0.039 370 1	=	inches
	x	0.003 380 839	=	feet
meters	x	3.280 839 895	=	feet
	x	1 000.000	=	millimeters
kilometers	x	0.621 371 192	=	miles
	x	1 000.000	=	meters

MASS

MULTIPLY		BY		TO OBTAIN
ounces (oz) (avdp)	x	28.349 523 125	=	grams (g)
pounds (lbs) (avdp)	x	0.453 592 37	=	kilograms (kg)
tons (short/avdp)	x	0.907 184 74	=	metric tons (t)
grams	x	0.035 273 961	=	ounces
kilograms	x	2.204 622 622	=	pounds
metric ton	x	1.102 311 311	=	tons (short/avdp)

VOLUME

MULTIPLY		BY		TO OBTAIN
cubic inches (in^3)	x	16.387 064	=	cubic centimeters (cm^3)
cubic feet (ft^3)	x	0.028 316 846	=	cubic meters (m^3)
cubic centimeters (cc, ml)	x	0.61 023 744	=	cubic inches
cubic meters	x	35.314 666 72	=	cubic feet
liters (L)	x	1.056 688 209	=	quarts (qt)
	x	33.814 022 70	=	fluid ounces (fl oz)
fluid ounces	x	29.573 529 562	=	cubic centimeters
quarts	x	0.946 352 946	=	liters
gallons (gal) (US)	x	3.785 411 784	=	liters

VELOCITY

MULTIPLY		BY		TO OBTAIN
miles per hour (mph)	x	1.609 344	=	kilometers per hour (kph)
kilometers per hour	x	0.621 371 192	=	miles per hour

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Weights of Building Materials, Agricultural Commodities, and Floor Loads for Buildings

The loads considered for a building are divided into two major categories; dead loads and live loads. Dead loads are associated with the building and do not change magnitude or location. It includes the weight of the building components, structural parts, and also any fixed equipment such as plumbing, electric, heating, ventilating, refrigeration, and sprinkler systems. Live loads change with time and include loads caused by people, animals, grain, potatoes, equipment, manure, etc.

Table 1 and 2 list estimated weights of selected materials. Known values should be used when available.

Table 1. Weights of common building materials.

Building material	Unit weight
Aluminum[1]	171 pounds per cubic foot
Cast Iron[1]	450 pounds per cubic foot
Cement[2]	94 pounds per cubic foot
Concrete[2]	150 pounds per cubic foot
Crushed Stone[2]	2,500 pounds per cubic yard
Gravel[2]	2,700 pounds per cubic yard
Gypsum or plaster board[3]	
3/8 inch	1.56 pounds per square foot
1/2 inch	2.08 pounds per square foot
5/8 inch	2.60 pounds per square foot
Insulation[3]	
Mineral fiber (fiberglass)	2 pounds per cubic foot
Extruded polystyrene	1.8 pounds per cubic foot
Expanded polystyrene	1.5 pounds per cubic foot
Polyurethane	1.5 pounds per cubic foot
Vermiculite	40 pounds per cubic foot
Limestone	171 pounds per cubic foot
Lumber (@ 35 pounds per cubic foot, Douglas Fir)[4]	
2X4	1.28 pounds per foot
2X6	2.00 pounds per foot
2X8	2.64 pounds per foot
2X10	3.37 pounds per foot
2X12	4.10 pounds per foot
4X4	2.98 pounds per foot
6X6	7.35 pounds per foot
6X8	10.03 pounds per foot

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Weights of Building Materials, Agricultural Commodities, and Floor Loads for Buildings (cont'd)

Masonry Walls[5]		
	4 inch brick	42 pounds per square foot
	8 inch concrete block	55 pounds per square foot
	12 inch concrete block	80 pounds per square foot
Plywood[3]		
	1/4 inch	0.71 pounds per square foot
	3/8 inch	1.06 pounds per square foot
	1/2 inch	1.42 pounds per square foot
	5/8 inch	1.77 pounds per square foot
	3/4 inch	2.13 pounds per square foot
Roofing[5]		
	Asphalt shingles	3 pounds per square foot
	1/4 in. slate	10 pounds per square foot
	Aluminum (26 gauge)	0.3 pounds per square foot
	Steel (29 gauge)	0.8 pounds per square foot
	Built-up 3 ply & gravel	5.5 pounds per square foot
Sand[2]		
	Bank sand	2,500 pounds per cubic yard
	Torpedo Sand	2,700 pounds per cubic yard
Steel[1]		490 pounds per cubic foot

Table 2. Bulk density of selected products[6]

Product	Unit density
Baled hay or straw	8-14 pounds per cubic foot
Shelled corn	45 pounds per cubic foot
Ear corn	28 pounds per cubic foot
Feed Grains & supplement	32 pounds per cubic foot
High protein supplement	50 pounds per cubic foot
Potatoes	43 pounds per cubic foot
Fruits and vegetables	30-40 pounds per cubic foot
Soil	2,500 pounds per cubic yard
Manure	60 pounds per cubic foot
Water	62.4 pounds per cubic foot

Tables 3 and 4 list distributed floor live loads from the BOCA code and a standard from ASAE. Live loads for design are usually estimated based on code requirements or standards of practice. By code definition, the design live load is the greatest load by the intended use or occupancy but not less than the minimum uniformly distributed load outlined in the codes.

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Chapter 2: Crane Configurations

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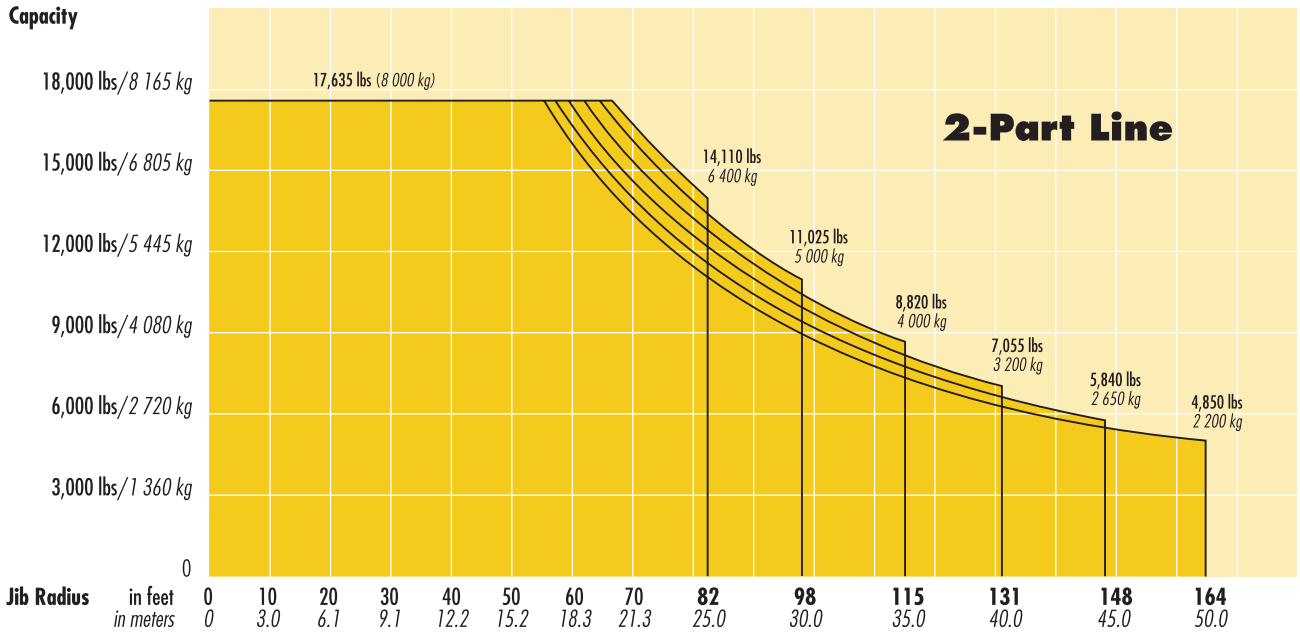
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Hammerhead Tower Crane
Chart A

Radius and Capacities

Hook Radius	**2-Part Line** Max Capacity – Radius	ft / *m*	40 / *12.2*	50 / *15.2*	60 / *18.3*	70 / *21.3*	80 / *24.4*	**82** / *25.0*	90 / *27.5*	**98** / *30.0*	105 / *32.0*	110 / *33.5*	**115** / *35.0*	123 / *37.5*	**131** / *40.0*	139 / *42.5*	**148** / *45.0*	156 / *47.5*	**164** / *50.0*
164 ft *50.0m*	17,635 lbs – 54.5 ft *8 000 kg – 16.6m*	lbs *kg*	17,635 *8 000*	17,635 *8 000*	16,180 *7 340*	13,710 *6 220*	11,815 *5 360*	11,175 *5 070*	10,010 *4 540*	9,060 *4 110*	8,355 *3 790*	7,825 *3 550*	7,560 *3 430*	6,945 *3 150*	6,415 *2 910*	5,950 *2 700*	5,555 *2 520*	5,180 *2 350*	**4,850** ***2 200***
148 ft *45.0m*	17,635 lbs – 56.8 ft *8 000 kg – 17.3m*	lbs *kg*	17,635 *8 000*	17,635 *8 000*	16,910 *7 670*	14,350 *6 510*	12,370 *5 610*	11,705 *5 310*	10,495 *4 760*	9,500 *4 310*	8,765 *3 975*	8,200 *3 720*	7,935 *3 600*	7,300 *3 310*	6,745 *3 060*	6,285 *2 850*	**5,840** ***2 650***		
131 ft *40.0m*	17,635 lbs – 58.7 ft *8 000 kg – 17.9m*	lbs *kg*	17,635 *8 000*	17,635 *8 000*	17,550 *7 960*	14,945 *6 780*	12,875 *5 840*	12,190 *5 530*	10,935 *4 960*	9,900 *4 490*	9,125 *4 140*	8,555 *3 880*	8,270 *3 750*	7,630 *3 460*	**7,055** ***3 200***				
115 ft *35.0m*	17,635 lbs – 62.0 ft *8 000 kg – 18.9m*	lbs *kg*	17,635 *8 000*	17,635 *8 000*	17,635 *8 000*	15,875 *7 200*	13,690 *6 210*	12,960 *5 880*	11,640 *5 280*	10,535 *4 780*	9,735 *4 415*	9,125 *4 140*	**8,820** ***4 000***						
98 ft *30.0m*	17,635 lbs – 64.6 ft *8 000 kg – 19.7m*	lbs *kg*	17,635 *8 000*	17,635 *8 000*	17,635 *8 000*	16,580 *7 520*	14,285 *6 480*	13,535 *6 140*	12,170 *5 520*	**11,025** ***5 000***									
82 ft *25.0m*	17,635 lbs – 66.9 ft *8 000 kg – 20.4m*	lbs *kg*	17,635 *8 000*	17,635 *8 000*	17,635 *8 000*	16,930 *7 680*	14,815 *6 720*	**14,110** ***6 400***											

2-Part Line



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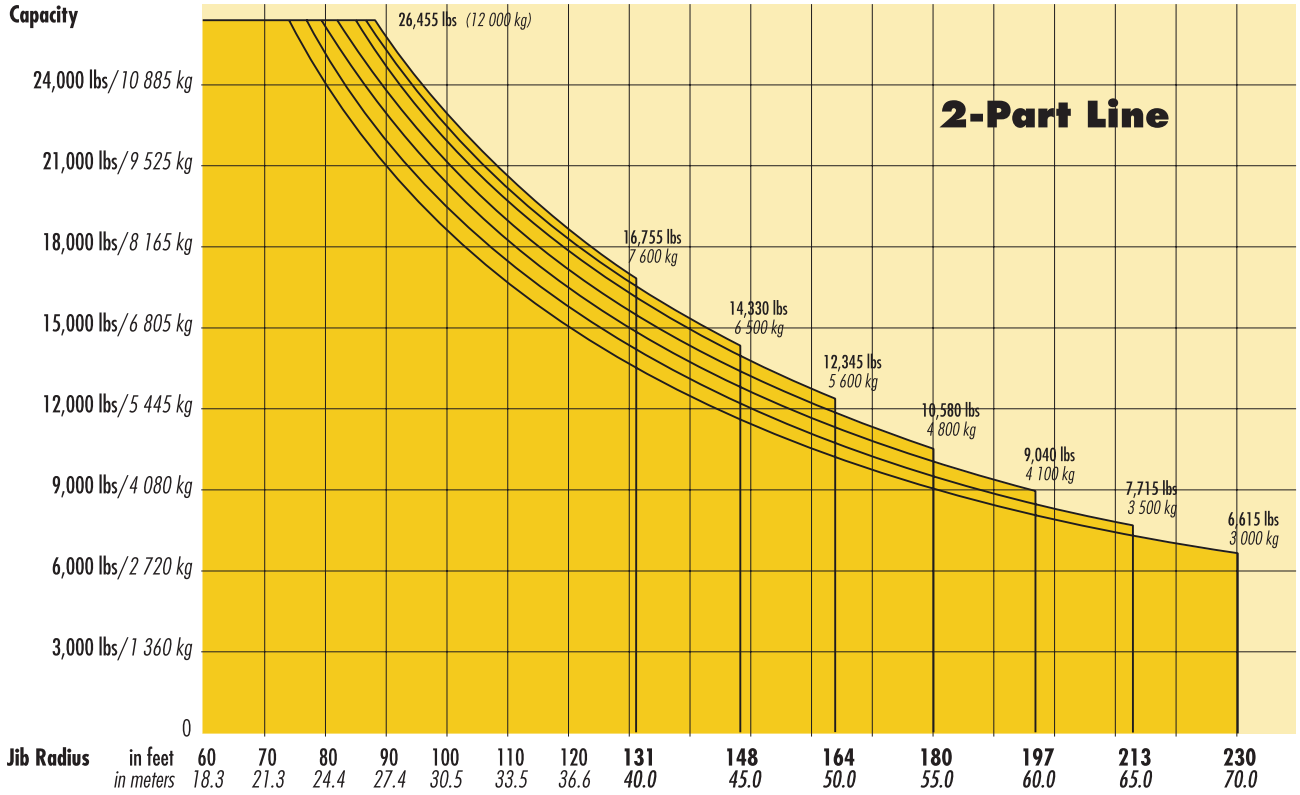
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Hammerhead Tower Crane
Chart B

Radius and Capacities

Hook Radius	Maximum Capacity – Radius	ft / m	72 / 22.0	79 / 24.0	85 / 26.0	92 / 28.0	98 / 30.0	112 / 34.0	125 / 38.0	131 / 40.0	138 / 42.0	148 / 45.0	157 / 48.0	164 / 50.0	180 / 55.0	190 / 58.0	197 / 60.0	213 / 65.0	230 / 70.0
230 ft 70.0m	26,455 lbs – 73 ft 12 000 kg – 22.4m	lbs kg	26,455 12 000	24,515 11 120	22,400 10 160	20,590 9 340	19,025 8 630	16,470 7 470	14,440 6 550	13,580 6 160	12,810 5 810	11,770 5 340	10,870 4 930	10,320 4 680	9,150 4 150	8,530 3 870	8,155 3 700	7,320 3 320	**6,615** ***3 000***
213 ft 65.0m	26,455 lbs – 76 ft 12 000 kg – 23.3m	lbs kg	26,455 12 000	25,595 11 610	23,390 10 610	21,515 9 760	19,885 9 020	17,220 7 810	15,100 6 850	14,220 6 450	13,405 6 080	12,325 5 590	11,400 5 170	10,825 4 910	9,610 4 360	8,975 4 070	8,575 3 890	**7,715** ***3 500***	
197 ft 60.0m	26,455 lbs – 79 ft 12 000 kg – 24.2m	lbs kg	26,455 12 000	26,455 12 000	24,470 11 100	22,510 10 210	20,810 9 440	18,035 8 180	15,830 7 180	14,905 6 760	14,065 6 380	12,940 5 870	11,970 5 430	11,375 5 160	10,100 4 580	9,435 4 280	**9,040** ***4 100***		
180 ft 55.0m	26,455 lbs – 82 ft 12 000 kg – 25.1m	lbs kg	26,455 12 000	26,455 12 000	25,485 11 560	23,455 10 640	21,695 9 840	18,805 8 530	16,535 7 500	15,565 7 060	14,705 6 670	13,535 6 140	12,520 5 680	11,905 5 400	**10,580** ***4 800***				
164 ft 50.0m	26,455 lbs – 85 ft 12 000 kg – 25.9m	lbs kg	26,455 12 000	26,455 12 000	26,345 11 950	24,250 11 000	22,420 10 170	19,445 8 820	17,110 7 760	16,115 7 310	15,210 6 900	14,020 6 360	12,960 5 880	**12,345** ***5 600***					
148 ft 45.0m	26,455 lbs – 87 ft 12 000 kg – 26.4m	lbs kg	26,455 12 000	26,455 12 000	26,455 12 000	24,760 11 230	22,905 10 390	19,865 9 010	17,480 7 930	16,470 7 470	15,540 7 050	**14,330** ***6 500***							
131 ft 40.0m	26,455 lbs – 88 ft 12 000 kg – 26.8m	lbs kg	26,455 12 000	26,455 12 000	26,455 12 000	25,155 11 410	23,280 10 560	20,215 9 170	17,790 8 070	**16,755** ***7 600***									

2-Part Line



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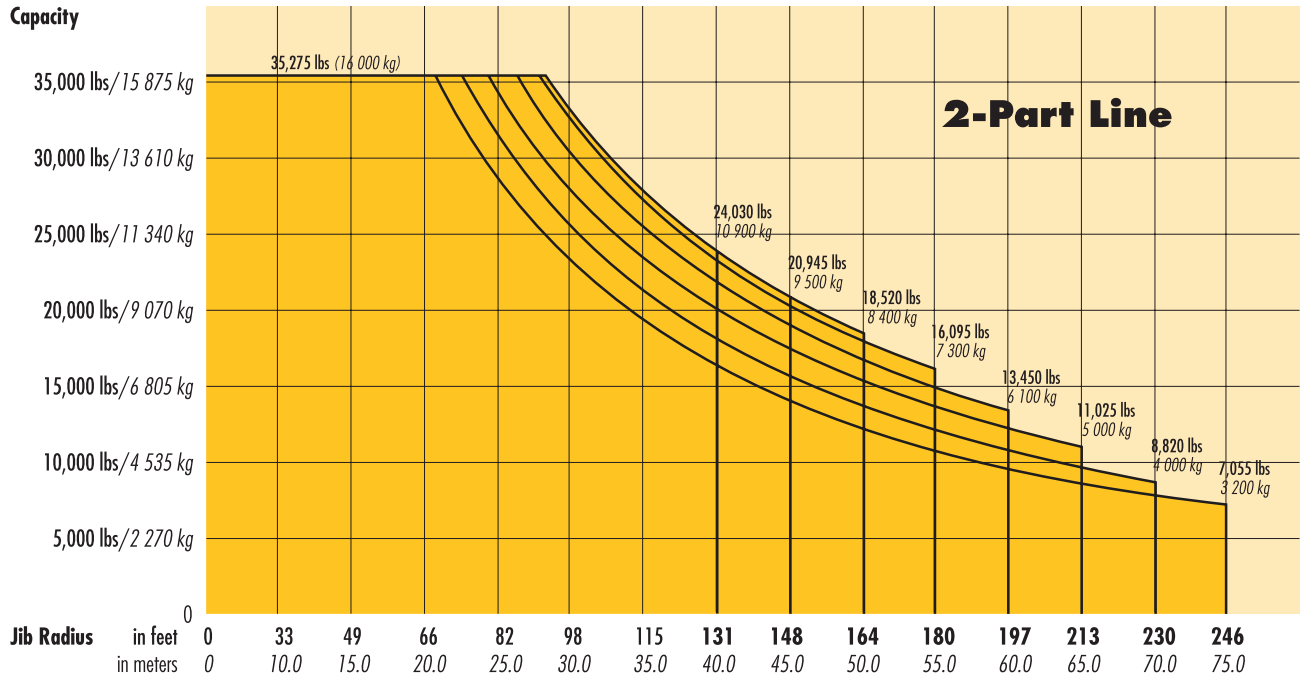
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Hammerhead Tower Crane
Chart C

Radius and Capacities

Hook Radius	Maximum Capacity – Radius	ft / m	33 / 10.0	49 / 15.0	66 / 20.0	82 / 25.0	98 / 30.0	115 / 35.0	131 / 40.0	148 / 45.0	164 / 50.0	180 / 55.0	197 / 60.0	213 / 65.0	230 / 70.0	246 / 75.0
246 ft *75.0m*	35,275 lbs – 67.9 ft *16 000 kg – 20.69m*	lbs *kg*	35,275 *16 000*	35,275 *16 000*	35,275 *16 000*	28,536 *12 944*	23,153 *10 502*	19,312 *8 760*	16,435 *7 455*	14,198 *6 440*	12,412 *5 630*	10,948 *4 966*	9,731 *4 414*	8,701 *3 947*	7,820 *3 547*	**7,055** ***3 200***
230 ft *70.0m*	35,275 lbs – 73.8 ft *16 000 kg – 22.49m*	lbs *kg*	35,275 *16 000*	35,275 *16 000*	35,275 *16 000*	31,345 *14 218*	25,489 *11 562*	21,314 *9 668*	18,186 *8 249*	15,754 *7 146*	13,810 *6 264*	12,222 *5 544*	10,897 *4 943*	9,777 *4 435*	**8,820** ***4 000***	
213 ft *65.0m*	35,275 lbs – 79.8 ft *16 000 kg – 24.33m*	lbs *kg*	35,275 *16 000*	35,275 *16 000*	35,275 *16 000*	34,237 *15 530*	27,934 *12 671*	23,439 *10 632*	20,073 *9 105*	17,456 *7 918*	15,364 *6 969*	13,653 *6 193*	12,229 *5 547*	**11,025** ***5 000***		
197 ft *60.0m*	35,275 lbs – 86.0 ft *16 000 kg – 26.22m*	lbs *kg*	35,275 *16 000*	35,275 *16 000*	35,275 *16 000*	35,275 *16 000*	30,379 *13 780*	25,534 *11 582*	21,905 *9 936*	19,083 *8 656*	16,828 *7 633*	14,985 *6 797*	**13,450** ***6 100***			
180 ft *55.0m*	35,275 lbs – 91.2 ft *16 000 kg – 27.80m*	lbs *kg*	35,275 *16 000*	35,275 *16 000*	35,275 *16 000*	35,275 *16 000*	32,418 *14 705*	27,280 *12 374*	23,430 *10 628*	20,441 *9 272*	18,049 *8 187*	**16,095** ***7 300***				
164 ft *50.0m*	35,275 lbs – 92.77 ft *16 000 kg – 28.28m*	lbs *kg*	35,275 *16 000*	35,275 *16 000*	35,275 *16 000*	35,275 *16 000*	33,053 *14 993*	27,857 *12 636*	23,965 *10 870*	20,937 *9 497*	**18,520** ***8 400***					
148 ft *45.0m*	35,275 lbs – 92.8 ft *16 000 kg – 28.29m*	lbs *kg*	35,275 *16 000*	35,275 *16 000*	35,275 *16 000*	35,275 *16 000*	33,065 *14 998*	27,864 *12 639*	23,970 *10 873*	**20,945** ***9 500***						
131 ft *40.0m*	35,275 lbs – 93.0 ft *16 000 kg – 28.35m*	lbs *kg*	35,275 *16 000*	35,275 *16 000*	35,275 *16 000*	35,275 *16 000*	33,144 *15 034*	27,932 *12 670*	**24,030** ***10 900***							

2-Part Line



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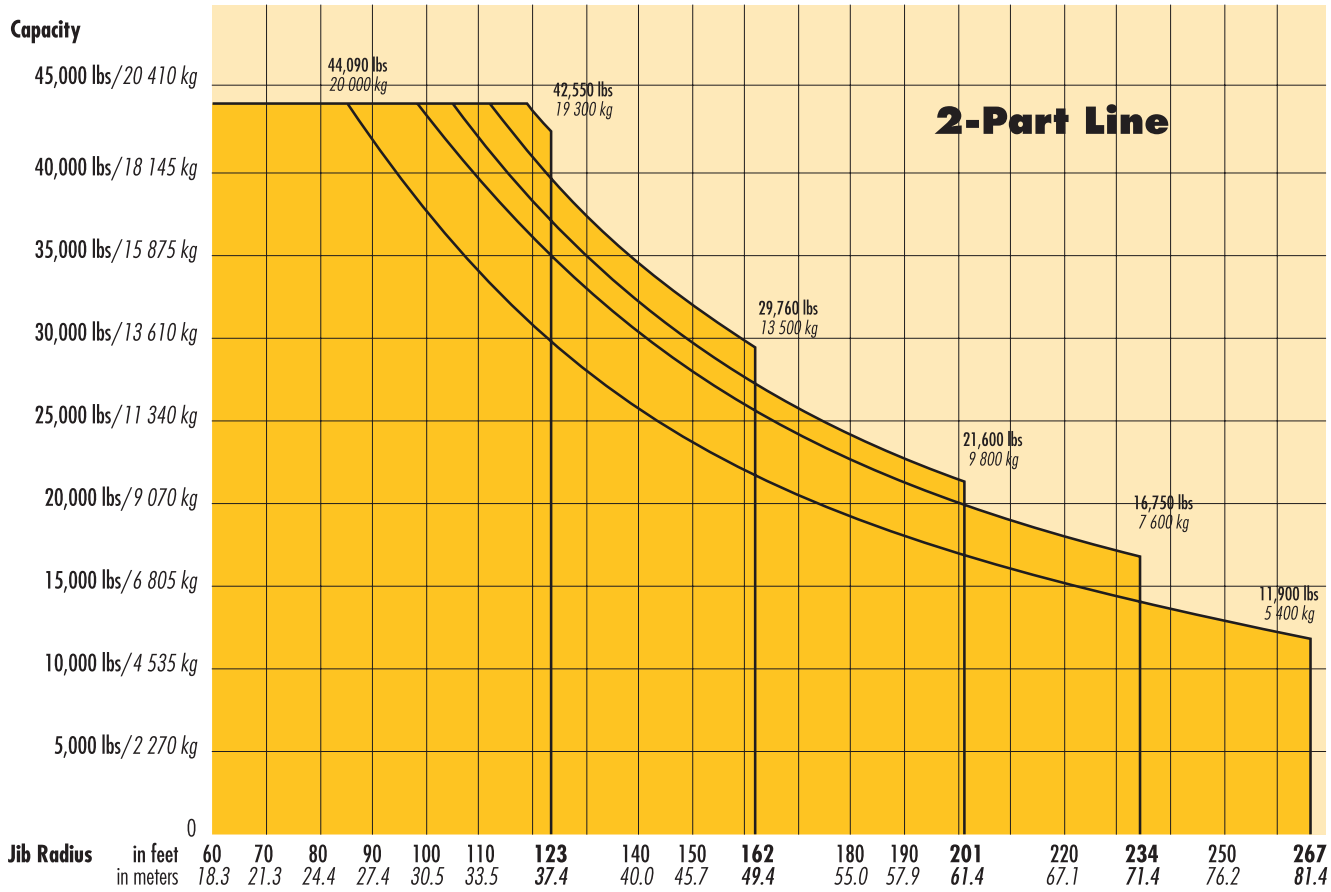
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Hammerhead Tower Crane
Chart D

Radius and Capacities

Hook Radius	Maximum Capacity – Radius	ft *m*	10 *3.1*	16 *5.0*	33 *10.0*	49 *15.0*	66 *20.0*	82 *25.0*	98 *30.0*	**123** ***37.4***	131 *40.0*	148 *45.0*	**162** ***49.4***	180 *55.0*	**201** ***61.4***	213 *65.0*	**234** ***71.4***	246 *75.0*	**267** ***81.4***
267 ft *81.4m*	44,090 lbs – 85 ft *20 000 kg – 25.9m*	lbs *kg*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	37,920 *17 200*	29,960 *13 590*	27,845 *12 630*	24,425 *11 080*	21,960 *9 960*	19,400 *8 800*	16,995 *7 710*	15,875 *7 200*	14,110 *6 400*	13,230 *6 010*	**11,900** ***5 400***
234 ft *71.4m*	44,090 lbs – 98 ft *20 000 kg – 30.0m*	lbs *kg*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	34,900 *15 830*	32,495 *14 740*	28,570 *12 960*	25,750 *11 680*	22,815 *10 350*	20,060 *9 100*	18,740 *8 510*	**16,750** ***7 600***		
201 ft *61.4m*	44,090 lbs – 105 ft *20 000 kg – 32.0m*	lbs *kg*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	37,390 *16 960*	34,820 *15 795*	30,665 *13 910*	27,645 *12 540*	24,515 *11 120*	**21,600** ***9 800***				
162 ft *49.4m*	44,090 lbs – 112 ft *20 000 kg – 34.2m*	lbs *kg*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	40,145 *18 210*	37,410 *16 970*	32,980 *14 960*	**29,760** ***13 500***						
123 ft *37.4m*	44,090 lbs – 119 ft *20 000 kg – 36.2m*	lbs *kg*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	44,090 *20 000*	**42,550** ***19 300***									

2-Part Line



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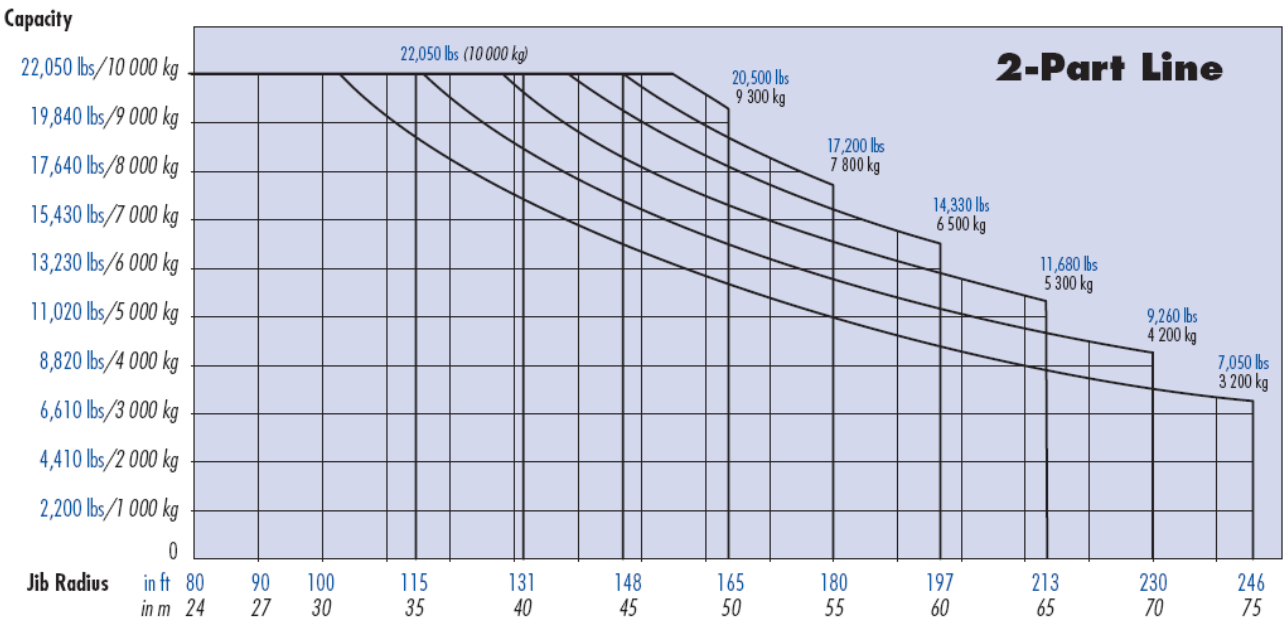
Hammerhead Tower Crane
Chart E

Radius and Capacities

2-Part Operation

Hook Radius	Jib Tip Radius	Maximum Capacity – Radius	ft / m	33 / 10	49 / 15	66 / 20	82 / 25	98 / 30	115 / 35	131 / 40	148 / 45	164 / 50	180 / 55	197 / 60	213 / 65	230 / 70	246 / 75
246 ft / 75m	252'-0" / 76.8m	22,050 lbs – 104 ft / 10 000 kg – 31.6m	lbs / kg	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	19,670 / 8 920	16,670 / 7 560	14,370 / 6 520	12,540 / 5 690	11,050 / 5 010	9,790 / 4 440	8,730 / 3 960	7,830 / 3 550	7,050 / 3 200
230 ft / 70m	235'-7" / 71.8m	22,050 lbs – 117 ft / 10 000 kg – 35.6m	lbs / kg	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	19,180 / 8 700	16,600 / 7 530	14,530 / 6 590	12,850 / 5 830	11,460 / 5 200	10,270 / 4 660	9,260 / 4 200	
213 ft / 65m	219'-2" / 66.8m	22,050 lbs –129 ft / 10 000 kg – 39.2m	lbs / kg	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	21,500 / 9 750	18,650 / 8 460	16,380 / 7 430	14,530 / 6 590	12,990 / 5 890	11,680 / 5 300		
197 ft / 60m	202'-9" / 61.7m	22,050 lbs – 139 ft / 10 000 kg – 42.4m	lbs / kg	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	20,460 / 9 280	17,990 / 8 160	16,000 / 7 260	14,330 / 6 500			
180 ft / 55m	186'-0" / 56.7m	22,050 lbs – 148 ft / 10 000 kg – 45m	lbs / kg	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	21,910 / 9 940	19,310 / 8 760	17,200 / 7 800				
164 ft / 50m	169'-7" / 51.7m	22,050 lbs – 155 ft / 10 000 kg – 47.3m	lbs / kg	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	20,500 / 9 300					
148 ft / 45m	153'-3" / 46.7m	22,050 lbs – 148 ft / 10 000 kg – 45m	lbs / kg	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000						
131 ft / 40m	136'-10" / 41.7m	22,050 lbs – 131 ft / 10 000 kg – 40m	lbs / kg	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000							
115 ft / 35m	120'-5" / 36.7m	22,050 lbs – 115 ft / 10 000 kg – 35m	lbs / kg	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000	22,050 / 10 000								





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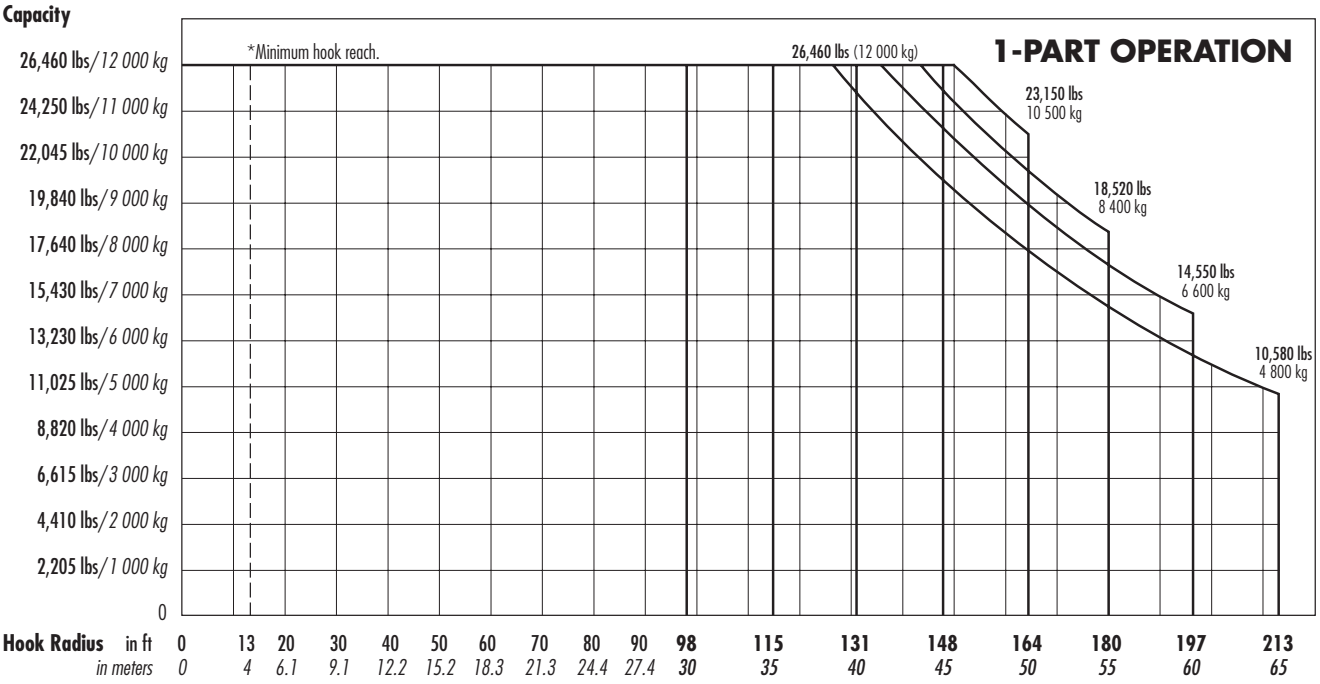
Luffing Boom Tower Crane
Chart F-1

Radius and Capacities

Hook Reach	Maximum Capacity – Radius	ft *m*	13* *4**	66 *20*	98 *30*	107 *32.5*	115 *35*	123 *37.5*	131 *40*	139 *42.5*	148 *45*	156 *47.5*	164 *50*	172 *52.5*	180 *55*	189 *57.5*	197 *60*	205 *62.5*	213 *65*
213 ft *65m*	**26,460 lbs – 127 ft** *12 000 kg – 38.8m*	**lbs** *kg*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**25,245** *11 450*	**22,155** *10 410*	**20,945** *9 500*	**19,160** *8 690*	**17,550** *7 960*	**16,115** *7 310*	**14,795** *6 710*	**13,625** *6 180*	**12,520** *5 680*	**11,530** *5 230*	**10,580** *4 800*
197 ft *60m*	**26,460 lbs – 136 ft** *12 000 kg – 41.4m*	**lbs** *kg*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**24,440** *11 540*	**23,345** *10 590*	**21,495** *9 750*	**19,820** *8 990*	**18,320** *8 310*	**16,955** *7 690*	**15,720** *7 130*	**14,550** *6 600*		
180 ft *55m*	**26,460 lbs – 144 ft** *12 000 kg – 43.8m*	**lbs** *kg*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**25,395** *11 520*	**23,415** *10 620*	**21,625** *9 810*	**20,020** *9 080*	**18,520** *8 400*				
164 ft *50m*	**26,460 lbs – 150 ft** *12 000 kg – 45.8m*	**lbs** *kg*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**25,065** *11 370*	**23,150** *10 500*						
148 ft *45m*	**26,460 lbs – 148 ft** *12 000 kg – 45m*	**lbs** *kg*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*								
131 ft 40m	**26,460 lbs – 131 ft** 12 000 kg – 40m	**lbs** kg	**26,460** 12 000	**26,460** 12 000	**26,460** 12 000	**26,460** 12 000	**26,460** **12 000**	**26,460** **12 000**	**26,460** **12 000**										
115 ft *35m*	**26,460 lbs – 115 ft** *12 000 kg – 35m*	**lbs** *kg*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*												
98 ft *30m*	**26,460 lbs – 98 ft** *12 000 kg – 30m*	**lbs** *kg*	**26,460** *12 000*	**26,460** *12 000*	**26,460** *12 000*														

*Minimum hook reach.

1-PART OPERATION



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Luffing Boom Tower Crane
Chart F-2

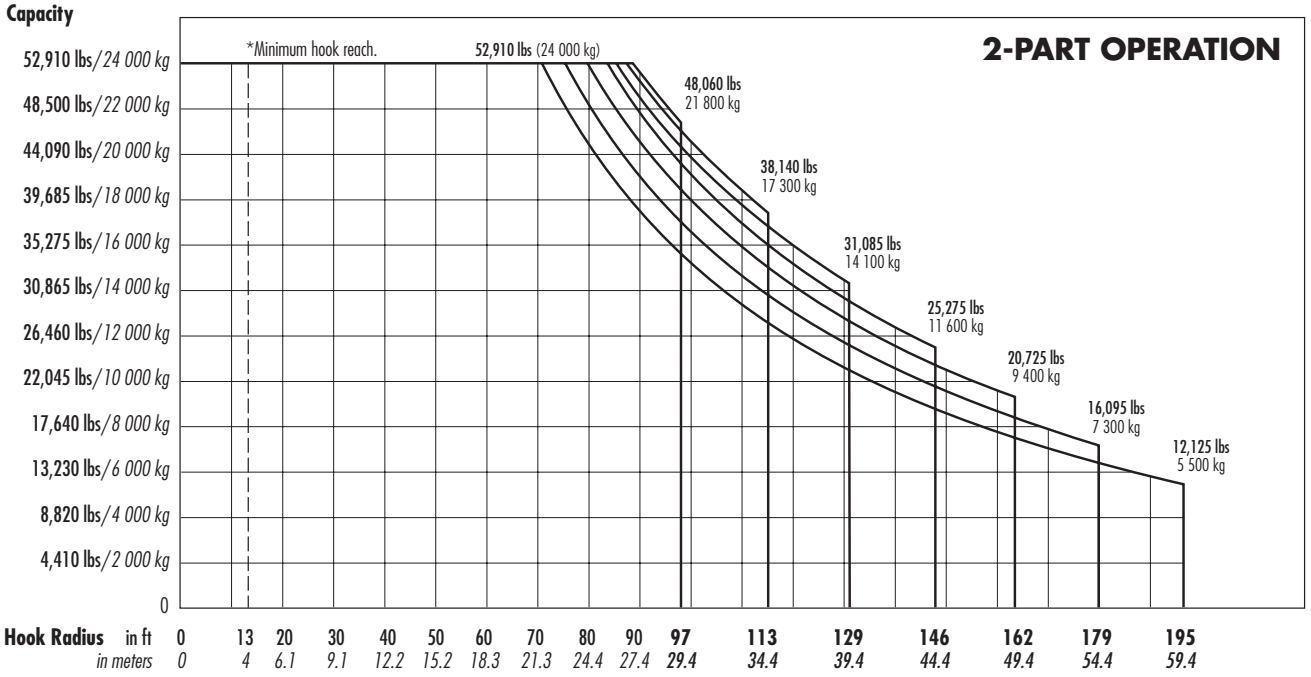
Radius and Capacities

Boom Length	Hook Reach	Maximum Capacity – Radius	ft / m	13* / 4*	82 / 25	90 / 27.5	97 / 29.4	107 / 32.5	113 / 34.4	123 / 37.5	129 / 39.4	139 / 42.5	146 / 44.4	156 / 47.5	162 / 49.4	172 / 52.5	179 / 54.4	189 / 57.5	195 / 59.4
197 ft *60m*	195 ft *59.4m*	52,910 lbs – 71 ft *24 000 kg – 21.6m*	lbs *kg*	52,910 *24 000*	43,650 *19 800*	38,490 *17 460*	34,195 *15 510*	30,690 *13 920*	27,645 *12 540*	25,090 *11 380*	22,860 *10 370*	20,920 *9 490*	19,180 *8 700*	17,635 *8 000*	16,270 *7 380*	15,035 *6 820*	13,890 *6 300*	12,850 *5 830*	12,125 *5 500*
180 ft *55m*	179 ft *54.4m*	52,910 lbs – 75 ft *24 000 kg – 23m*	lbs *kg*	52,910 *24 000*	47,530 *21 560*	42,020 *19 060*	37,480 *17 000*	33,730 *15 300*	30,510 *13 840*	27,780 *12 600*	25,400 *11 520*	23,325 *10 580*	21,495 *9 750*	19,840 *9 000*	18,365 *8 330*	17,040 *7 730*	16,095 *7 300*		
164 ft *50m*	162 ft *49.4m*	52,910 lbs – 80 ft *24 000 kg – 24.3m*	lbs *kg*	52,910 *24 000*	51,060 *23 160*	45,280 *20 540*	40,500 *18 370*	36,550 *16 580*	33,200 *15 060*	30,335 *13 760*	27,820 *12 620*	25,640 *11 630*	23,680 *10 740*	21,935 *9 950*	20,725 *9 400*				
148 ft *45m*	146 ft *44.4m*	52,910 lbs – 84 ft *24 000 kg – 25.5m*	lbs *kg*	52,910 *24 000*	52,910 *24 000*	48,125 *21 830*	43,055 *19 530*	38,870 *17 630*	35,295 *16 010*	32,230 *14 620*	29,565 *13 410*	27,205 *12 340*	25,575 *11 600*						
131 ft *40m*	129 ft *39.4m*	52,910 lbs – 86 ft *24 000 kg – 26.1m*	lbs *kg*	52,910 *24 000*	52,910 *24 000*	49,580 *22 490*	44,400 *20 140*	40,100 *18 190*	36,420 *16 520*	33,270 *15 090*	31,085 *14 100*								
115 ft *35m*	113 ft *34.4m*	52,910 lbs – 88 ft *24 000 kg – 26.7m*	lbs *kg*	52,910 *24 000*	52,910 *24 000*	50,990 *23 130*	45,660 *20 710*	41,160 *18 670*	38,140 *17 300*										
98 ft *30m*	97 ft *29.4m*	52,910 lbs – 89 ft *24 000 kg – 27.2m*	lbs *kg*	52,910 *24 000*	52,910 *24 000*	51,985 *23 580*	48,060 *21 800*												

*Minimum hook reach.



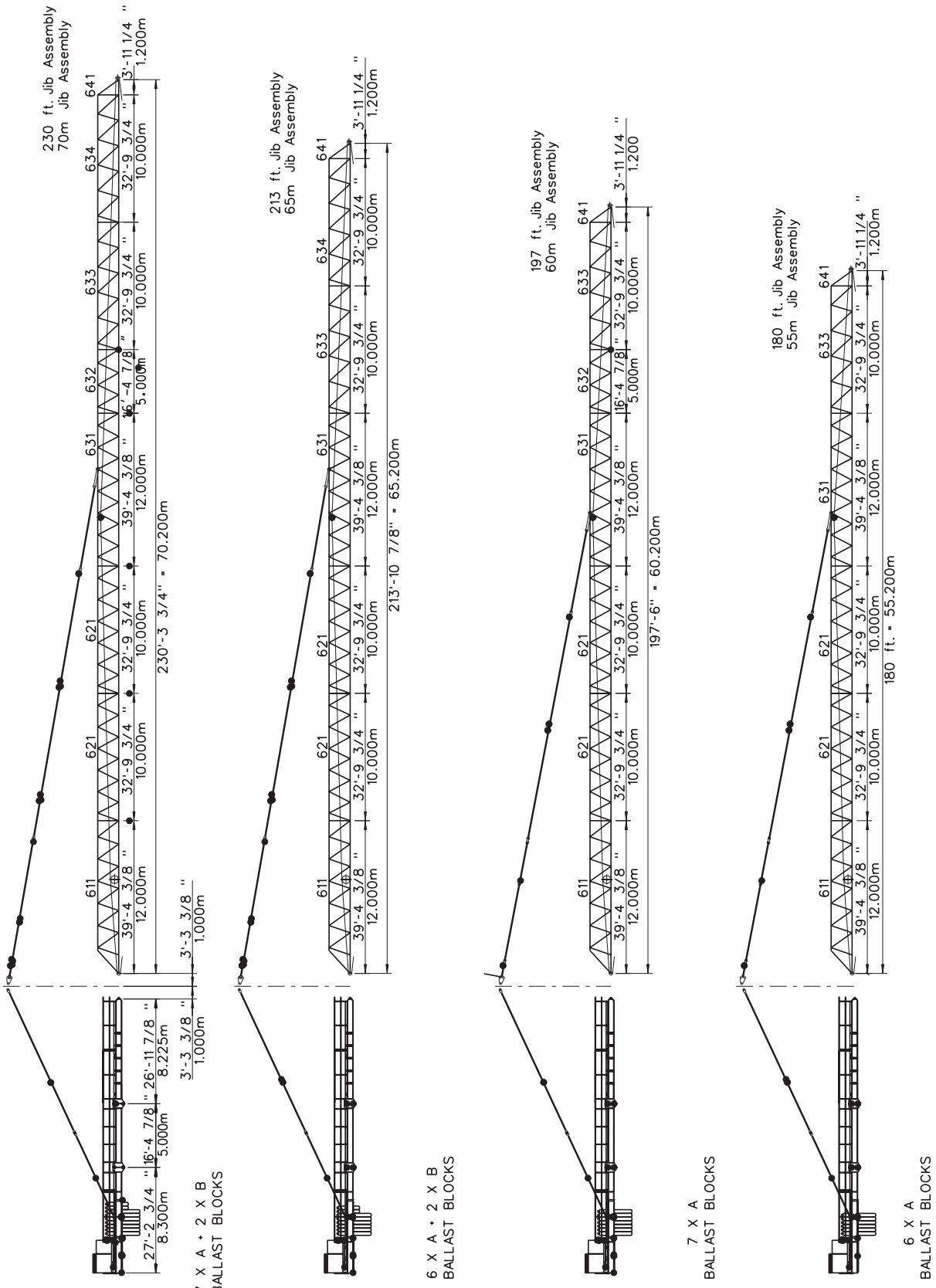
2-PART OPERATION



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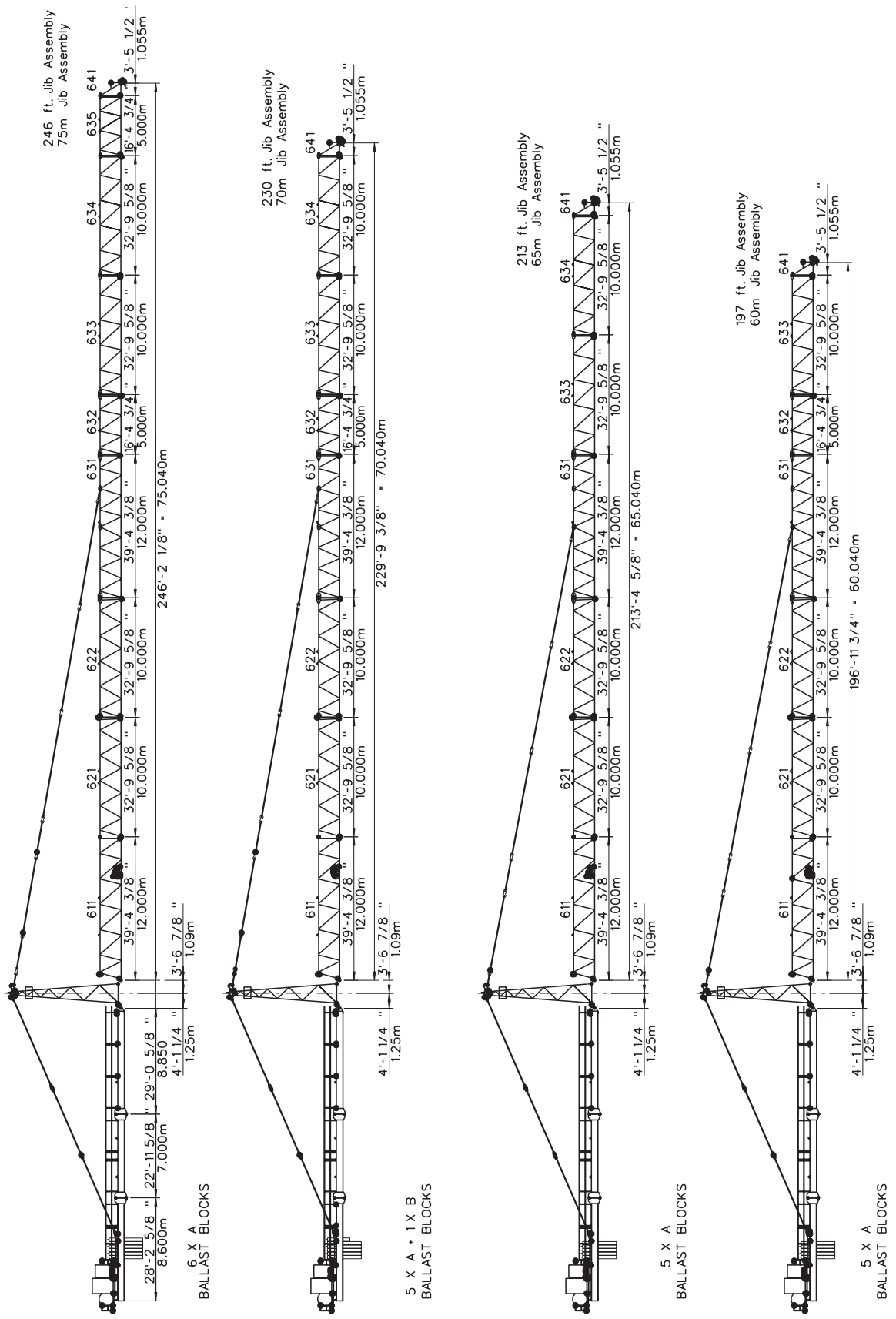
Jib and Counterjib Configurations
Crane A



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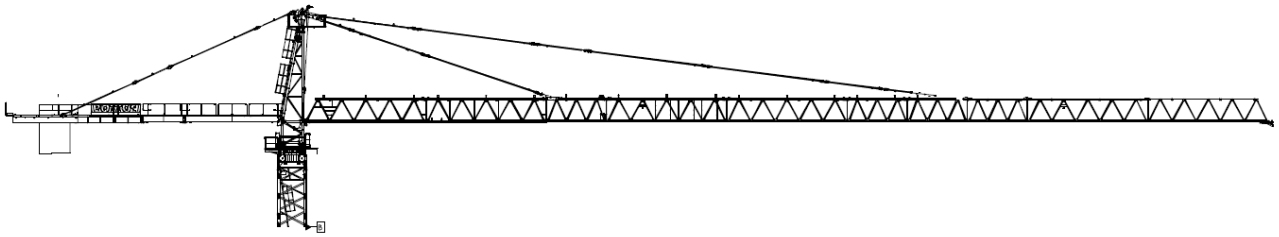
Jib and Counterjib Configurations
Crane B

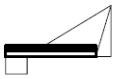


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Counterweight Arrangement A



LENGTH		BLOCK (kg)			COUNTERWEIGHT FOR CRANE WORK AND TELESCOPING
		 CBD 4000	 CBC 6000		 ± 2%
80m	24 m	0	5		30000
75m	24 m	1	4		28000
70m	24 m	1	4		28000
65m	24 m	2	3		26000
60m	24 m	1	3		22000
55m	24 m	2	2		20000
50m	20.50 m	2	3		26000
45m	20.50 m	1	3		22000
40m	20.50 m	2	2		20000
35m	20.50 m	1	2		16000

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Counterweight Arrangement B

max. radius / jib length (m)	Counter-jib (End section C 053.001 – 711.211 9394 298 01)	Load moment curves LM 1 and PLUS LM2 (Exception see *)) WiW 280 VZ 402 – 2 speed FU **) – 65 kW WiW 300 VZ 401 – 3 speed FU **) – 110 kW													
81.5 / 82.3	four-part 25.735 m (two intermediate sections)	6xC + 1xA +	beneath frame	1xD = 29.04 t ➔	D	C	C	C	C	C	C	A			
71.5 / 72.3		5xC + 1xA +		1xD = 25.08 t ➔	D	C	C	C	C	C	A				
61.5 / 62.3		4xC + 1xA +		1xD = 21.12 t ➔	D	C	C	C	C	A					
51.5 / 52.3	three-part 20.735 m (one intermediate section)	5xC + 2xA +		1xD = 27.96 t ➔	D	C	C	C	C	C	A	A			
41.5 / 42.3 !)		4xC + 2xA +		1xD = 24.00 t ➔	D	C	C	C	C	A	A				
35.9 / 36.7 !*)		4xC +		1xD = 18.24 t ➔	D	C	C	C	C						
29.8 / 30.6 !*)	two-part 15.735 m (without intermediate section)	5xC +		1xD = 22.20 t ➔	D	C	C	C	C	C					
24.3 / 25.1 !*)		3xC + 1xA +		1xD = 17.16 t ➔	D	C	C	C	A						

*) – Special jib ➔ only load moment curve LM 1.

!) – Install wind sail, see chapter 3.

***) – Frequency converter.

☞ **D** = Place **one "D" - block** (**2.4 t**) beneath the hoist unit frame before installing the counterjib (see illustration) !

The counterweight blocks must be installed across the opening, starting at the rear or farthest point from the crane tower !

The correct weight of the blocks must be maintained !

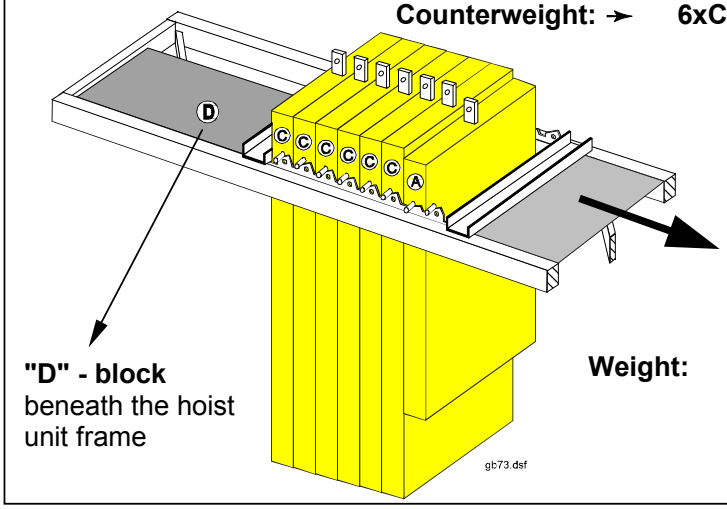
➔ The weight of the blocks must be verified when they are manufactured.

Counterweight block dimensions are for a specific gravity of 2.4 t/m³.

Recommendation ➔ Weigh the blocks again before installing.

Example: Layout of counterweight blocks for **82.3 m** jib length with a **max.** radius of **81.5 m**

Counterweight: ➔ **6xC + 1xA + 1xD = 29.04 t**



Towards the tower

"D" - block beneath the hoist unit frame

Weight: block **A** = **2 880 kg**
block **C** = **3 960 kg**
block **D** = **2 400 kg**

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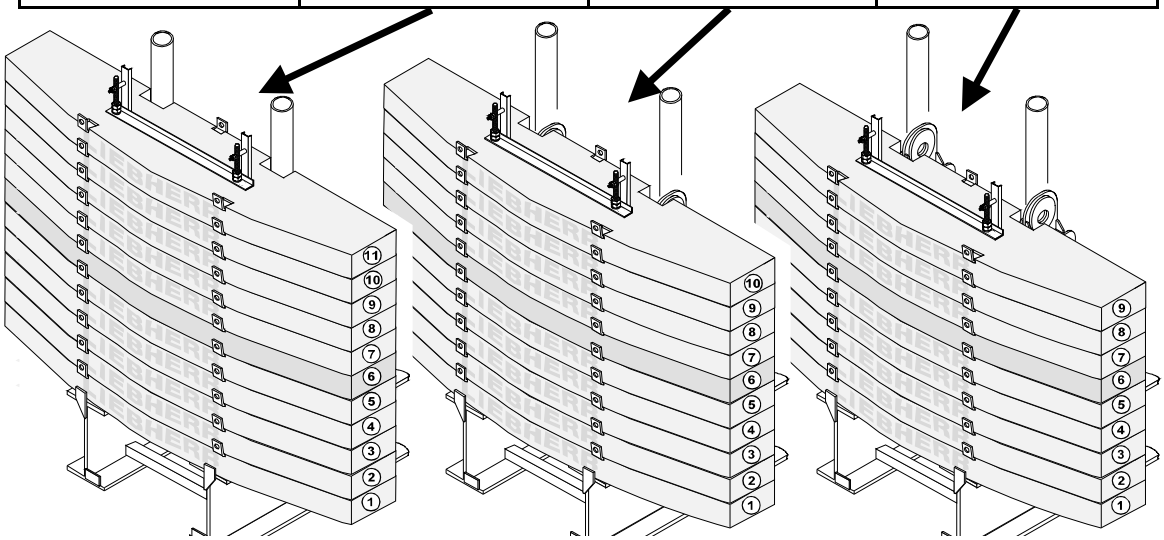
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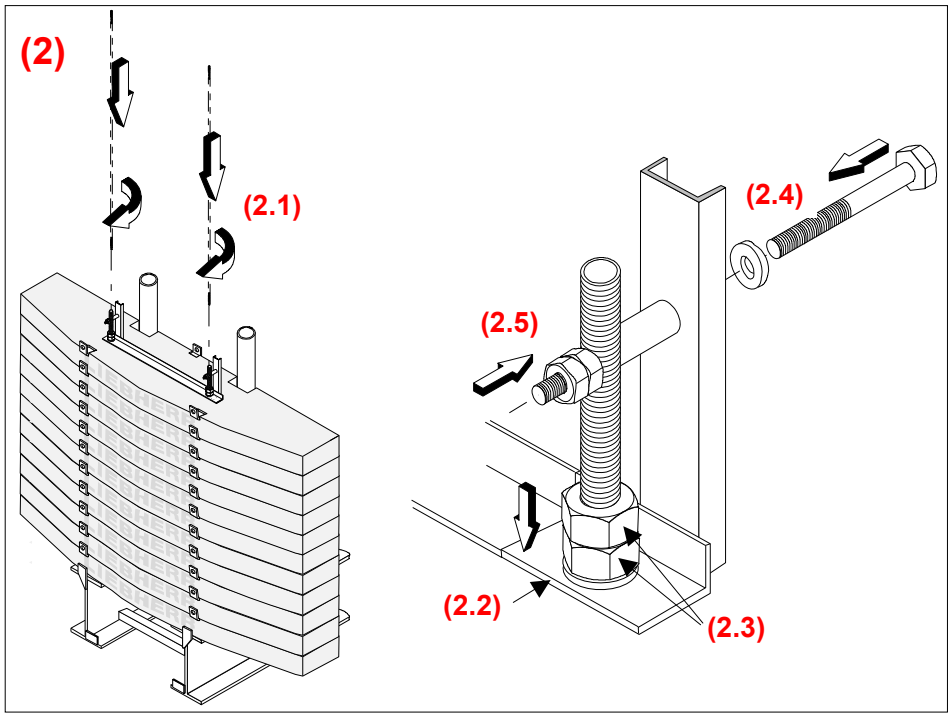
Counterweight Arrangement C

Installing the counterweight (steel counterweight)

6 counterweight blocks have been placed onto the gear platform and secured before installing the boom!

Number of counterweight blocks:			
for boom length:	**50, 55, 60 and 65 m**	**40 and 45 m**	**30 and 35 m**
Number of blocks:	**11**	**10**	**9**
Total weight:	54 t	49 t	44 t

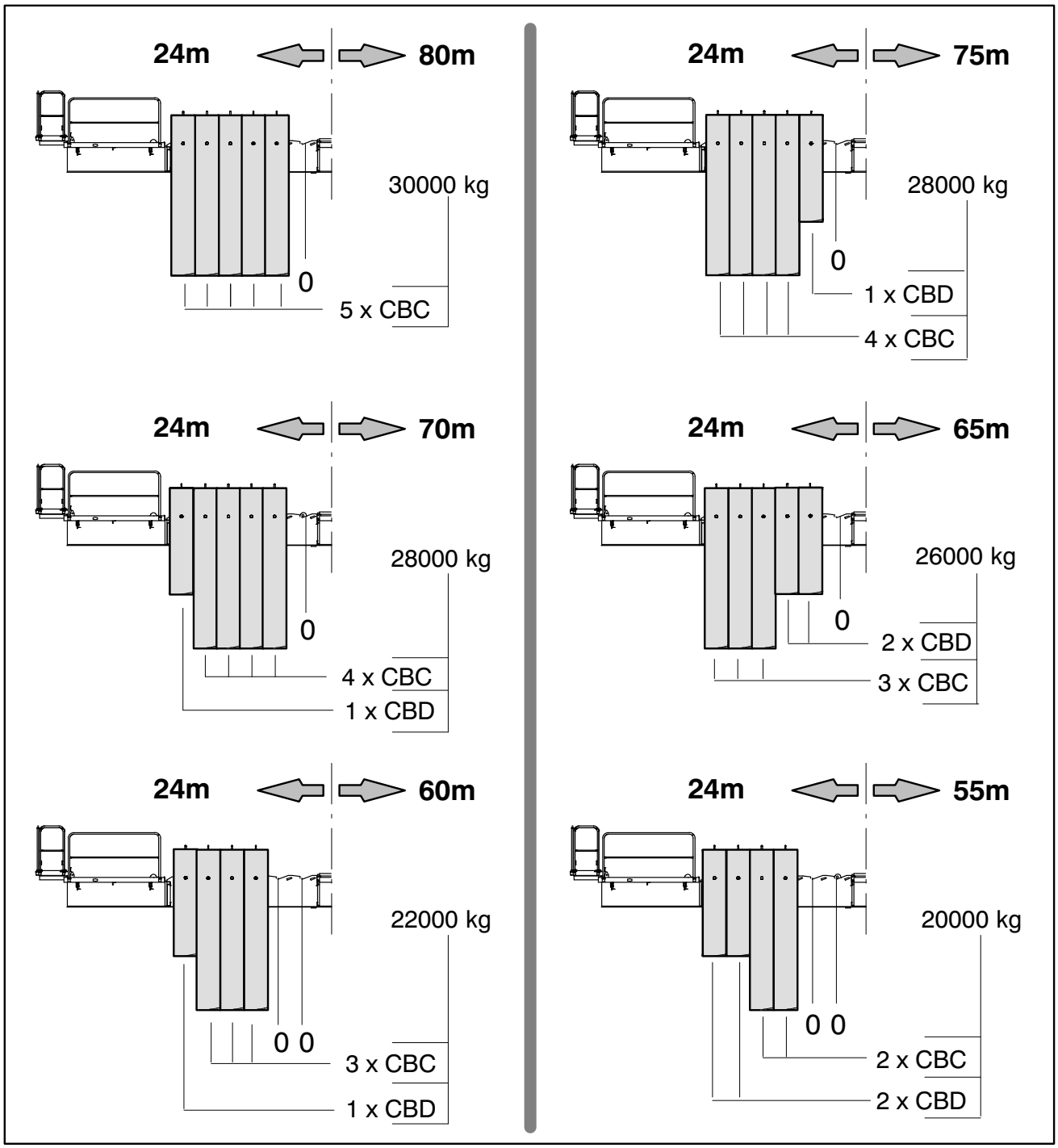




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Counterweight Arrangement D



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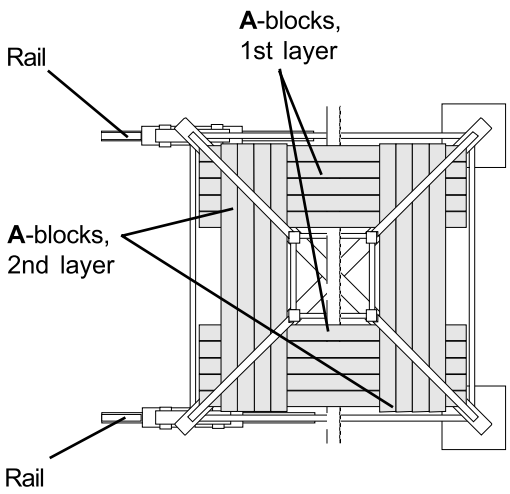
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Central Ballast Sheet A

Weight: A-block 5.4 t

Central ballast	Number of ballast blocks
10.80 t	2 x A
21.60 t	4 x A
32.40 t	6 x A
43.20 t	8 x A
54.00 t	10 x A
64.80 t	12 x A
75.60 t	14 x A
86.40 t	16 x A
97.20 t	18 x A
108.00 t	20 x A
118.8 t	22 x A
129.6 t	24 x A

Example



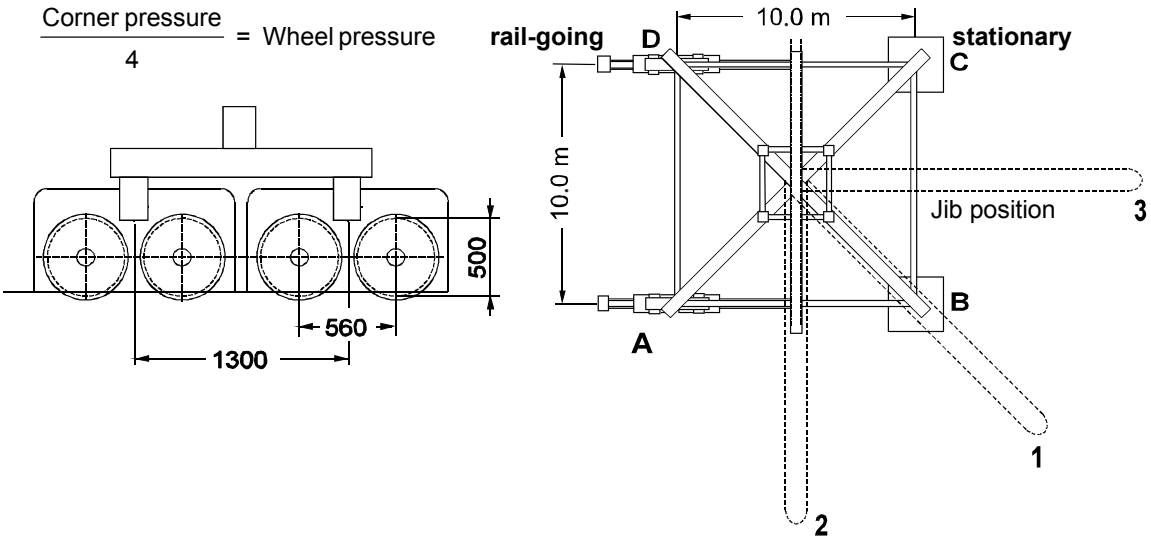
The central ballast blocks must be installed in the prescribed order (refer to the illustration).

Abstain from any operation which could impair the stability of the crane

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Central Ballast Sheet B



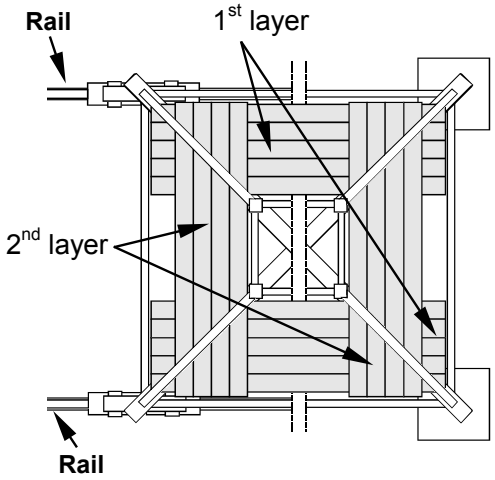
Arrangement of the central ballast blocks:

- **The amount of ballast required varies according to tower height and jib length. Refer to the corner pressure tables for the specific tower height and jib length to be installed.**
- **The central ballast blocks must be distributed equally around the tower base.**

Weight: A - block = 5.4 t

Central ballast	Number of ballast blocks
10.80 t	2 x A
21.60 t	4 x A
32.40 t	6 x A
43.20 t	8 x A
54.00 t	10 x A
64.80 t	12 x A
75.60 t	14 x A
86.40 t	16 x A
97.20 t	18 x A
108.00 t	20 x A
118.80 t	22 x A

Example



The central ballast blocks must be installed in the prescribed order (refer to the illustration).

Abstain from any operation which could impair the stability of the crane!

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Central Ballast Sheet C

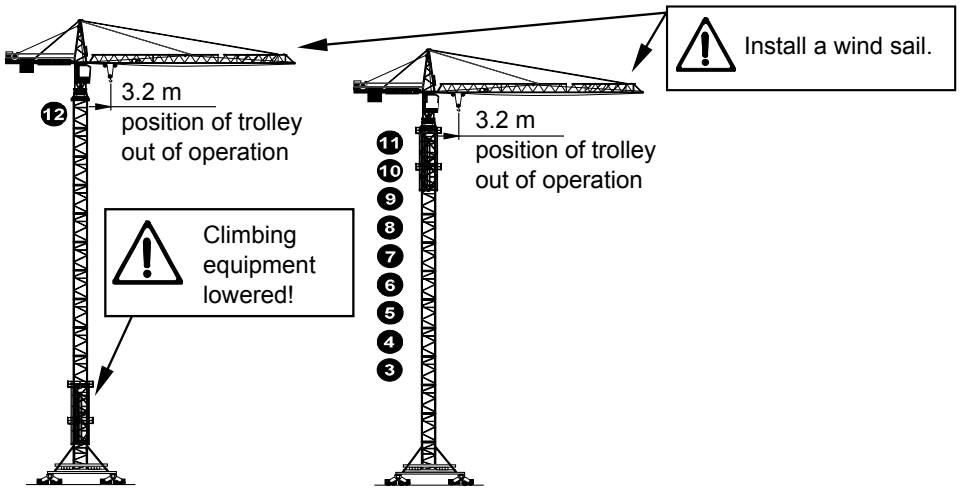
Crane rail-going and stationary on anchor shoes, **with climbing equipment**

Radius: **35.93m** Track: **10.0m**

Tower section: **5.80m** Wheel gauge: **10.0m**

No. of tower sections	Hook height [m]	Central ballast [to]	Corner pressure in operation [kN], MD=372 kNm					Corner pressure out of operation [kN], MD=0				
				Position of jib			Hor. force		Position of jib			Hor. force
			Corner	1	2	3	[kN]	Corner	1	2	3	[kN]
3	28.10	21.600	A	413	664	126	76	A	362	329	394	140
			B	**821**	737	700		B	324	329	329	
			C	413	163	700		C	362	394	329	
			D	5	90	126		D	**399**	394	394	
4	33.90	21.600	A	429	686	128	80	A	374	404	344	160
			B	**859**	775	731		B	**429**	404	404	
			C	429	172	731		C	374	344	404	
			D	0	83	128		D	318	344	344	
5	39.70	21.600	A	437	709	128	83	A	390	468	311	175
			B	**905**	815	762		B	**518**	468	468	
			C	437	181	762		C	390	311	468	
			D	0	75	128		D	261	311	311	
6	45.50	32.400	A	499	760	154	87	A	433	564	301	190
			B	**954**	883	821		B	**641**	564	564	
			C	499	216	821		C	433	301	564	
			D	0	93	154		D	224	301	301	
7	51.30	43.200	A	531	810	180	90	A	475	664	287	204
			B	**1034**	953	882		B	**770**	664	664	
			C	531	251	882		C	475	287	664	
			D	28	108	180		D	181	287	287	
8	57.10	54.000	A	574	861	204	93	A	518	768	269	219
			B	**1104**	1025	943		B	**906**	768	768	
			C	574	286	943		C	518	269	768	
			D	43	122	204		D	131	269	269	
9	62.90	64.800	A	617	913	228	97	A	561	876	246	234
			B	**1176**	1098	1005		B	**1049**	876	876	
			C	617	320	1005		C	561	246	876	
			D	57	135	228		D	74	246	246	
10	68.70	86.400	A	682	992	278	100	A	631	1016	247	249
			B	**1281**	1199	1095		B	**1225**	1016	1016	
			C	691	381	1095		C	631	247	1016	
			D	92	174	278		D	37	247	247	
11	74.50	97.200	A	723	1045	299	103	A	641	1133	215	264
			B	**1359**	1274	1160		B	**1414**	1133	1133	
			C	736	413	1160		C	641	215	1133	
			D	100	184	299		D	0	215	215	
* 12	80.30	97.200	A	741	1065	305	107	A	648	1166	214	273
			B	**1386**	1306	1185		B	**1464**	1166	1166	
			C	750	426	1185		C	648	214	1166	
			D	105	185	305		D	0	214	214	

* In this configuration the climbing equipment has to be lowered after erection!



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TOWER CRANE MAINTENANCE LOG

Model: **Manufacturer/Model**

Serial Nr: **Serial No.**

Notice

This maintenance log is for the purpose of indicating items which require maintenance, with recommended intervals, and for recording maintenance done.
For specific information on any item, refer to the equipment manufacturers operation manual.

WARNING

Specified maintenance and lubrication must be carried out at the recommended intervals in order to ensure that the equip-ment remains in a safe and serviceable condition at all times.

FAILURE TO CARRY OUT THE INSTRUCTIONS HEREIN WILL VOID ALL WARRANTIES AND COULD LEAD TO AN ACCIDENT RESULTING IN PROPERTY DAMAGE, SERIOUS INJURY OR LOSS OF LIFE.

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Maintenance and lubrication record

for Hammerhead type tower cranes

Crane Model: Serial Number: for the month of , 20

Int.	No.	Item	Key	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Daily	6	Limit switches	I																															
	11	Bolt and pin connection	I																															
	15	Wire ropes	I																															
			I																															
Weekly	8	Slewing ring gear teeth	L																															
	9	Crane travel wheels	L																															
	12	Brake and hydraulic fluid levels	I																															
	14	Gearbox oil levels	I																															
	16	Overload units	I/L																															
			I																															
Bi-weekly	1	Hook block and sheaves	I/L																															
	3	Pillow blocks	L																															
	4	Trolley wheels																																
	5	Slewing brake																																
	10	limit switch draives and switches	I																															
	15	Wire ropes	L																															
			L																															
Monthly	2	Slewing ring ball races	L																															
	7	Slipring unit	I/L																															
	17	Wheel bogies	L																															
	18	Cable drum and cable guide	L																															
	19	Hoist, travel and trolley brakes	I/L																															
	20	Fluid couplings	I																															
	21	Carbon brushes (motor and slipring)	I																															
	22	Control Panel and electrical cables	I																															
	23	Counterweights	I																															
		Telescopic current supply bars	I																															
Daily hours of operation																																		

Note! Refer to the lubrication chart and operation manual for information on specific items. Operator: _____ Date checked: _____ Technician: _____

Use reverse side for comments. Key: I = Inspect, L = Lubricate

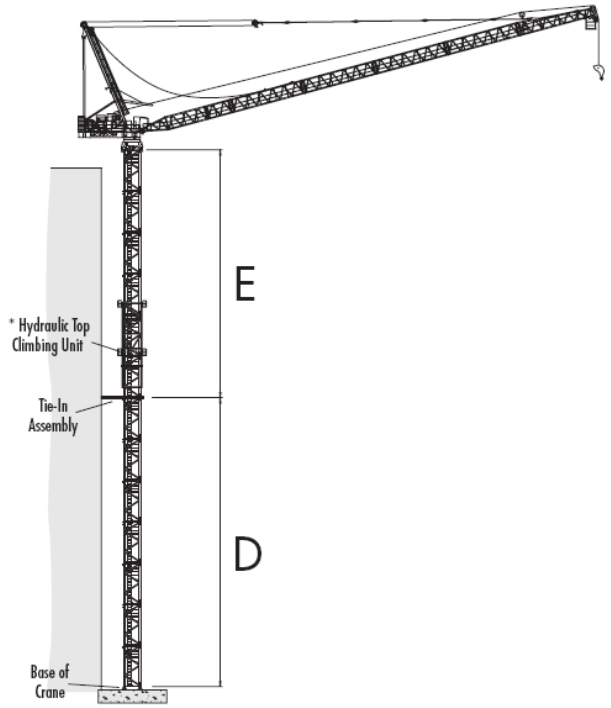
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Tie-in Spacing A

Tie-in configurations

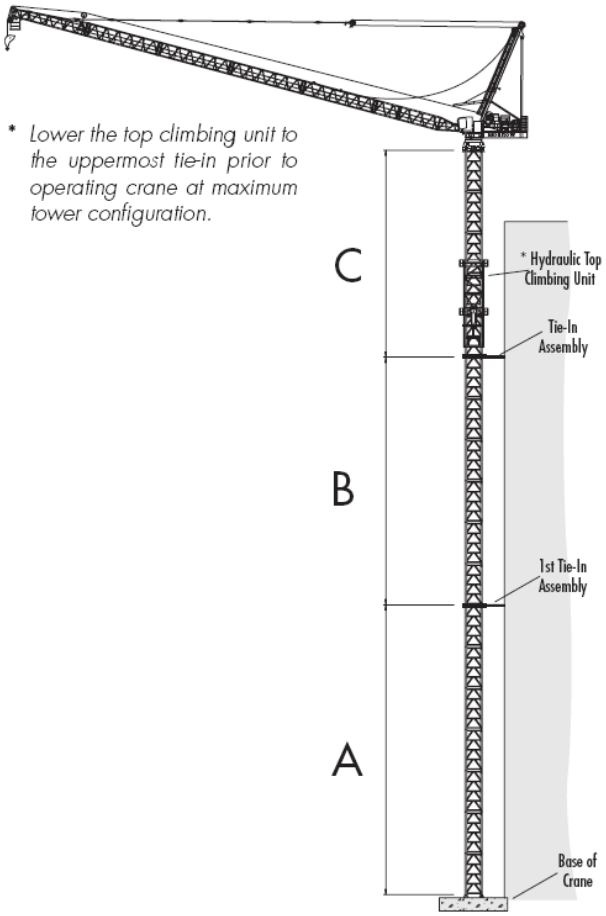
IMPORTANT! *Please consult crane operation manual before erecting, operating, climbing, servicing and dismantling.*



TOP CLIMBING

Tied to structure with 1 tie-in

* *Lower the top climbing unit to the uppermost tie-in prior to operating crane at maximum tower configuration.*



TOP CLIMBING

Tied to structure with 2 tie-ins

Tower sections required with 1 tie-in

Boom Length	213' — 180' *(65m – 55m)*	164' — 131' *(50m – 40m)*	115' — 98' *(35m – 30m)*
Above uppermost tie-in (E)	6 max – 3 min	7 max – 3 min	8 max – 3 min
Base to 1st tie-in assembly (D)	7 max – 4 min	8 max – 4 min	9 max – 4 min

Tower sections required with 2 or more tie-ins

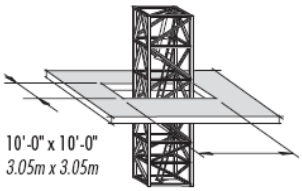
Boom Length	213' — 180' *(65m – 55m)*	164' — 131' *(50m – 40m)*	115' — 98' *(35m – 30m)*
Above uppermost tie-in (C)	5 max – 3 min	6 max – 3 min	7 max – 3 min
Between tie-in assemblies (B)	6 max – 4 min	7 max – 4 min	8 max – 4 min
Base to 1st tie-in assembly (A)	7 max – 4 min	8 max – 4 min	9 max – 4 min

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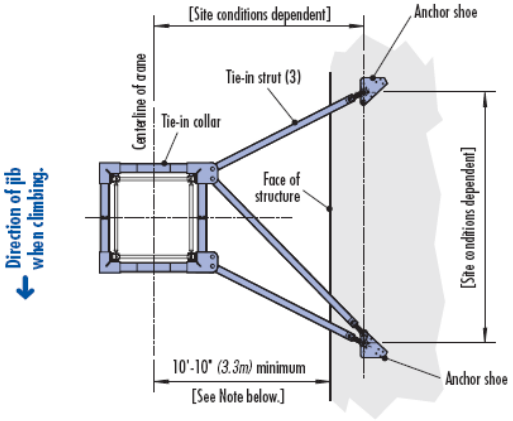
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Tie-in Spacing B

Tie-in Details



SLAB OPENING
Recommended
(TS 212/S 35)

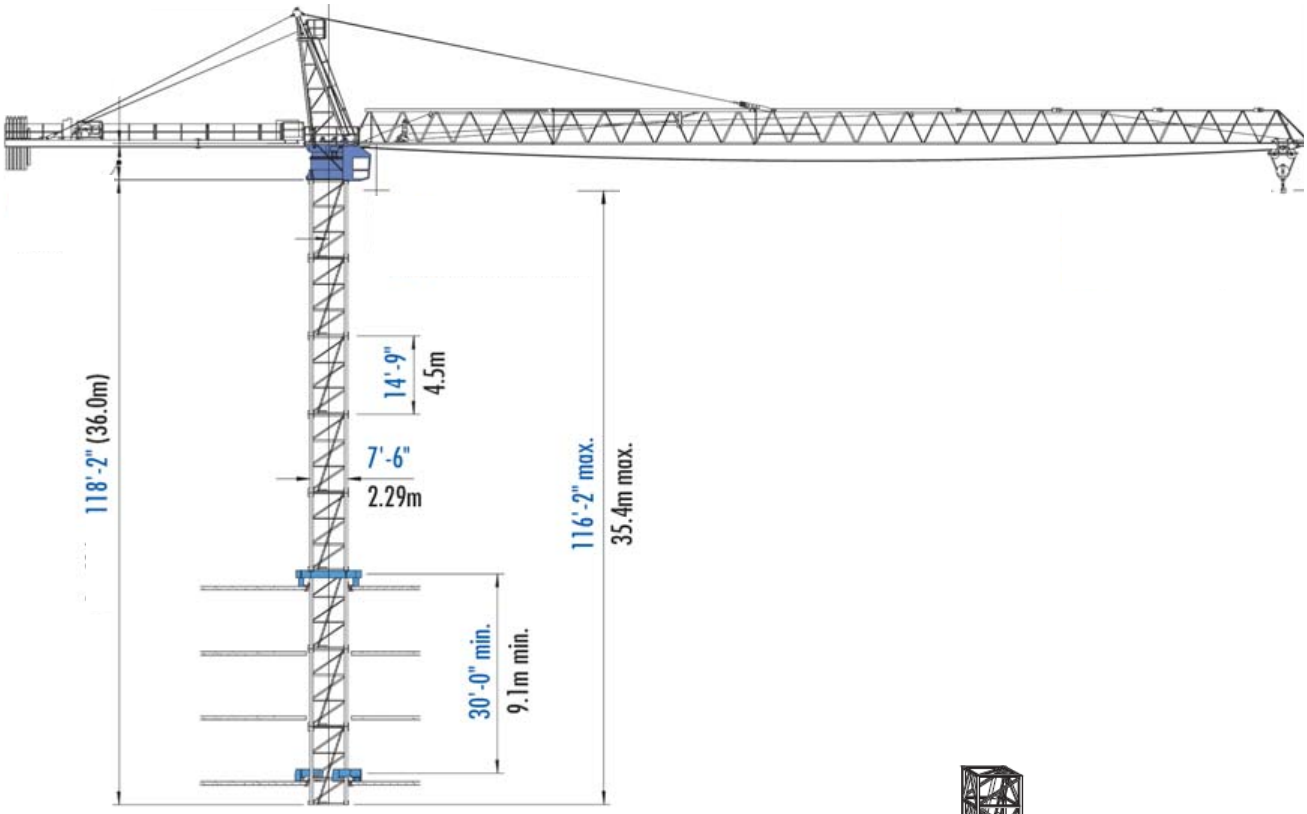


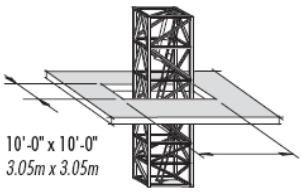
TIE-IN ASSEMBLY
with TS 212 (S 35) Tower
plan view

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Bottom Climbing





SLAB OPENING
Recommended
(TS 212/S 35)

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NCCCO TOWER CRANE REFERENCE MANUAL

Chapter 3: Crane Operations

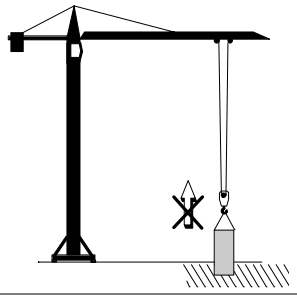
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Operating instructions

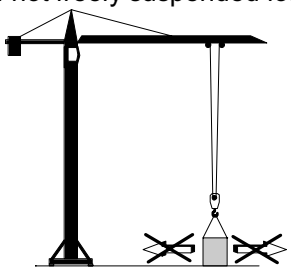
1 ***Avoid*** any operation that might be a risk to the ***stability*** of the crane!

as for example:

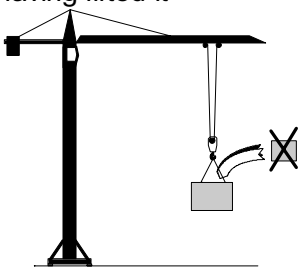
Pulling off fixed loads



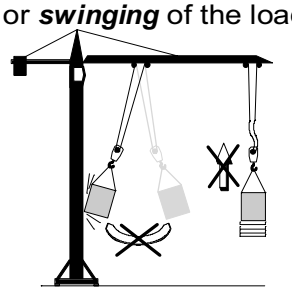
Horizontal displacement of not freely suspended loads



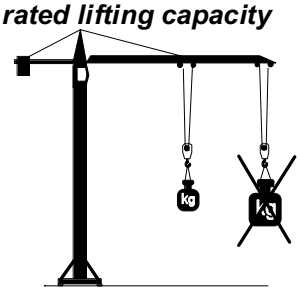
Increasing the load after having lifted it



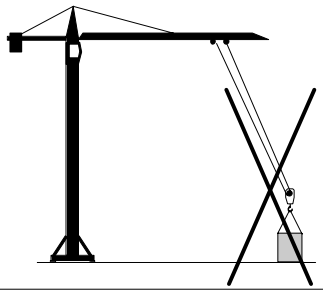
Pendulous movements or ***swinging*** of the load



Any ***loading beyond the rated lifting capacity***



Pulling loads at an angle



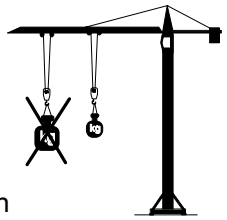
2 The crane should be operated only by ***reliable*** persons who are at least ***18 years old*** and who are ***familiar*** with the crane and have been instructed as to the possible ***accident risks*** involved.

3 No ***unauthorized*** persons are allowed to board the crane.

4 ***Do not submit the hoist gear to additional load !***

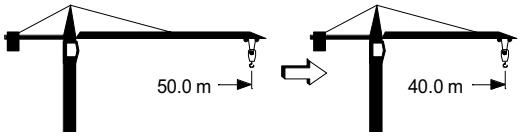
Perform gear shifting ***only*** with the hoist gear at a standstill.

5 The overload protection ***must not be used*** to switch off the hoist gear and trolley travel gear. ➔ ***must not be employed as a balance***



No loads exceeding the lifting capacity inspite of an installed overload protection

6 When changing the operating mode of the crane, reset the ***overload cut-outs*** to the ***new lifting capacity*** or ***load moment ranges.***



7 Safety devices (limit switches):

- ➔ ***do not bridge them !***
- ➔ ***do not change their setting !***

8 ***max. permissible in operation:***
45 mph (≅ wind force 8)

at 27 to 30 mph (≅ wind force 6) the max. wind speed in gusts could reach 45 mph.
➔ ***anemometer !***

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Operating instructions

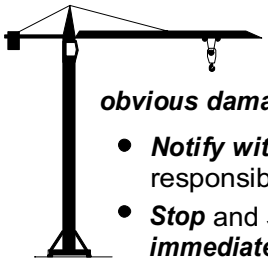
9 Operate the crane only if all ***protective*** and ***safety devices*** are in place and fully functional.

10 Before starting up the crane, make sure that nobody can be ***endangered.***

11 Before beginning work, make yourself familiar with the circumstances of the site.

- ***obstacles*** in the working and travelling area?
- required barriers separating the construction site from public roads?

12

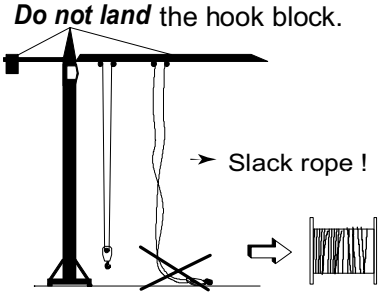


daily

obvious damage and ***defects:***

- ***Notify without delay*** the responsible person
- ***Stop*** and ***secure*** the crane ***immediately***

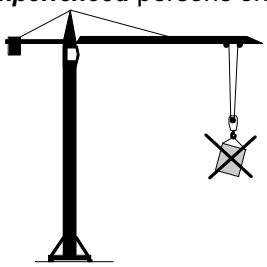
13 ***Do not land*** the hook block.



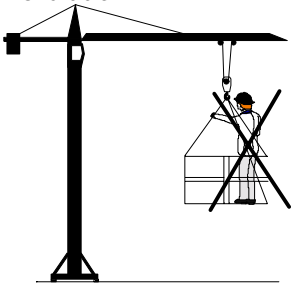
Slack rope !

14 During ***start-up*** and ***shut-down procedures*** always watch the ***indicators*** according to the instruction manual.

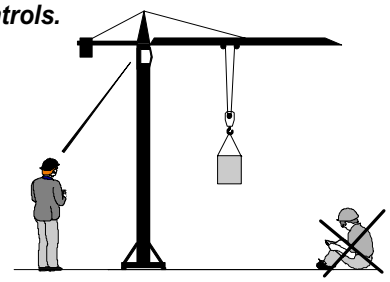
15 ***Slinging*** of loads should be entrusted to ***experienced*** persons only.



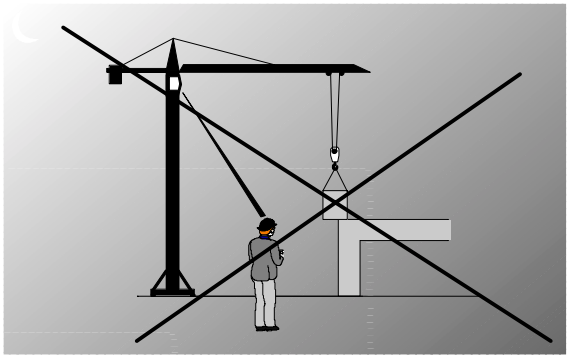
16 The ***carriage*** of persons with the load is ***forbidden.***



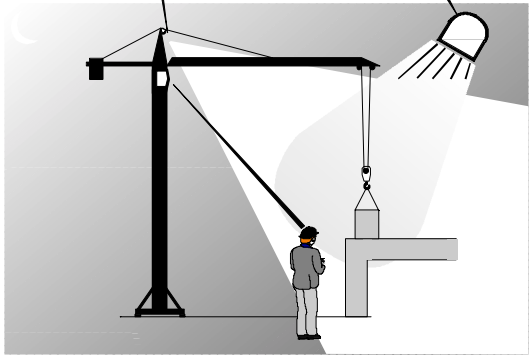
17 Whenever a load is suspended from the hook, the operator must ***remain at the controls.***



18 ***Bad visibility*** and ***darkness***

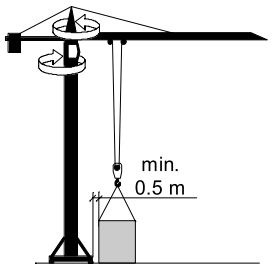


crane lamp or construction site lamp



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19 ***Maintain the safety distance:***



20 Keep the safety instructions and warnings attached to the crane always ***complete*** and ***perfectly legible.***

21 ***Uncontrolled movement***

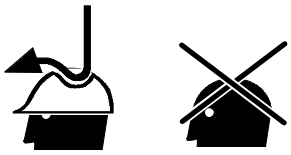
The response to uncontrolled movement is to engage the emergency stop button on the remote or contol desk. This will de-energize the crane and set all brakes.

22

- ***Protect*** tools and loose objects ***against falling down.***
- Keep all handles, steps, handrails, platforms, landings and ladders ***free from dirt, snow*** and ***ice.***

23 Special ***instructions*** given for the construction site ***must be observed.***

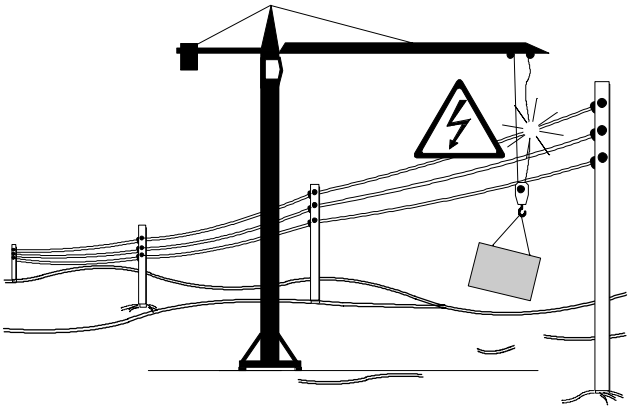
24  ***WARNING:*** Suspended loads



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25

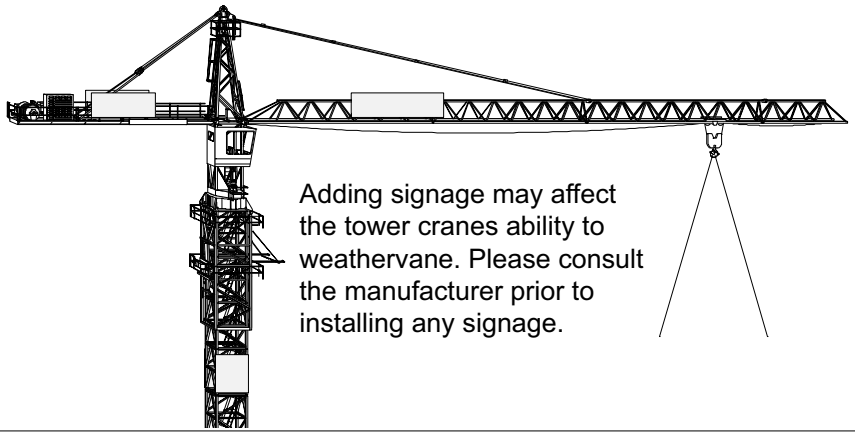
Maintain a safe distance from ***overhead electric lines.***



- Do not leave the tower crane.
- Do not touch the steel construction of the tower crane.
- If practicable, drive the crane out of the hazard zone.
- Warn others against approaching and touching the crane.
- Arrange to have the power switched off in the contacted / damaged line.
- Do not leave the tower crane until the contacted / damaged line has been safely de-energized.

26

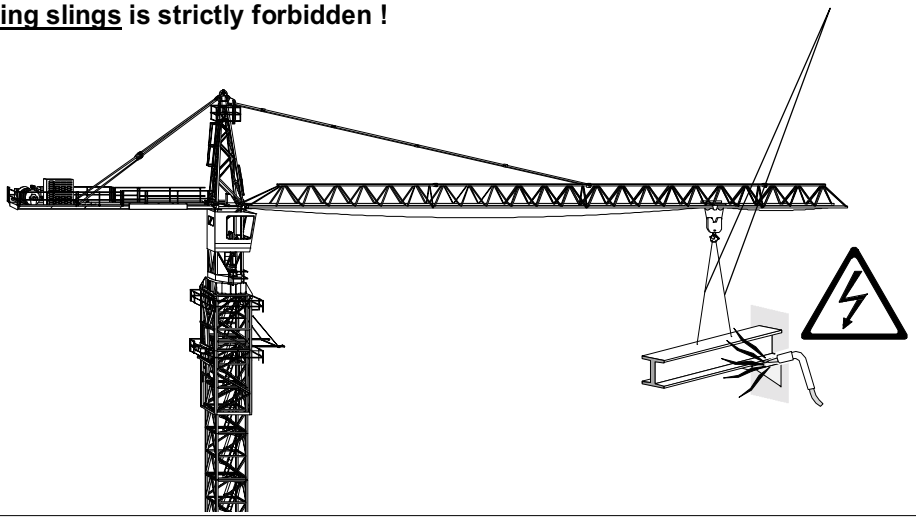
Do not make any changes, install or modify anything without permission from the manufacturer ! (e.g.: welding work on structural steelwork, putting up advertisement boards, or anchoring jibs)



Adding signage may affect the tower cranes ability to weathervane. Please consult the manufacturer prior to installing any signage.

27

Welding work on loads suspended from the hook without suitably <u>insulated lifting slings</u> is strictly forbidden !



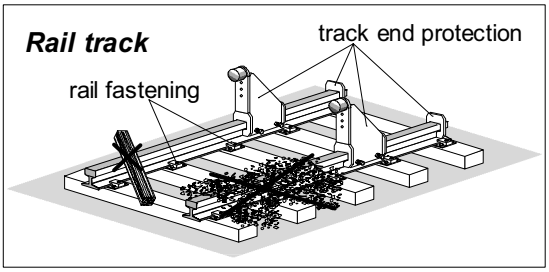
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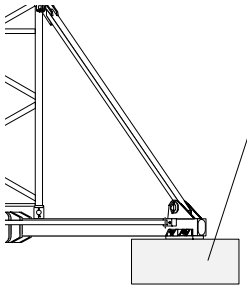
Daily Inspections

Switchgear cabinet

nominal voltage supplied?

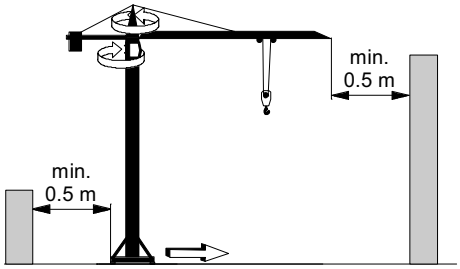
Rail track





Check the condition of foundation

Unobstructed freedom of movement in the ***travelling and slewing area?***



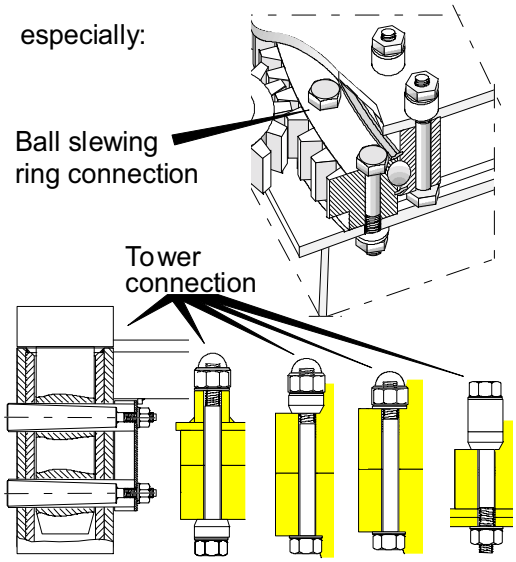
Check that all ***central ballast*** and ***counterballast blocks*** are in place and properly secured.

If the crane is equipped with a lightning protection, ensure correct ***earthing!***

Are all ***open gear wheels*** lubricated?

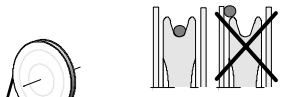
Tightness of all ***bolts*** and ***pins***

especially:



Ropes

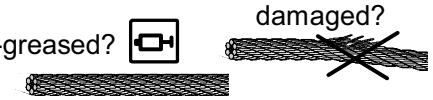
correctly reeved?



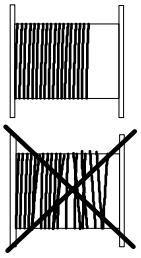
Ropes run correctly in the rope pulleys?

Rope pulley grooves
free from hardened grease?

well-greased?



Hoisting and trolley travel ropes must be ***wound evenly onto their drums.*** Check for ***correct spooling.***



Required maintenance work performed?

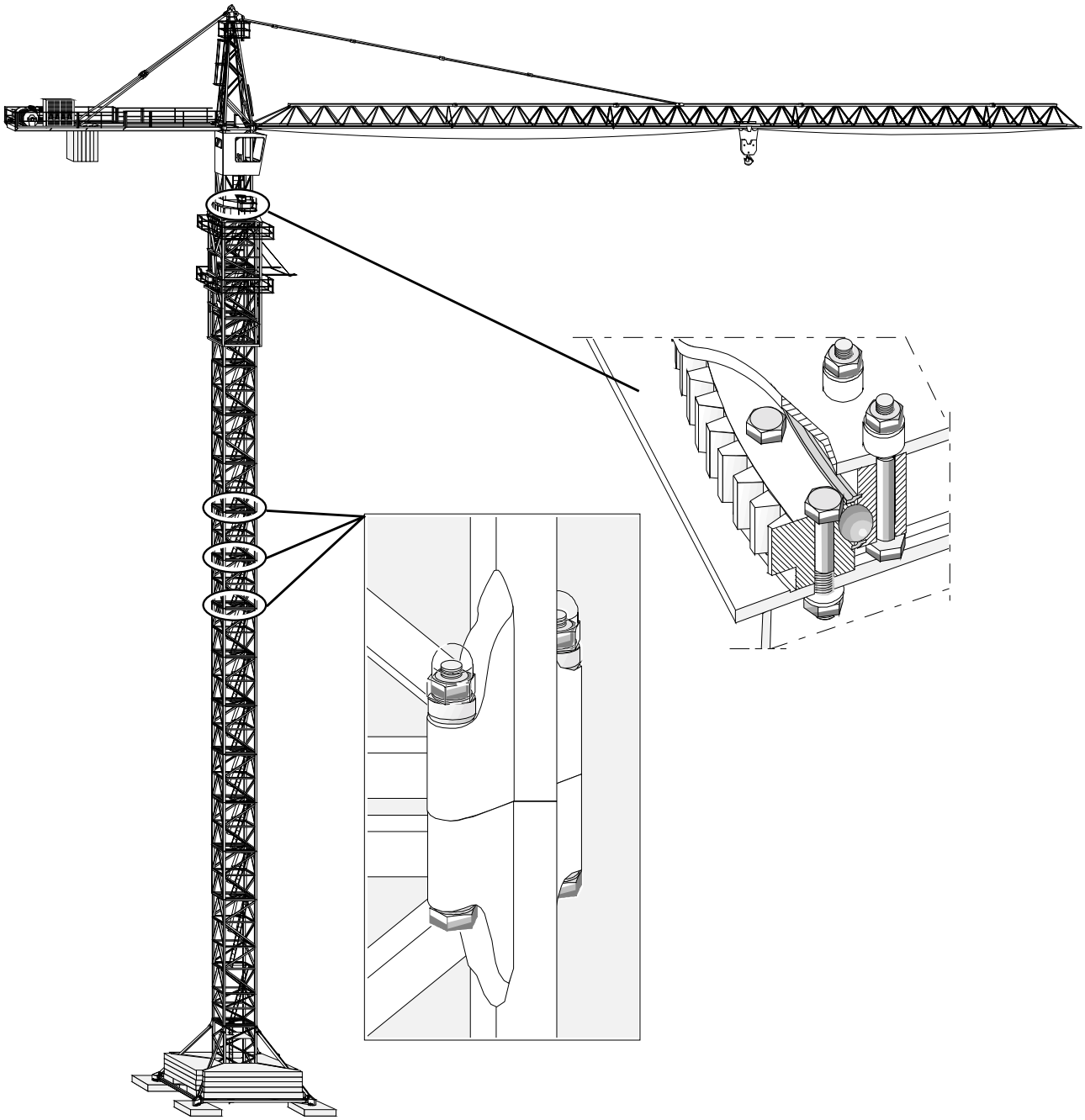
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Chapter 4: Bolting Procedures

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Prestressed High-Tensile Strength Bolt Connections



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1. General on high-tensile strength bolt connections

When correct, prestressed high-tensile bolts can transmit big (external) tensile forces in the direction of the bolt axis. The preload of the bolt is increased only slightly. This has a favourable effect on the fatigue strength especially in case of alternating loads.
For that reason it is of importance, that the high-tensile bolt connections are prestressed with the correct tightening torque!

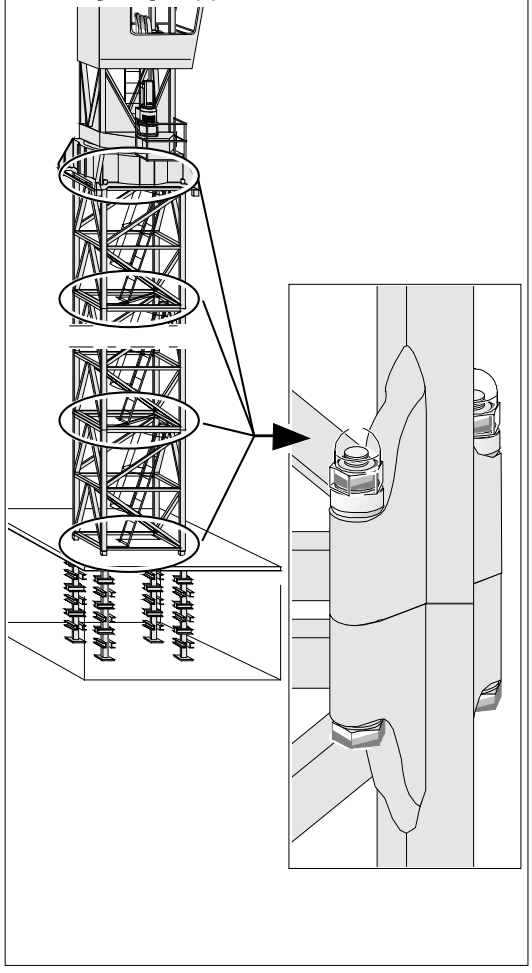
The condition of the high-tensile bolt connections is of great importance for the operational safety of a tower crane.

Task of high-tensile bolt connections:

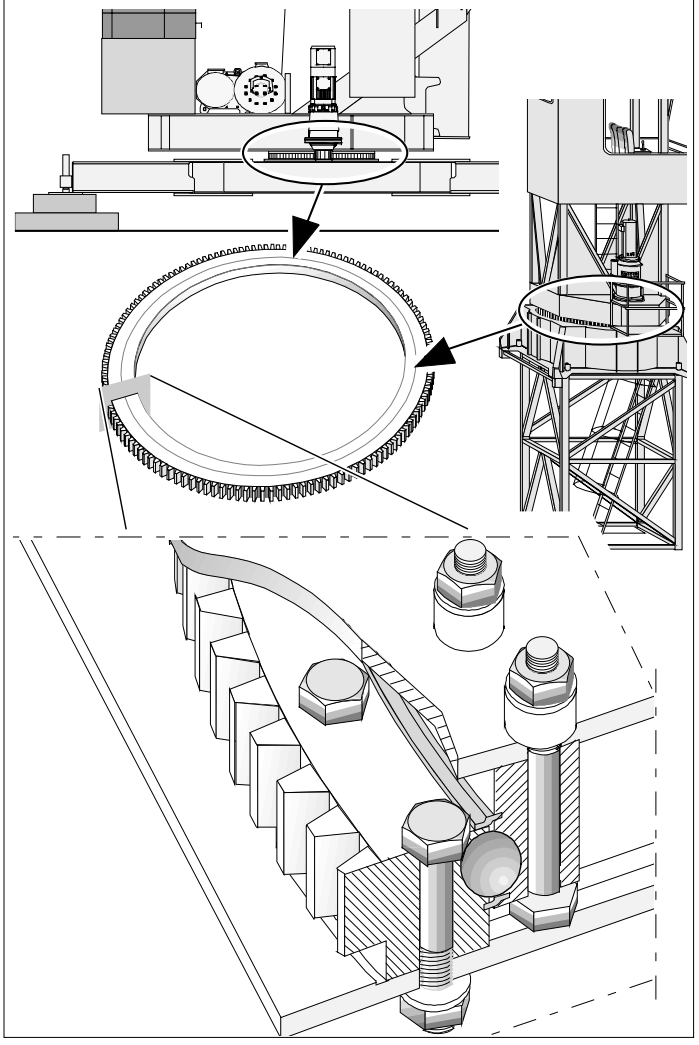
Connecting components and transmitting forces !

Essentially these are the following components:

Foundation anchors, tower sections, slewing ring support

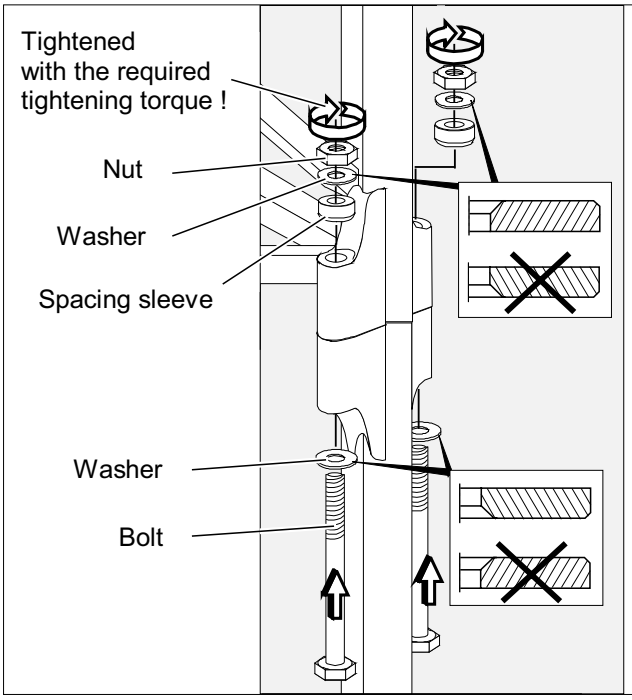


Slewing ring connection



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2. Explanation of term: What is a high-tensile strength bolt connection?



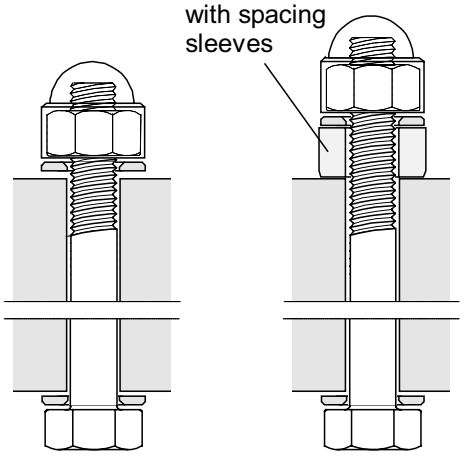
A high-tensile bolt connection is a connection consisting of bolts, nuts, washers and possibly spacing sleeves.

- **All components are manufactured from high-strength materials**, only components with the same strength rating shall be used (marking see clause 4.1).
  Example: Bolt 10.9 with nut 10
  - or - bolt 12.9 with nut 12

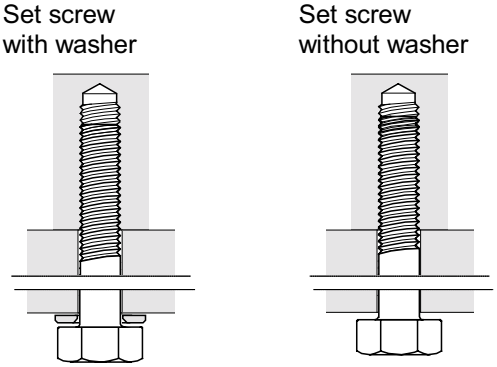
- **It shall be tightened with the required tightening torque to achieve the correct preload !**

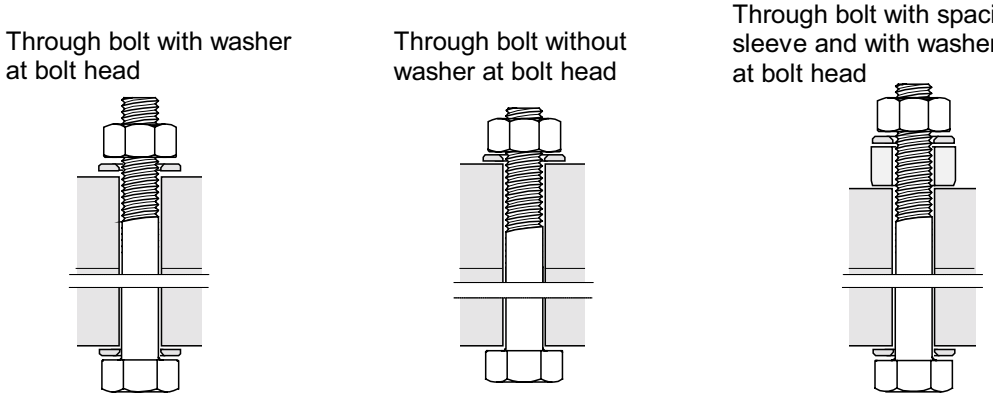
3. Different kinds of high-tensile strength bolt connections

Connection of tower sections:



Slewing ring connection:
decisive are the specifications in the instruction manual !





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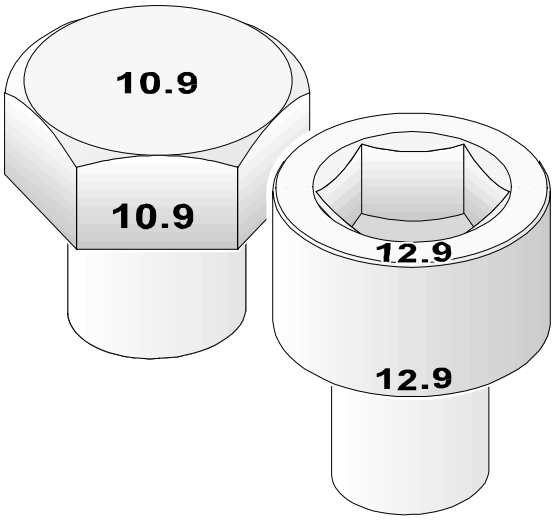
4. Components and marking of a high-tensile strength bolt connection

4.1 Marking

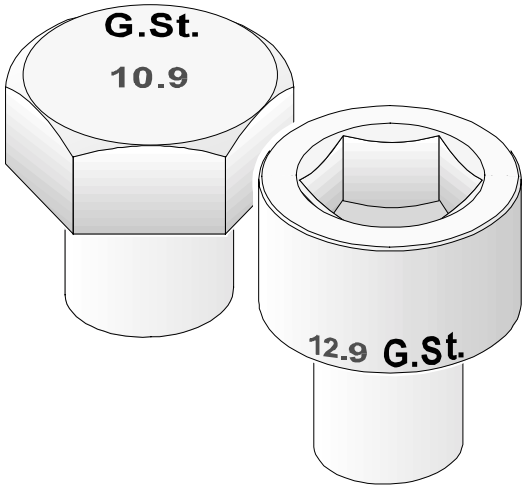
All components are specifically marked. The grade and marking requirements result from national and international standards.

4.2 High-tensile bolts

High-tensile strength bolts shall be identified according to international standard ISO 898-1. The strength rating, e.g., 10.9 or 12.9 is marked on the bolt head.



In addition, bolts shall be marked with the bolt manufacturer's designation. This designation generally appears near the strength rating identification.

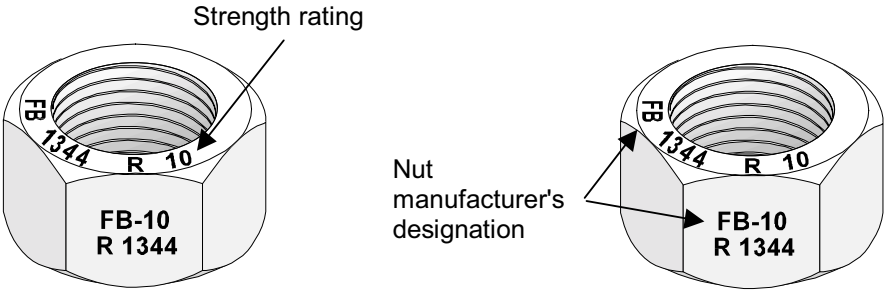


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4.3 High-tensile strength nuts

High-tensile strength nuts shall be identified according to international standard ISO 898-2. The strength rating, e.g., 10 or 12 is inset on the contact face or one of the flat faces.

In addition, nuts shall be marked with the nut manufacturer's designation. This designation generally appears near the strength rating identification.
ISO 898-2 also states that symbols can be used to identify the strength ratings. However, a description of the diverse symbols which can be used is beyond the scope of this description.



For high-tensile strength bolt connections only nuts with strength ratings 10 or 12 shall be used! AND always make sure that irs strength rating matches that of the bolt!

Example: Nut 10 and bolt 10.9
Nut 12 and bolt 12.9

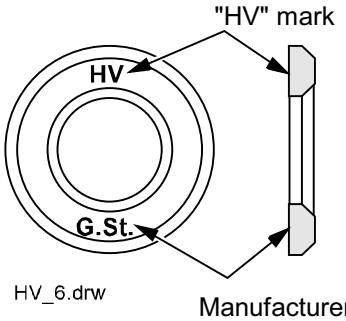
4.4 High-tensile strength washers

Since there is not yet an ISO standard for washers, washers manufactured in Germany for use on high-tensile bolt connections are marked "HV".

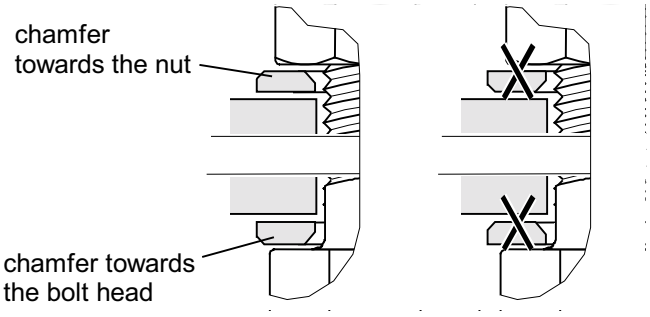
For high-tensile strength bolt connections only washers with "HV" marking shall be used AND always make sure that its execution matches that of the bolt and the nut!

Example: Washer galvanized with bolt 10.9 and nut 10
Washer blackened and oiled with bolt 12.9 and nut 12

on underside:



Observe the correct fitting !

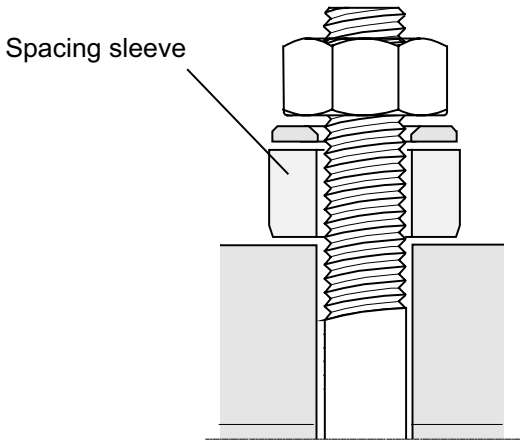


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4.5 Spacing sleeves

Spacing sleeves are required on some high-tensile bolt connections because of design specifications.

Spacing sleeves shall be installed according to the instructions given in the instruction manual.



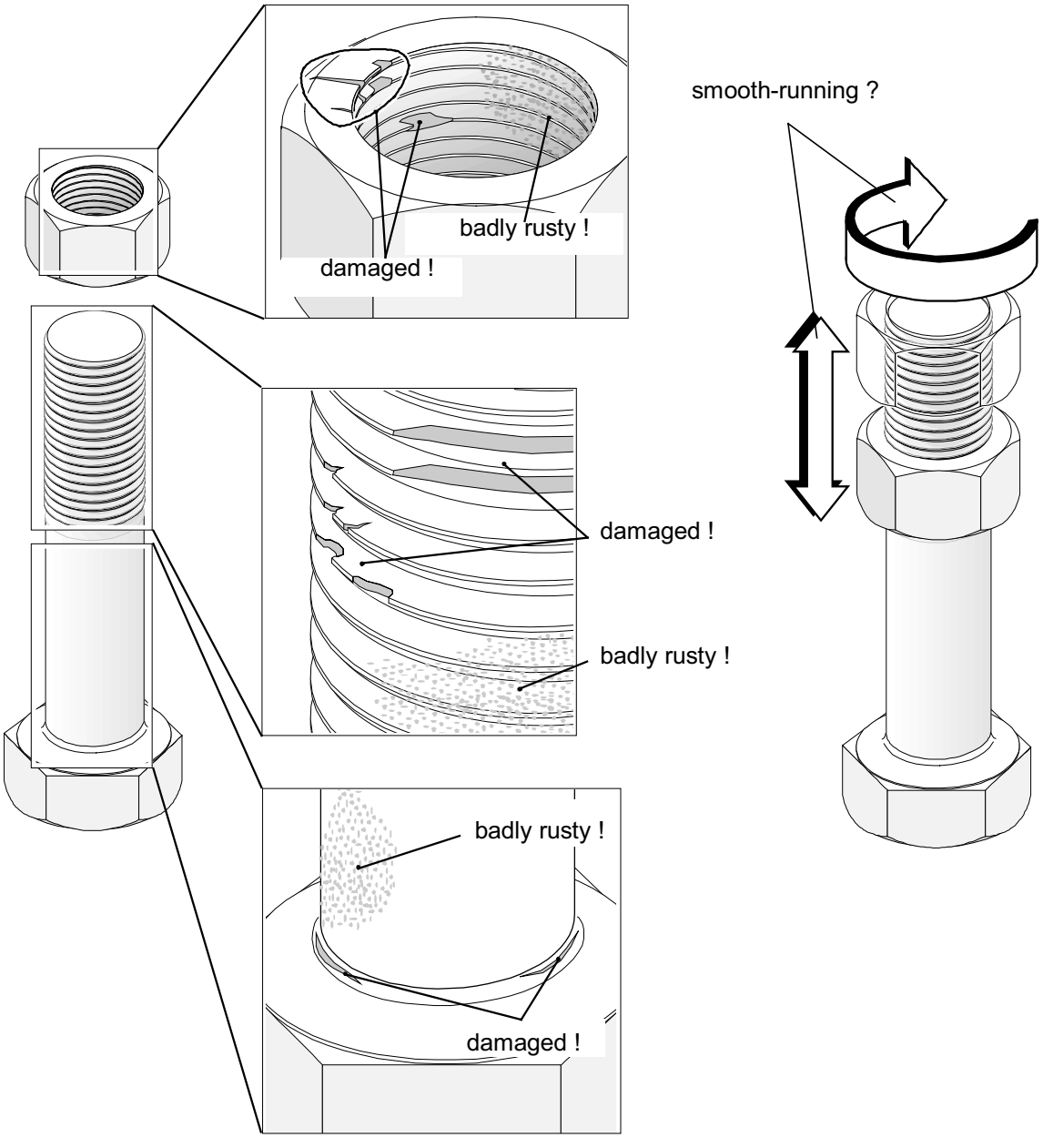
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5. Inspecting high-tensile strength bolt connection components before installation

5.1 Condition of components

Before installation, high-tensile bolt connection components shall be cleaned and visually examined for damage and corrosion !
Bolt and nut threads, bolt shank, edge between shank and bolt head, location of the nut on the bolt (threads should be smooth-running, so preventing the nut from seizing).)

Example: A high-tensile bolt connection must NEVER look like this !

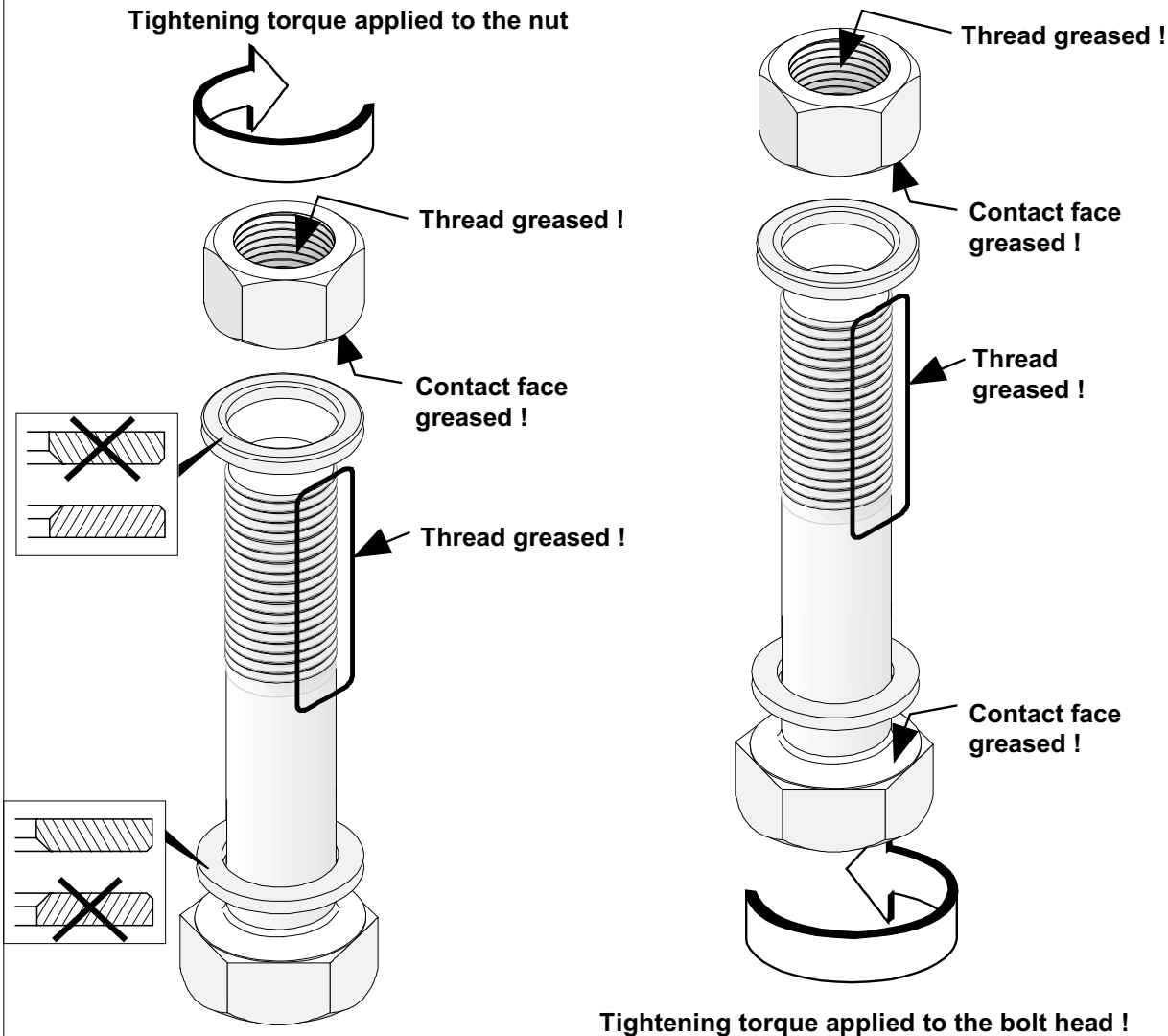


High-tensile bolts and nuts which are damaged or show signs of damage and/or are badly rusty, shall not be used !

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5.2 Lubrication of components

Adequate lubrication gives uniform frictional resistance during tightening and the correct pre-tension of the high-tensile bolt connection is achieved.
An incorrect pre-load could occur, when using an unsuitable grease, in addition removal of the high-tensile bolt connection at a later stage could become a problem.



Lubricate the thread of bolts and nuts as well as the contact face of the nut !
If the tightening torque is applied to the bolt head, adequately lubricate the contact face of the bolt head too !

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6. Tightening high-tensile strength bolt connections

6.1 Importance of correct tightening

High-tensile bolt connections can only fulfil their function properly if they are tightened to the correct torque value. The bolt is stretched to a specific percentage of its elastic limit at the correct torque value, thereby pressing the structural crane elements together and achieving an intensive clamping action between these components.

Correct tightening torque and preload are vital for achieving the optimum operating life of a high-tensile bolt connection.



Torque values which are too high or too low can lead to premature failure of a high-tensile bolt connection.

Never use un-greased bolts or nuts for high-tensile strength bolt connections!

6.2 Tightening torque

Each high-tensile bolt connection shall be tightened with the correct torque value.

Preferably, the tightening torque shall be applied to the nut. If the tightening torque is applied to the bolt, attention shall be paid that no friction can occur between the bolt head and bearing surface, or between the bolt shank and the bolt hole which can distort the preload.

The tightening torque value is dependent on the type and size of the bolts and nuts used on the connection, and is important when tower sections or slewing ring connections are bolted together. See "**Tightening torques**" in clause 9, table 1 and table 2. It should be taken into account that the values are based on the strength ratings according to ISO 898-1 and Part 2.

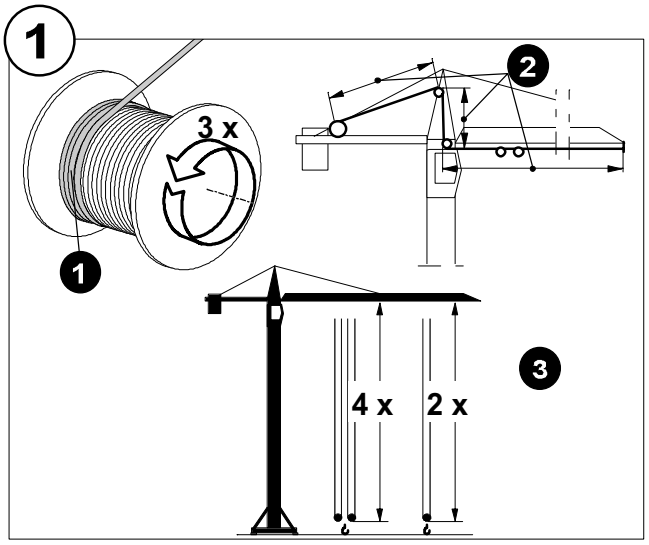
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Chapter 5: Wire Rope

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Information on increasing the service life of the hoist rope page 1 of 3



Rope length matched precisely to the crane installation height !

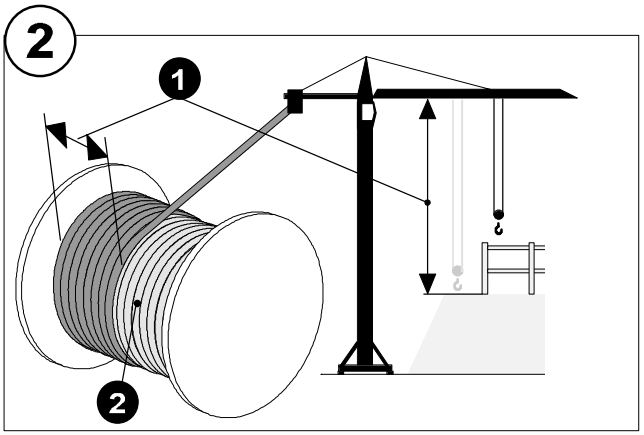
1. 3 safety turns

- plus -

2. Required amount of rope in crane (see determination of the hoist rope length)

- plus -

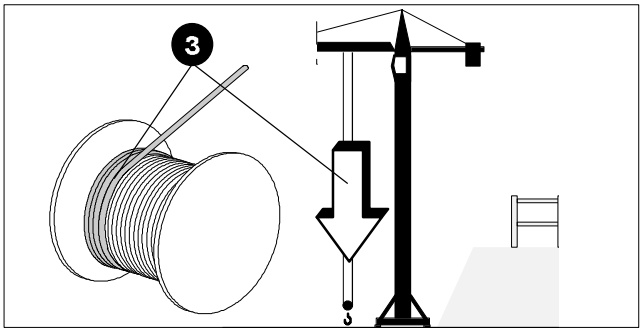
3. 4 x hook height with 4-fall operation
2 x hook height with 2-fall operation



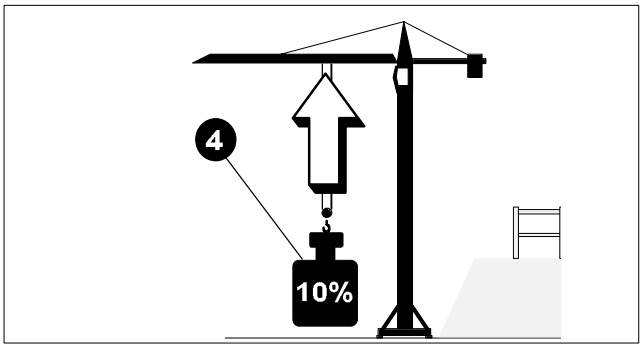
If the lower wraps are not used (dead wraps), unwind the hoist rope and wind it back under pretension (approx. 10% of the max. load) !
(e.g.: working area in same condition over long period of time !)

1. Working area in same condition

2. Dead wraps



3. Unwind the entire hoist rope except for 3 safety wraps

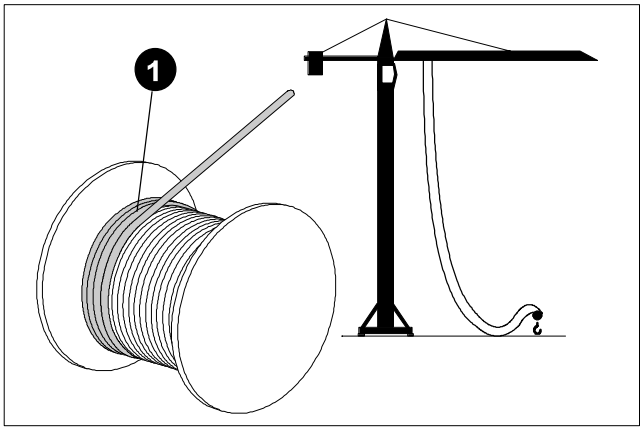


4. Wind in the hoist rope with approx. 10% of the maximum permissible load

After a few days with new ropes, otherwise at long intervals !

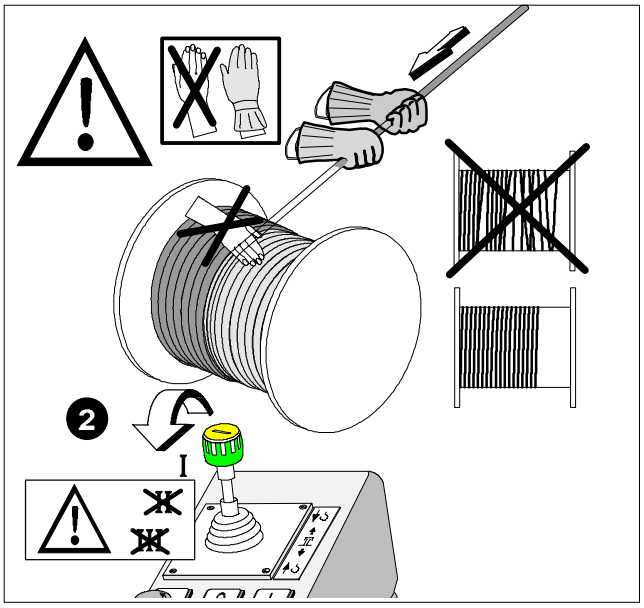
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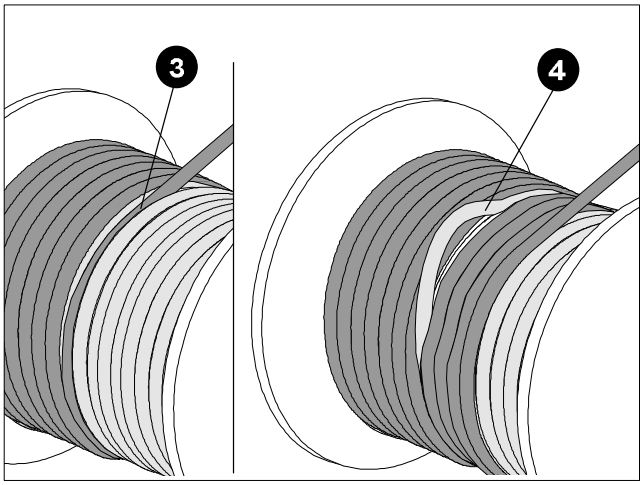


If the rope cannot be wound in under pretension:

1. Unwind the entire hoist rope except 3 safety turns



2. Wind in and guide the hoist rope in stage 1



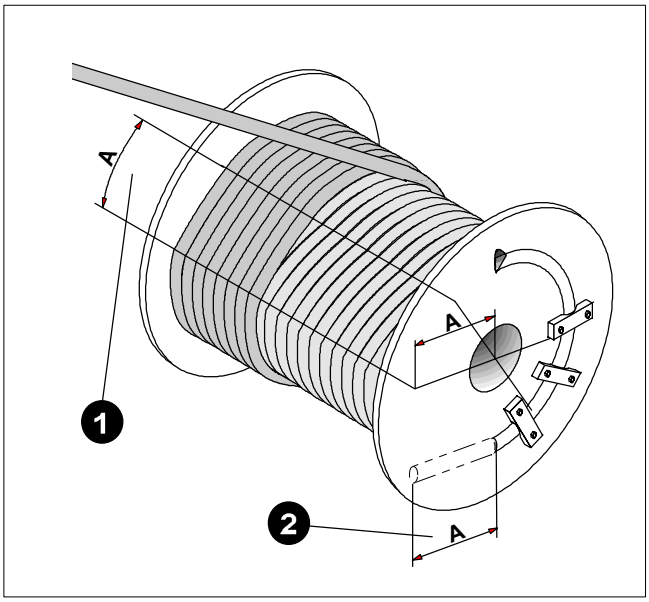
The following winding faults and resultant damage to the rope can be avoided by carrying out the instructions in points 1 to 3 at regular intervals:

3. e.g.: "interlacing" with lower rope turns !

4. or: formation of loops among lower rope turns !

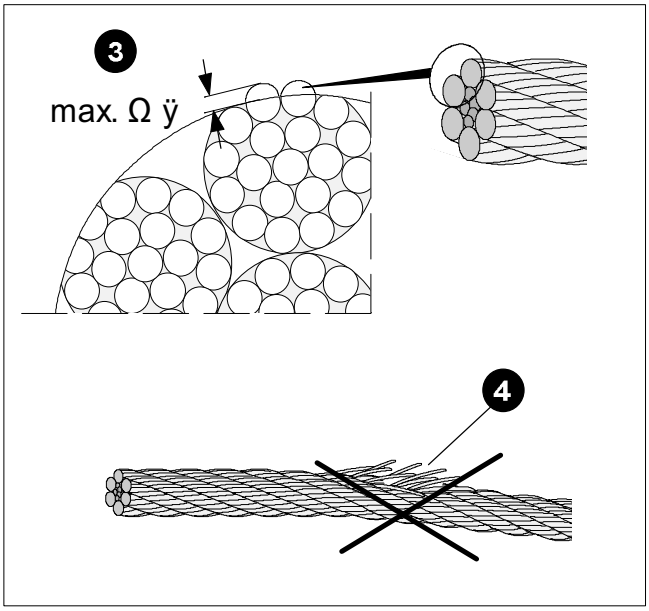
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4



1. The rope is put under greater strain in the cross-over area (A).

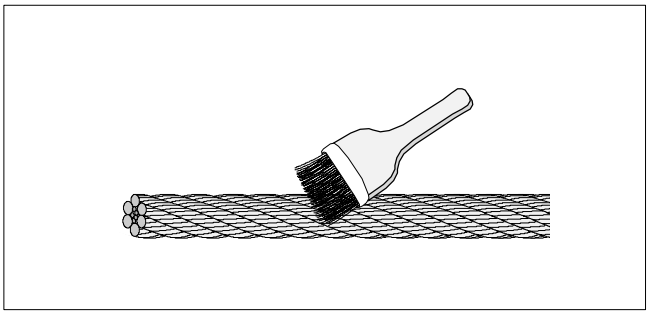
2. ***Displace the rope !***
(can generally be done twice).
Shorten the rope by approx. half the drum diameter.



When to displace the rope:

3. Flattenings are at most half the wire strength.

4. and still no wire fractures.



Lubricate at regular intervals !

See Maintenance: Ropes

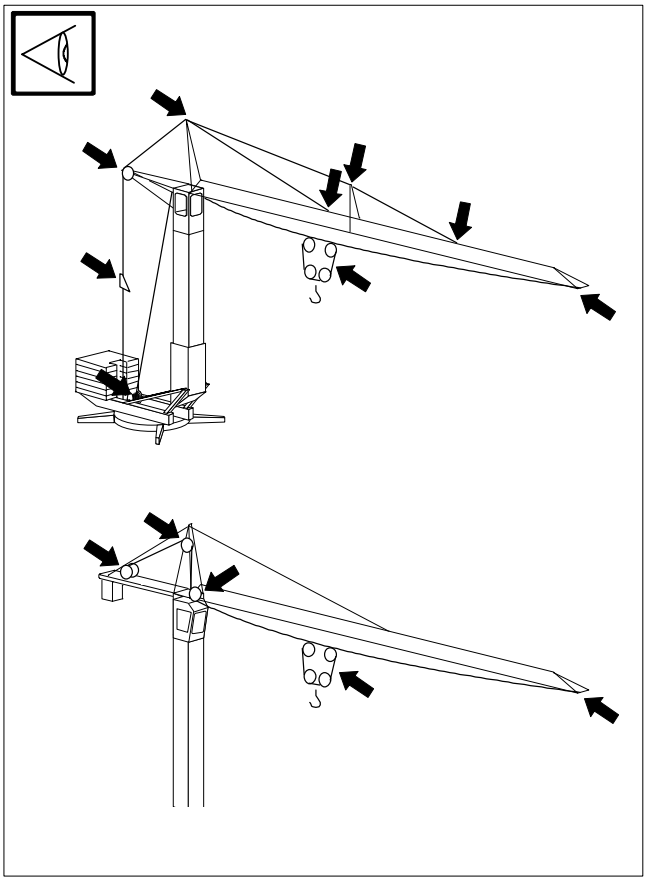
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Checks and Maintenance: Crane ropes, rope pulleys, load hooks and rope end fittings

***When* to check:**

- ***At regular intervals.*** The period of time elapsed between checks should be short enough to ensure that any ***damage is detected at an early stage !***
- ***In the first few weeks*** after a new rope has been installed: ***Carry out checks at shorter intervals !***
- ***After the rope has been subjected to unusually high loads*** or where damage is suspected but not visible: ***Carry out checks at shorter intervals !*** (on basis of hours if necessary)
- When starting up again ***after a lengthy shut-down period !***
- ***After any accident or damage has occured*** which could possibly have involved the rope !

Who* may make checks:** Checks ***must be carried out by a responsible professional (trained and skilled personnel) !



Pay particular attention to the rope sections running over rope pulleys or rope drums or which are in the proximity of rope end attachments !

Pay close attention to initial changes in the behaviour of the rope !

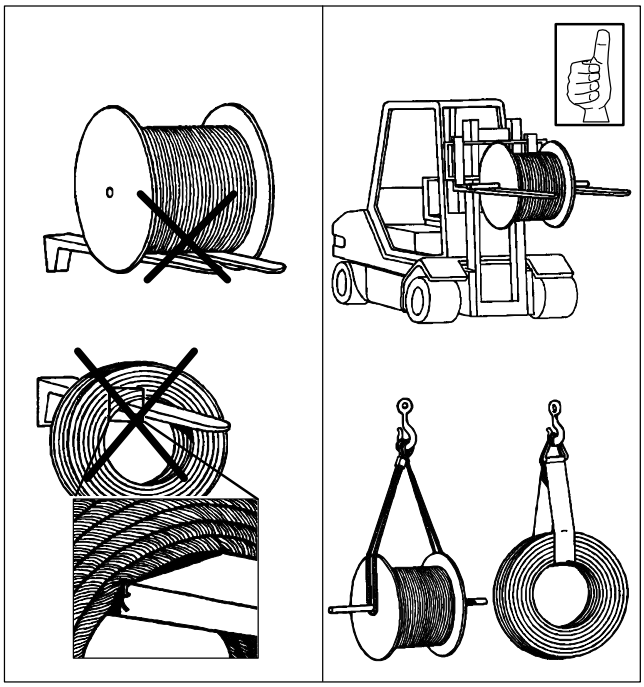
Use only ropes which comply with our specifications (see rope list) !

Regular checks and servicing will guarantee safety and prolong the service life !

If you have any doubts concerning the further operational safety of a particular crane rope, remove the rope at once !

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Checks and Maintenance: Crane ropes, rope pulleys, load hooks and rope end fittings

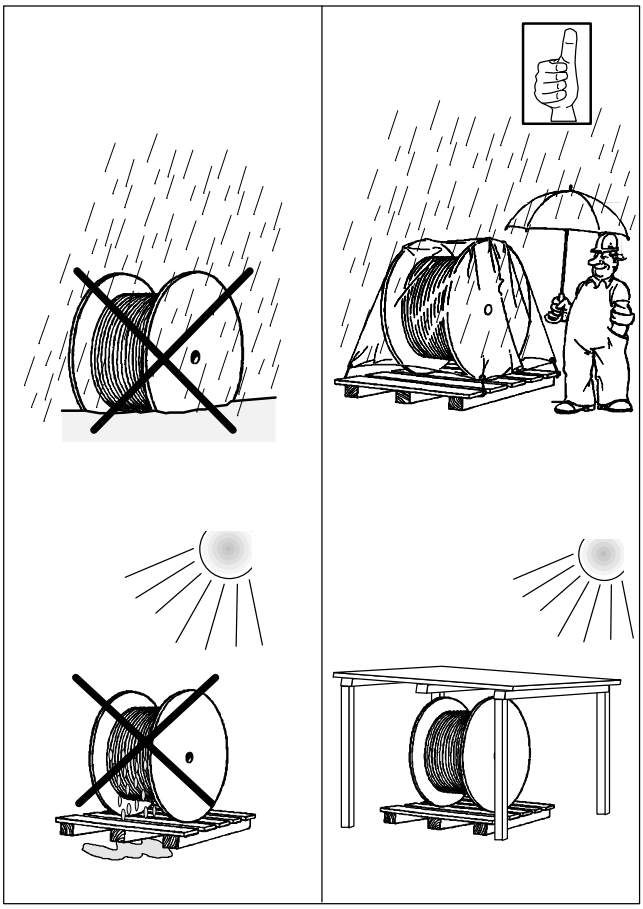


Ropes: Handling !

Unloading:

Do not allow the rope to come into direct contact with a load hook or the fork of a fork-lift truck !

e.g. Lift by the rod passed through the bore of the reel - or - with the help of wide lifting straps.

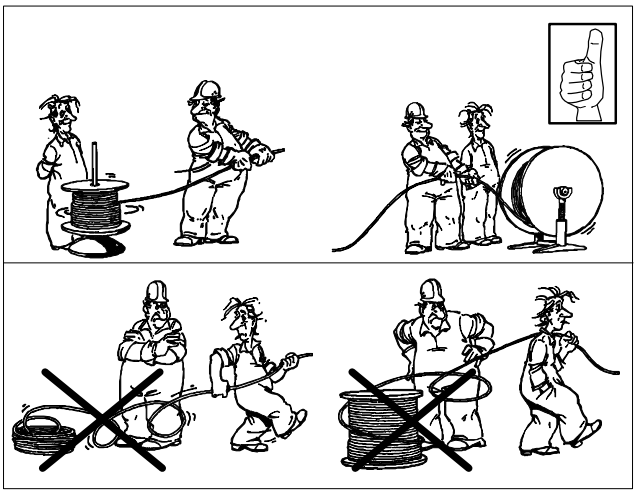


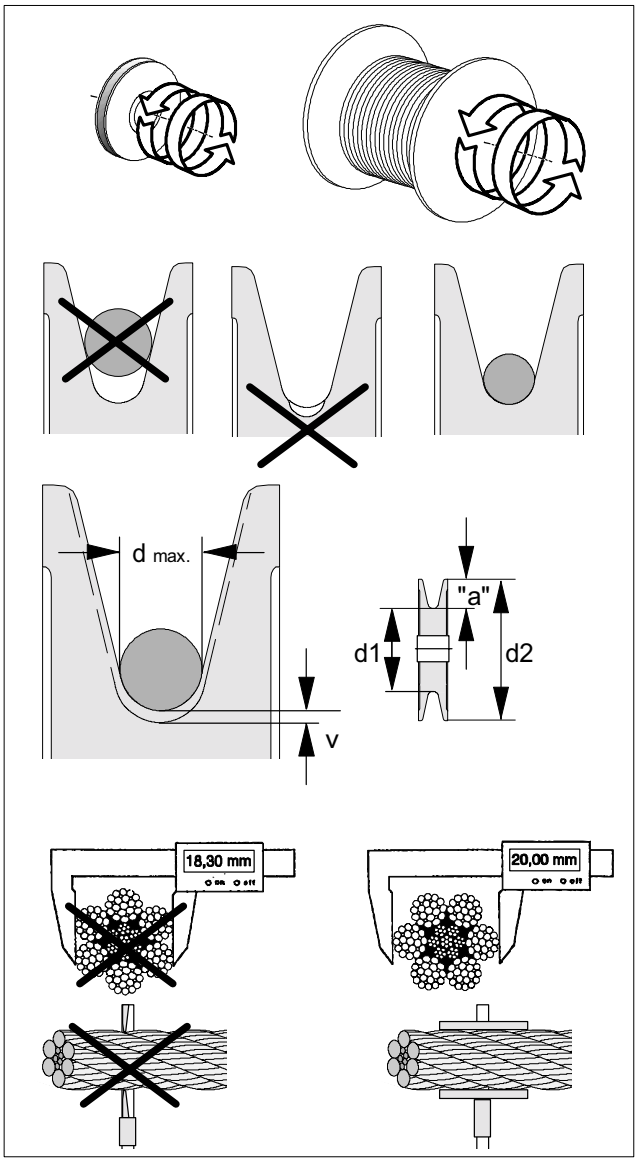
Storage:

- Store in a clean, cool and dry place !
- Store only on pallets; avoid contact with ground !
- If storing outdoor: Cover up the rope ! (provide intermediate layer of sacking to prevent build-up of condensation)
- Protect the rope from potentially harmful sunlight ! (lubricant on the rope will otherwise run and may leak out)

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Checks and Maintenance: Crane ropes, rope pulleys, load hooks and rope end fittings





Installing the rope !

Unwinding the rope from the reel:

Unwind from a turntable or a stand !

Do not unwind from the reel from the side !
This could lead to rope deformation or the formation of kinks and bends !

Before installing the rope, check:

- Do the rope drum and rope pulleys ***rotate smoothly in their bearings ?***
- Do the ***grooves*** in the rope drum and rope pulleys ***fit the rope diameter ?***
- Is there any ***imprinted rope tread*** in the grooves ?
- ***Groove radius*** on rope drum and rope pulleys is ***at least 0.53 x rope nominal diameter.***
  Example: Rope diameter 20 mm
  0.53 x 20 = 10.6 radius
  (can be measured with radius gauge)
- **Check for wear!**
  Use the following guide value:
  Example: Rope diameter 20 mm
  v = 0.15 x 20 mm = 3 mm
- **Determine the rope pulley diameter:**
  d2 - 2 ?"a" = d1

e.g. Ser 10.38 (see spare parts list)
d1 = 380 mm

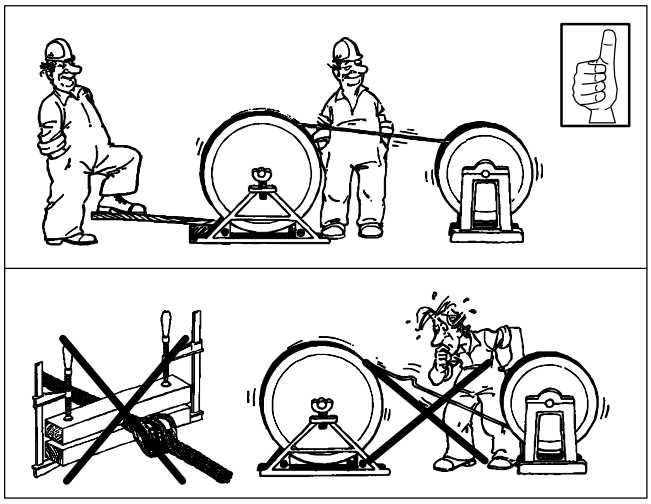
i.e. the minimum rope pulley diameter in this example is 374 mm. **Replace the rope pulley where diameter is smaller.**

Rope installed should be of the same type and strength as the original rope !

In the event of multi-layer drum winding: the rope actual diameter may exceed the rope nominal diameter by max. 4%. *Check the diameter !*

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Checks and Maintenance: Crane ropes, rope pulleys, load hooks and rope end fittings



Rewinding from the reel to the rope drum !

The rope should always be slightly taut; ***1-2% of the minimum rupture force*** of the rope. The reel flange should be slowed using a board !

Do ***not*** slow down by ***clamping*** the rope !

The rope must retain ***preferred bending direction !***

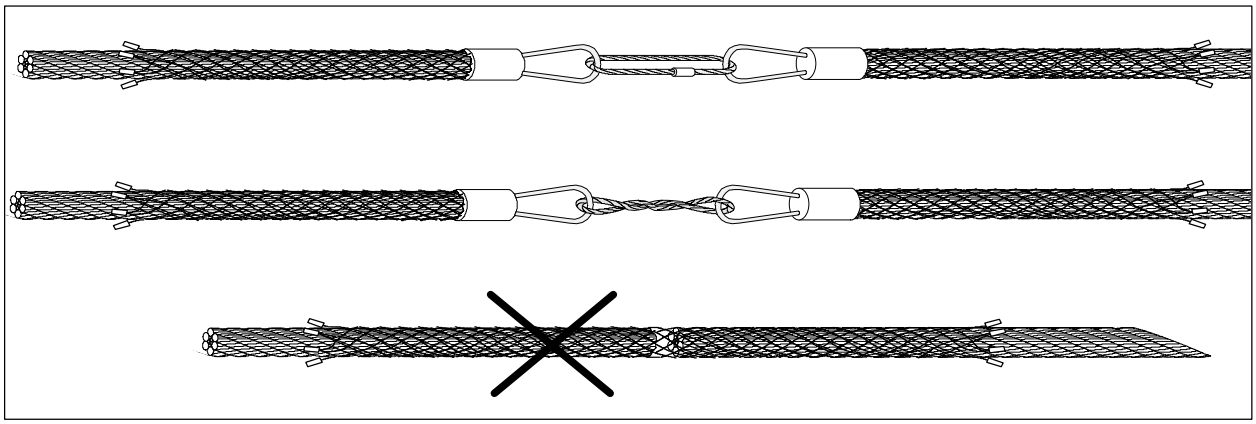
Do not draw the rope over square-edged components ! (line the danger areas with wood)

Do not allow rope to drag on the ground !

Attach the rope to the old rope still mounted or to an auxiliary rope !

The connection between old and new rope should not be rigid ! If it is, wire deformation in the old rope may be transferred to the new rope !

The recommended course of action is to use two open cable grips, which can be connected with each other via, for example, a strand or thin rope !



Where reeving with several runs, the hoist rope and the drum must have the ***same direction !***

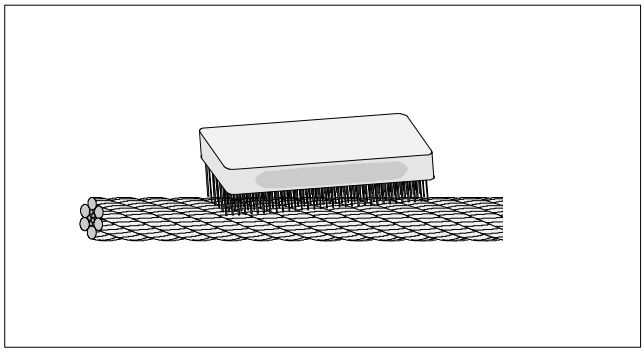
If a certain length of rope has to laid out on the ground for reeving in the hook block, ensure that the rope running in is ***not twisted !*** Lay the rope on plywood sheets to avoid contamination by dirt, etc.

Non-twistfree ropes should only be run with ***fixed points at both ends !***

A ***test-run of several lifts*** under partial load and later with alternately loaded and unloaded hook block is required ! The rope is thus adapted to the bending direction and bending radii !

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Checks and Maintenance: Crane ropes, rope pulleys, load hooks and rope end fittings

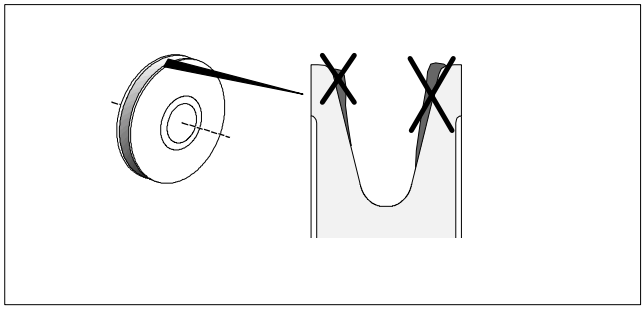


Clean wire ropes !

Clean wire ropes externally when necessary, if possible with brushes !

Do not use solvents !

➛ **solidified lubricant remainders will prevent penetration of the new lubricant !**

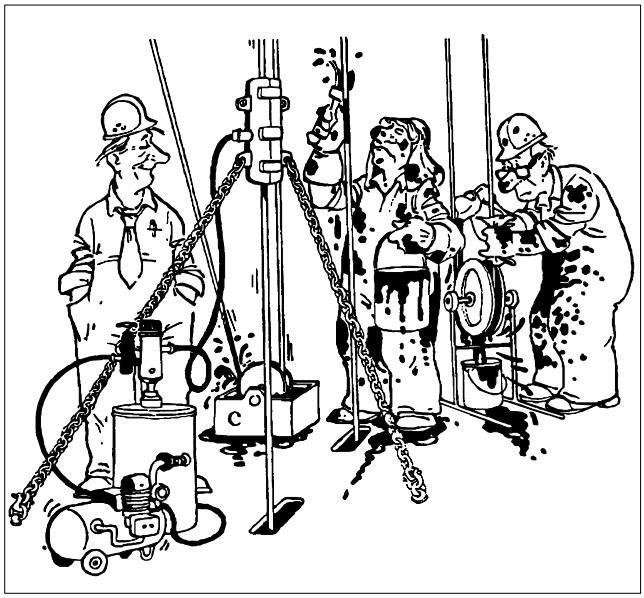


Clean rope pulleys !

Remove grease residue !

Check rope pulley bearings !
(do they rotate smoothly ?)

Check for signs of wear !



Lubricate wire ropes !

Lubricate wire ropes <u>every 200 operation hours</u> !

Regular lubrication prevents wear on parts and prolongs the service life of the rope !

Lubrication should be carried out more frequently under certain conditons (e.g. extreme weather conditons, near seawater etc.)

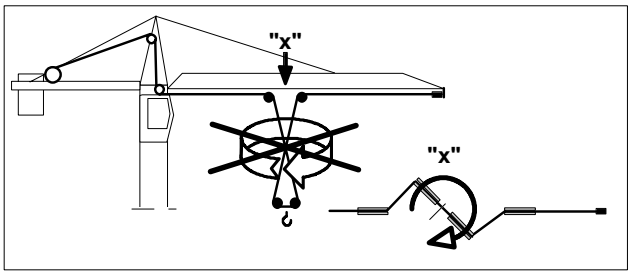
Ensure that the lubricant used for regreasing is compatible with the lubricant already present on the rope !

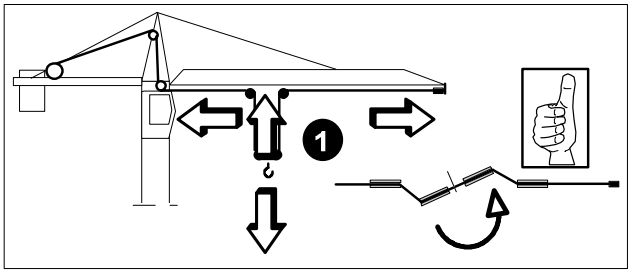
For recommended lubricants.

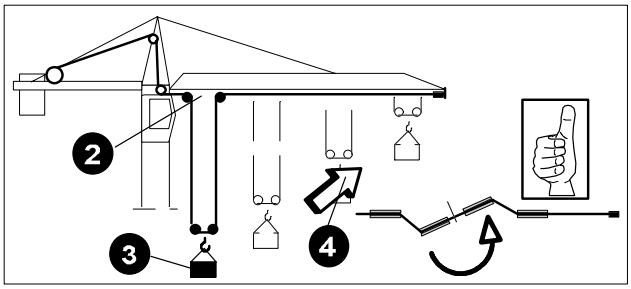
In the event of multi-layer winding (Lebus drum) **use lubricants containing graphite !**

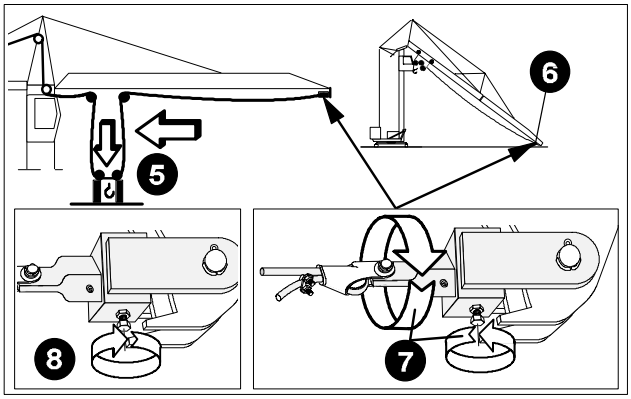
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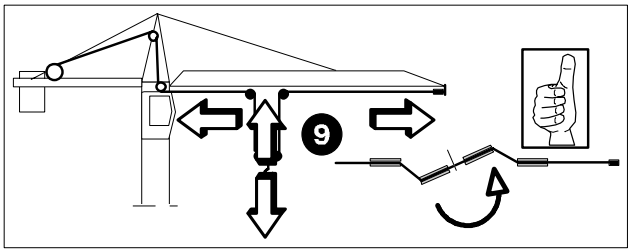
Checks and Maintenance: Crane ropes, rope pulleys, load hooks and rope end fittings

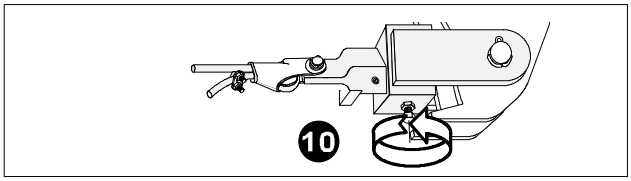












Hook block twisted !

The rope may be damaged if the strands above the hook block strike together !

You will need <u>expert knowledge and patience</u> to remedy this problem !

1. With twistfree hoist ropes (twist compensator open), it should be sufficient to run the crane trolley without a load a few times !

- or -

2. Trolley-in to the jib pivot end stops.

3. Attach a load.

4. Hoist-up, at the same time trolley-out to the jib tip end stops.

if not:

5. "Hoist-down", lower the hook block onto supports on the ground.

6. If working with a K-crane, set down the jib.

7. Open the twist compensator and turn the twist compensator or the hoist rope so as to compensate the twisted hook block.

8. Fix the twist compensator !

9. Make a few empty runs with the hook block and crane trolley, this will distribute the twisting over the entire length of the rope.

10. Reopen the twist compensator !

If the twist in the hook block is still not rectified - repeat the procedure !

Do not forcibly turn the rope over a short length !

<u>The twist compensator should generally be open if the hoist rope is twistfree !</u>

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Checks and Maintenance: Crane ropes, rope pulleys, load hooks and rope end fittings

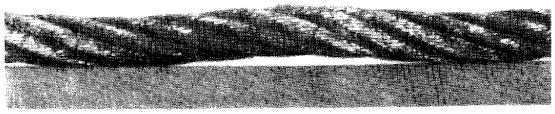


Fig. 1 - Wire rope with corkscrew-type deformation

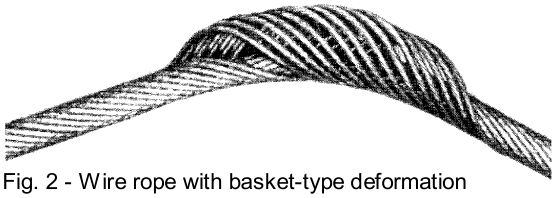


Fig. 2 - Wire rope with basket-type deformation



Fig. 3 - Wire rope with loops formed

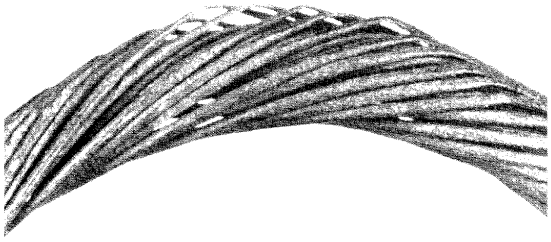


Fig. 4 - Wire rope with individual wires loosened by corrosion and abrasion



Fig. 5 - Wire rope with local decrease in diameter



Fig. 6 - Wire rope with flat caused by being run over

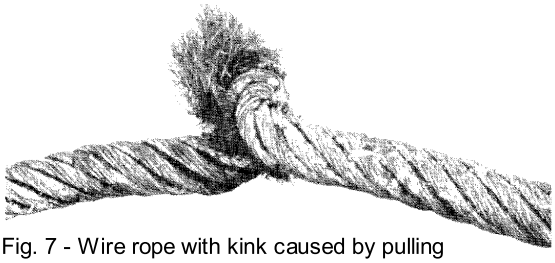


Fig. 7 - Wire rope with kink caused by pulling a loop

When to replace crane ropes !

Crane ropes should be removed if showing one of the following criteria:

- a strand has broken
- a wire breakage cluster has appeared
- the number of visible broken wires exceeds the permissible limits as listed in the table (table on following page)
- corkscrew-type deformation which exceeds 1/3 of the rope diameter (Fig. 1)
- basket-type deformation (Fig. 2)
- hair-pin type extrusion of wires or clusters of wires from the rope (Fig. 3)
- reduction of rope diameter by 15% - or - 10% below the nominal diameter accompanied by corrosion and/or wear (Fig. 4)
- structure of rope is loose (Fig. 4)
- necking (Fig. 5)
- rope is bent or flattened (Fig. 6+8)
- kinks or residual deformations (Fig. 7)

Where particular damage to the rope is detected, ascertain the cause and remedy the problem before installing a new rope !
Signs of damage and stress marks on the crane components provide valuable information for possible causes of rope damage.

If you are in any doubt as to the further operational safety of the crane rope, remove the rope or consult an expert for a second opinion.



Fig. 8 - Wire rope with bend caused by mechanical effect

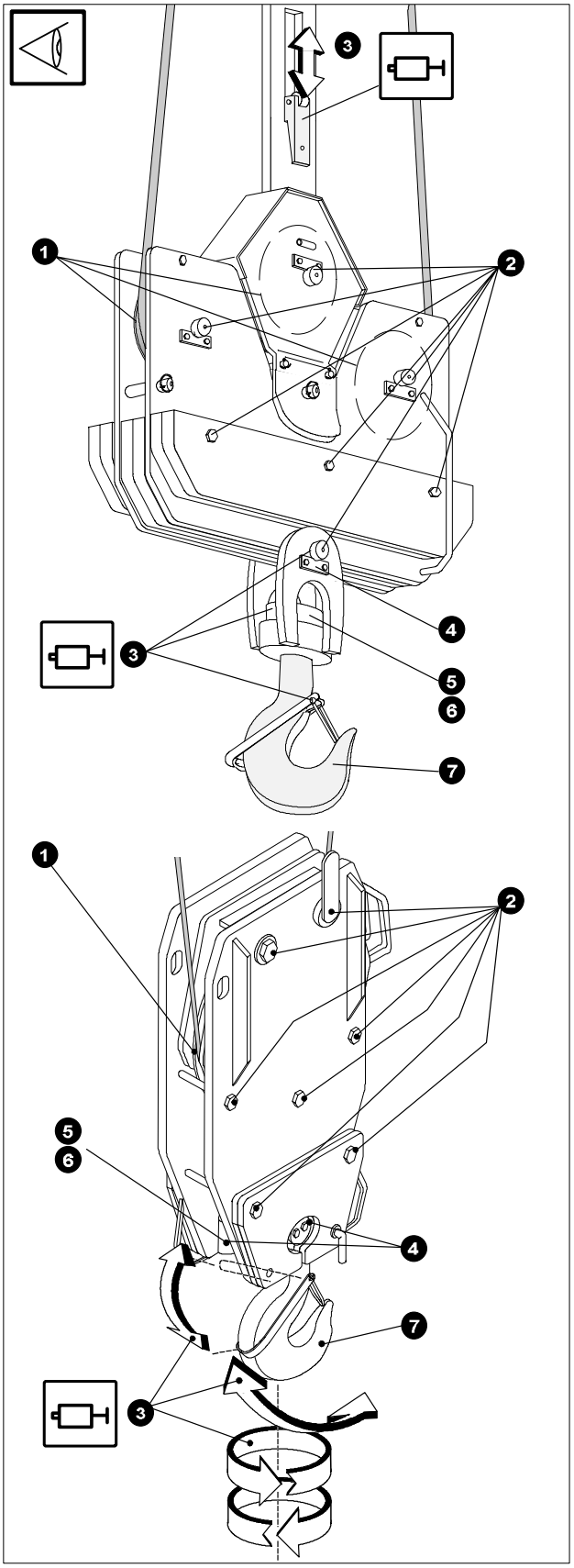
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Table: **Crane ropes to be replaced due to wire strand fractures**
on cranes belonging to rope drive classes 1 Em, 1 Dm, 1Bm, 1 Am

Construction	Lang lay	Regular lay	Number of Load-Bearing Wires in the Outer Strands	Number of Visible Wire Strand Fractures indicating need for replacement on a Length of	
				6 x rope ÿ	30 x rope ÿ
Twistfree Hoist Ropes					
PC Starlift		X	112	5	10
PC Powerlift		X	126	6	11
PC Eurolift	X		126	3	6
PD D 915 C	X		105	2	5
PD D 1315 C	X		105	2	5
PD D 915 CZ	X		105	2	5
PD D 1315 CZ	X		105	2	5
PD D 1318 CZ	X		126	3	6
PD D 1918 Z		X	126	6	11
PD D 2118 C	X		126	3	6
PD D 3615 C	X		105	2	5
PD D 1918 Z/So		X	126	6	11
PV 403	X		75	2	3
Perfekt TK 12		X	105	5	10
Non-twistfree Rope Types (multiple-/retract-/luffing-/ erection-/adjusting-/guy ropes					
PC Alphalift		X	152	6	13
PC Durolift		X	152	6	13
PC Stratolift		X	152	6	13
PC Turbolift		X	208	9	18
PC Turboplast		X	208	9	18
PD S 417		X	152	6	13
PD S 505		X	152	6	13
PD S 506		X	152	6	13
PD S 625		X	114	5	10
PD SKZ 8		X	208	9	18
PD P 825		X	152	6	13
PD PZ 371 > 14 mm ÿ		X	208	9	18
PC 8 FK		X	152	6	13
PC 8 FKV		X	208	9	18
PC FKX		X	190	8	16
P 331		X	171	7	14
P 335		X	171	7	14
P 336		X	190	8	16
P 550		X	288	12	24
PN 42		X	42	2	4
PN 114		X	114	5	10
PN 115/7		X	114	5	10
PN 116/7		X	114	5	10
PN 216/7		X	216	9	18
PN 222		X	222	10	19
PV 288/7		X	288	12	24
DIN 3066 FE		X	222	10	19
Perfekt 612 W		X	114	5	10
Perfekt BS 812 F		X	152	6	13

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Checks and Maintenance: Crane ropes, rope pulleys, load hooks and rope end fittings



Monitoring and checking: Hook blocks

When to check:
each time the crane has been erected; at least once a year !

Who may make checks:
Checks must be carried out by a responsible professional.
The type of check, the results of the check and action taken to remedy any fault should be noted in the crane documents !

What to check:

1. Rope pulleys:
- wear on groove radius, smooth running.

2. Fastenings on all connecting parts.

3. Lubricate all moving parts.

4. Cross-head:
- properly fastened and smooth rotation in its bearing

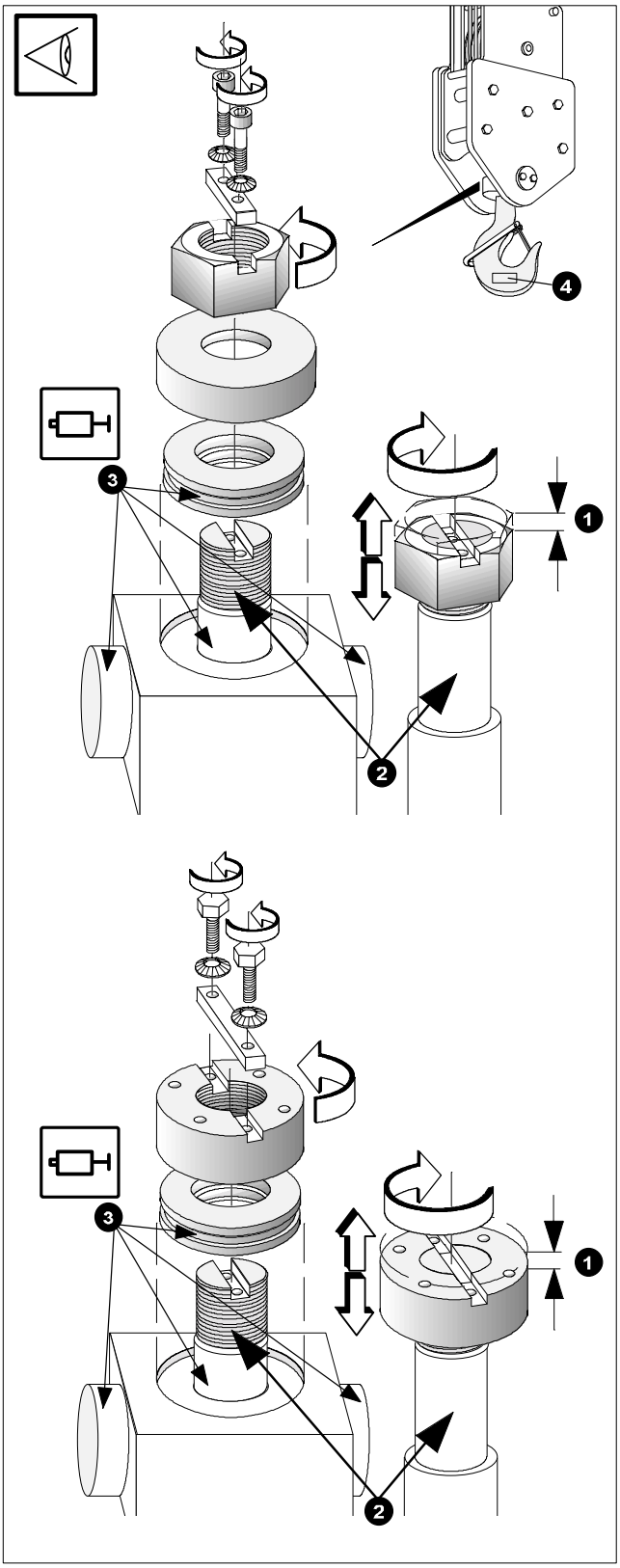
5. Turnability of the axial bearing.

6. Load hook - cross-head connection:
- axial play of the nut.
- check threads, shank and hook catch for signs of corrosion.

7. Load hook:
- wear of deformation tolerance levels.
- Hook safety catch: can be closed and run easily.

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Checks and Maintenance: Crane ropes, rope pulleys, load hooks and rope end fittings



Monitoring and checking: Load hook to cross-head connection

What to check:

1. Axial play of the nut.

2. Check threads and shank for signs of corrosion.

3. Lubricate all moving parts.

4. Load hook designation.

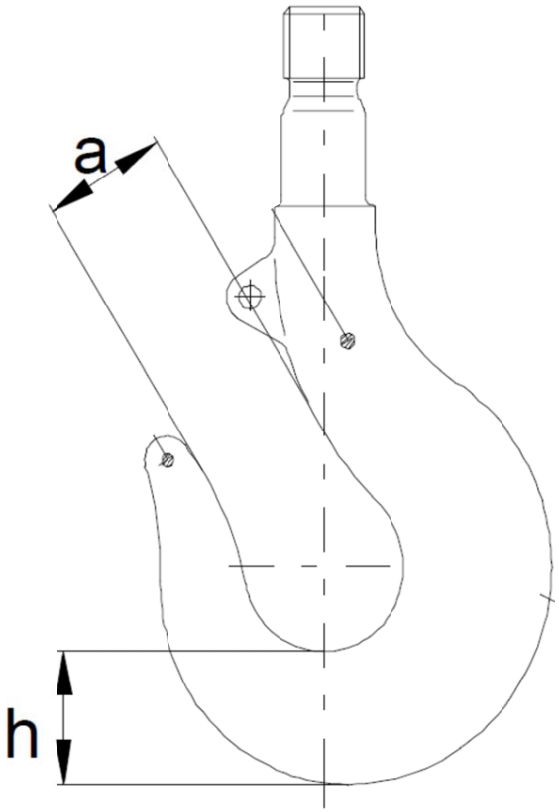
Axial play ❶				
Load hook	Hook no.	Permissible axial play		Threads
Lah 010 ...	RSN 08	metric threads	0.13	M 24
Lah 020 ...	RSN 1.6		0.14	M 30
Lah 030 ...	RSN 2.5		0.15	M 36
Lah 050 ...	RSN 4		0.16	M 42
Lah 063 ...	RSN 5		0.16	M 45
Lah 080 ...	RSN 6	round threads	0.10	Rd 50x6
Lah 100 ...	RSN 8		0.10	Rd 56x6
Lah 125 ...	RSN 10		0.10	Rd 64x8
Lah 160 ...	RSN 12		0.10	Rd 72x8
Lah 200 ...	RSN 16		0.20	Rd 80x10
Lah 250 ...	RSN 20		0.20	Rd 90x10
Lah 320 ...	RSN 25		0.20	Rd 100x12
Lah 400 ...	RSN 32		0.20	Rd 110x12
Lah 500 ...	RSN 40		0.20	Rd 125x14
Lah 630 ...	RSN 50		0.30	Rd 140x16
Lah 800 ...	RSN 80		0.30	Rd 160x18

Do not allow hook nuts, hook threads or safety devices to wear down:

Axial play may not be exceeded ! Hook and nut can only be replaced as a single unit !

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Checks and Maintenance: Crane ropes, rope pulleys, load hooks and rope end fittings



a = This dimension must not exceed 5% in throat opening or distortion from original new dimension up to a maximum 1/4” or within the recommendations of the manufacturer.

h = 10% wear or reduction from original new section dimensions

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Checks and Maintenance: Crane ropes, rope pulleys, load hooks and rope end fittings

Figure 1

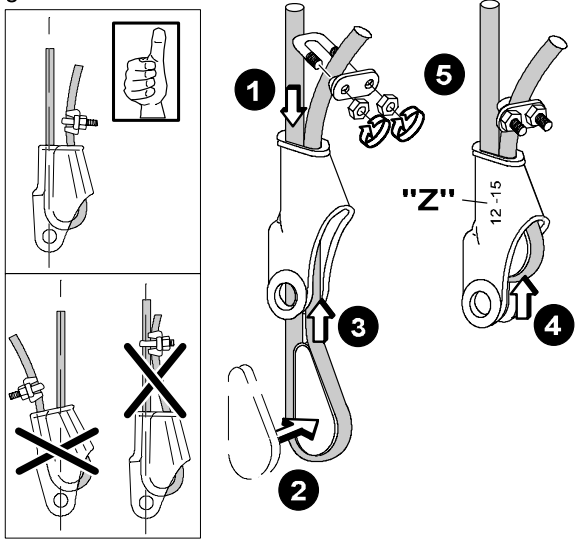
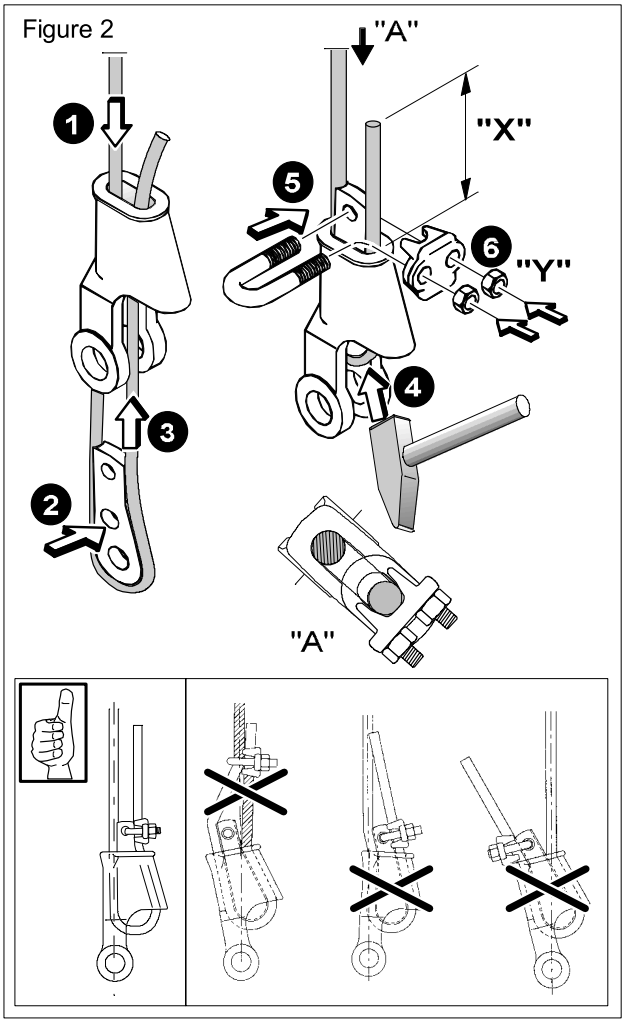


Figure 2



Installation, inspection and maintenance of wedge sockets !

If the wedge socket is not properly installed:

- **Loads / crane parts may fall down. A falling load can seriously injure or kill.**
- **Do not side load the wedge socket.**

Maintenance and Inspection:

Always inspect the wedge socket, the wedge and the pin before using.

Do not use parts showing cracks.

Do not use modified or substitute parts.

Repair minor nicks or gouges to socket or pin by lightly grinding until surfaces are smooth. Do not reduce the original dimensions by more than 10% !
Damage must not be repaired by welding.

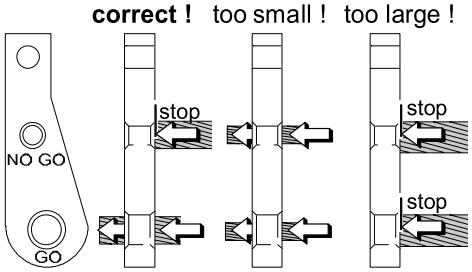
Inspect permanent connections once a year, or more often in severe operating conditions.

Installation:

See figures 1 and 2 for the installation process. These instructions must be followed.

The permissible rope diameter can be seen on the wedge socket body (**"Z"**). **Alternatively** it can be determined by the holes in the wedge.

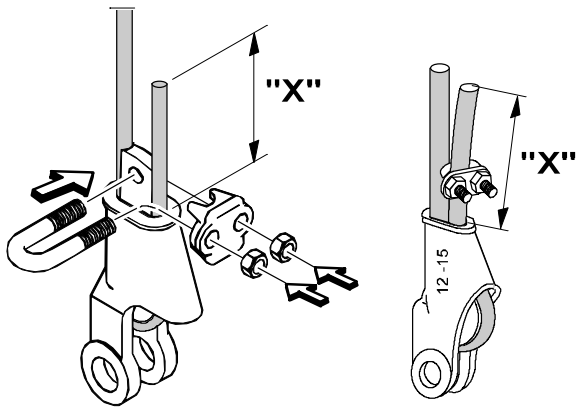
Example: The rope diameter for the following wedge socket size is:



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Checks and Maintenance: Crane ropes, rope pulleys, load hooks and rope end fittings

Figure 3



Installation, inspection and maintenance of wedge sockets !

Page 2 of 2

Tail length of the dead end: "X"

Standard 6 to 8 strand wire ropes:
minimum of 6 rope diameters,
but not less than 150 mm

Rotation resistant wire ropes:
minimum of 20 rope diameters,
but not less than 150 mm
Ensure that the dead end is welded.

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Chapter 6: Self-Erecting Tower Cranes

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Self-Erecting Tower Cranes

The use of self-erecting tower cranes is increasing substantially. These cranes have replaced rough terrain forklifts in many situations. Many users of self-erecting tower cranes are not familiar with the use of cranes. These machines represent significant risk and their use must be well planned and performed with attention to safety at all times. This Reference Manual will discuss several items critical to the safe use of self-erecting tower cranes. The items are as follows: Planning, Set-up, Erection, Operation, and Dismantling.

PLANNING

Extensive planning must occur prior to the crane's arrival at the jobsite. The plan must be developed by persons with sufficient training, knowledge, and experience on self-erecting tower cranes. The plan should be divided into two (2) major sections as follows:

1. Delivery, set-up, erection, and dismantle.
2. Lifting operations.

DELIVERY, SET-UP, ERECTION, AND DISMANTLE

These machines can be towed to the site using fixed or removable axels, hauled on a trailer, or driven under their own power. Check horizontal and vertical clearances, weight restrictions, and compaction and traction of surfaces at the jobsite.

A site-specific safety survey must be performed as part of the planning process. This will require a site visit. Items that could have a negative effect on crane operations must be identified. These items would include, but not be limited to, the following: overhead power lines, underground structures and utilities, paved areas, backfill, high water table, basements, proximity to bodies of water, excavations, adjacent structures, and changes to site conditions during construction.

These machines are usually set up on outriggers. The reaction forces at the outriggers are substantial. There are two (2) reactions, in service and out of service. A soil report must be provided prior to crane set-up so adequate foundations can be prepared for the crane. The outrigger float pads do not have sufficient area to spread the reaction loads over a large enough area to prevent settlement on soil. Therefore, concrete footings or crane mats must be placed under the outrigger float pads. The size and strength of these foundations must be determined by a qualified person, who will use information from the soils report and the maximum crane reactions supplied by the manufacturer.

The requirements of the Federal Aviation Administration (FAA) standard 7460-1 must be met for any obstruction of more than 200 feet in height above the ground level at its site.

Most self-erecting tower cranes require 3 phase electric service. This service is not available everywhere. Contact the power company well in advance if you plan on using their service. If using a generator to supply crane power, contact the crane manufacturer for the required kW rating and procure it well in advance. Some self-erecting tower crane control systems require that the power supply to the control panel be left on at all times to ensure a stable temperature for the electronics. In this case, the power from a generator may not be desirable.

Self-erecting tower cranes are required to weather vane (point downwind) when out of service. This will likely cause the crane's jib to over sail adjacent property. In addition, during lifting operations the jib could also over sail adjacent property while the load does not. If this will be the case, permission may be required from adjacent property owners to allow the over sail in order to avoid costly lawsuits and/or crane shutdowns.

Proper clearances (crane and load) must be allowed for during erection (including unfolding), operation, and dismantling (including folding). In order to obtain proper clearances; planners will have to use accurate dimensions of the crane, load, rigging, existing structures, and the structure under construction. It is important to remember that the structure under construction was not there when the crane was erected in most cases. Planners will likely use plan view drawings as well as elevation view drawings.

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The knowledge and experience required to erect and dismantle a self-erecting tower crane is much different than the knowledge and experience necessary to operate the crane. Planning must include someone who is qualified to set-up, erect, reconfigure, unfold, dismantle, and fold the crane. During unfolding and folding, self-erecting tower cranes are very vulnerable to wind. The maximum allowable wind speeds, per manufacturer or qualified person, must be part of the plan and adhered to during erecting and dismantling.

The plan must be communicated to the appropriate people. When communicating the plan to those people, ask for input, quite often the plan will be improved. Also, something occurs at this stage called “buy in.” People think this is their plan and are much more likely to work that plan. In addition the plan should be reviewed with personnel just prior to doing specific parts of the work.

LIFTING OPERATIONS

This section of the plan would identify staging and lay down areas. It is important to have accurate load weights and radii to ensure the crane has sufficient load ratings to do the work. Each work item should have its own place in the plan; examples of work items include, but are not limited to: form work, rebar, concrete placement, steel erection, masonry, framing, and roofing. Rigging methods and materials would be addressed here as well as signaling methods. In addition rigger and signalperson qualifications should be set forth. The crane manufacturer’s, or qualified person’s, requirements for in-service wind should be noted in the plan.

Set-Up

Self-erecting tower crane set-up includes preparing the foundation, placing the crane on the foundation and connecting the electric service. The foundation must be placed on subgrade as specified by the engineer or qualified person and in the location specified during pre-planning. The foundation size and construction must meet the specifications of the engineer or qualified person.

If using timber, the timber must be capable of distributing loads as intended. Timbers that are thru-bolted to act as a unit are preferred over loose timber. The use of individual loose timbers has been shown to cause a significant number of accidents for self-erecting tower cranes. Figure 1 shows some good and bad foundation conditions.

Once the crane is placed on the foundation the crane must be leveled to within the specification required by the crane manufacturer or qualified person. The foundation itself must be level and completely support the bottom of the outrigger pad.

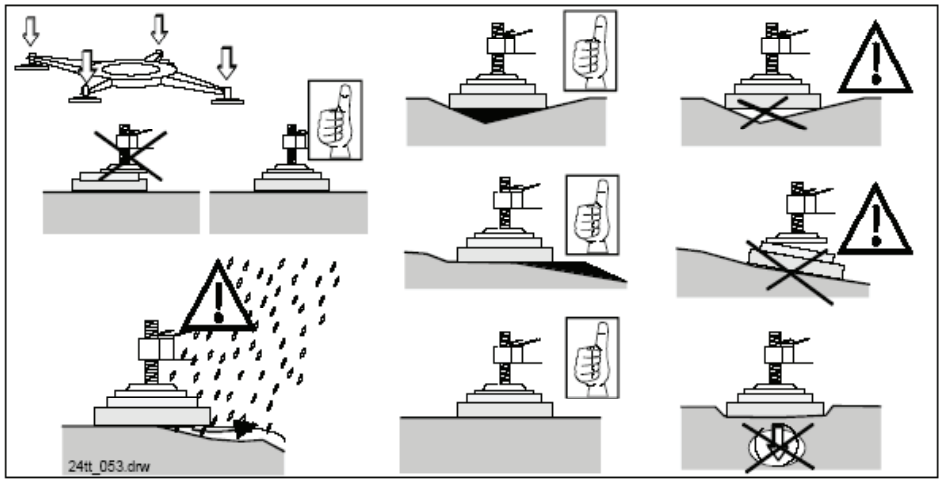


Figure 1

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If the self-erecting tower crane needs electric power to level, the electric service would be connected prior to leveling and if not before raising or unfolding. The crane must have a main disconnect switch mounted at or near the base of the crane. The switch must have surge protection and be capable of being locked in the off position. The crane must be properly grounded in accordance with the National Electric Code (NEC).

Erection

Self-erecting tower crane erection includes raising the crane from transport position, installing counterweight/ballast, unfolding, telescoping the mast, and reconfiguration. These operations require much different knowledge and experience than actually operating the crane during lifting operations. It is critical that this work be performed by a qualified person.

Self-erecting tower cranes normally use counterweight/ballast made of reinforced concrete. Prior to installation the counterweight/ballast must be checked for proper size, weight, damage, and integrity of lifting points. Defective or improper counterweight/ballast must not be installed. Install counterweight/ballast according to the crane manufacturer or qualified person's instructions.

Prior to erection, the person performing the erection operation must check for site hazards, see that there are no personnel in crane pinch points or fall zones, and the wind speed is below the maximum permitted by the crane manufacturer. After erection is completed and prior to use, the crane and foundation must be tested in accordance with the crane manufacturer's instructions. This will include setting all motion, zone, and load limits. If the crane is to be reconfigured after initial use, a qualified person is to perform the reconfiguration and ensure that all switches and limits are properly set before operation is continued.

When erection work requires personnel to work at locations where they are exposed to a fall of six (6) feet or more, appropriate fall protection measures must be implemented.

Operation

Self-erecting tower cranes must be operated by qualified persons. The operator must be able to read, understand, and follow signs, decals, labels, and the crane's operating manual. The manual must be available to the operator at all times when the crane is in operation.

If the operator is to leave the radio remote control unattended, the operator must de-energize the crane and secure the remote by removing the key or placing the remote in a lock box. During donning or removal of the remote using a belt or harness, the remote must be turned off or the crane de-energized.

The load ratings of a self-erecting tower crane must not be exceeded, except during testing. During testing, follow the crane manufacturer's instructions and have the operation supervised by a qualified person. Load ratings are for freely suspended loads only. Hoisting, slewing, trolleying, luffing, or traveling must not be used to pull, plumb, or move a load in a horizontal direction. Never attempt to lift stuck, frozen, or embedded loads.

Self-erecting tower cranes are bottom-slewing cranes. The area inside the crane's tail swing must be barricaded. This barricade must be in place at all times while the crane is in operation.

Never allow personnel under a suspended load.

Never leave loads suspended from the crane when the operator is not at the controls.

Never add weight to a suspended load.

Never hoist personnel without manufacturer's approval.

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Self-erecting tower crane operators must be familiar with emergency procedures. The response to uncontrolled movement is to engage the emergency stop button on the remote or control desk. This will de-energize the crane and set all brakes.

Another emergency would be contact with overhead power lines. If the operator is on the crane he should stay there unless it is unsafe to do so. If the operator is not on the crane he should do his best to advise personnel the crane is energized and they should avoid touching the crane or load. In addition, the operator should try to break contact with the lines if possible, but not exert so much force that the lines could be pulled down.

Dismantling

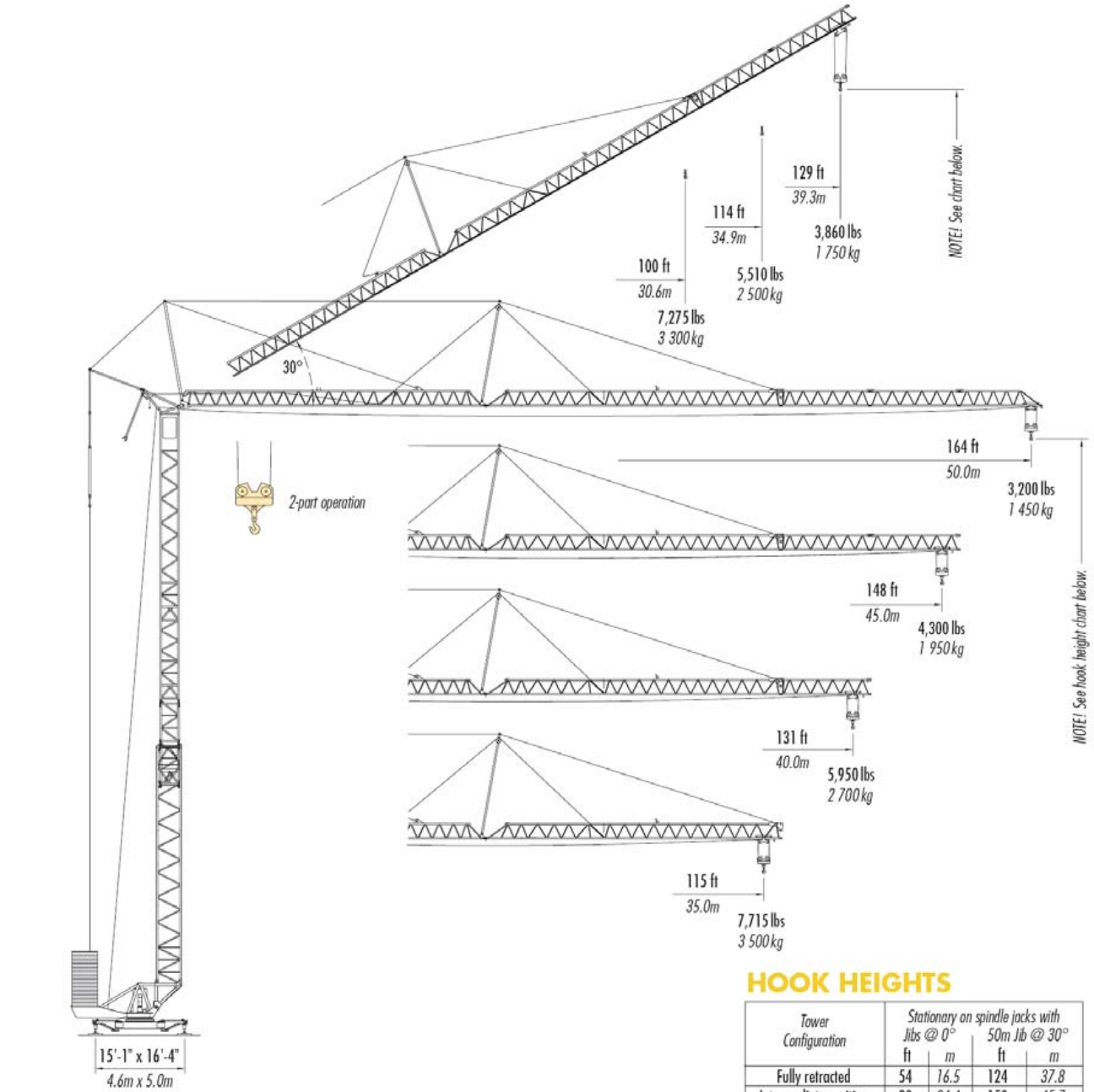
Dismantling a self-erecting tower crane includes folding the jib, lowering the mast, removal of counterweight/ ballast, placing the crane in transport position, and removal from the site. This work requires different knowledge and experience than operating the crane and must be performed by a qualified person.

Prior to dismantling, it must be determined that there is sufficient space available to perform all required operations and to remove the crane from the site.

Prior to dismantling, ensure that all switches, pins, etc. are in their proper position. Follow the crane manufacturer's instructions and specifications. Remove counterweight/ballast in the proper sequence and at the proper time. Follow all applicable fall protection requirements. Keep all personnel out of crane fall zones and pinch points.

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Self-Erector Technical Data A



STATIONARY

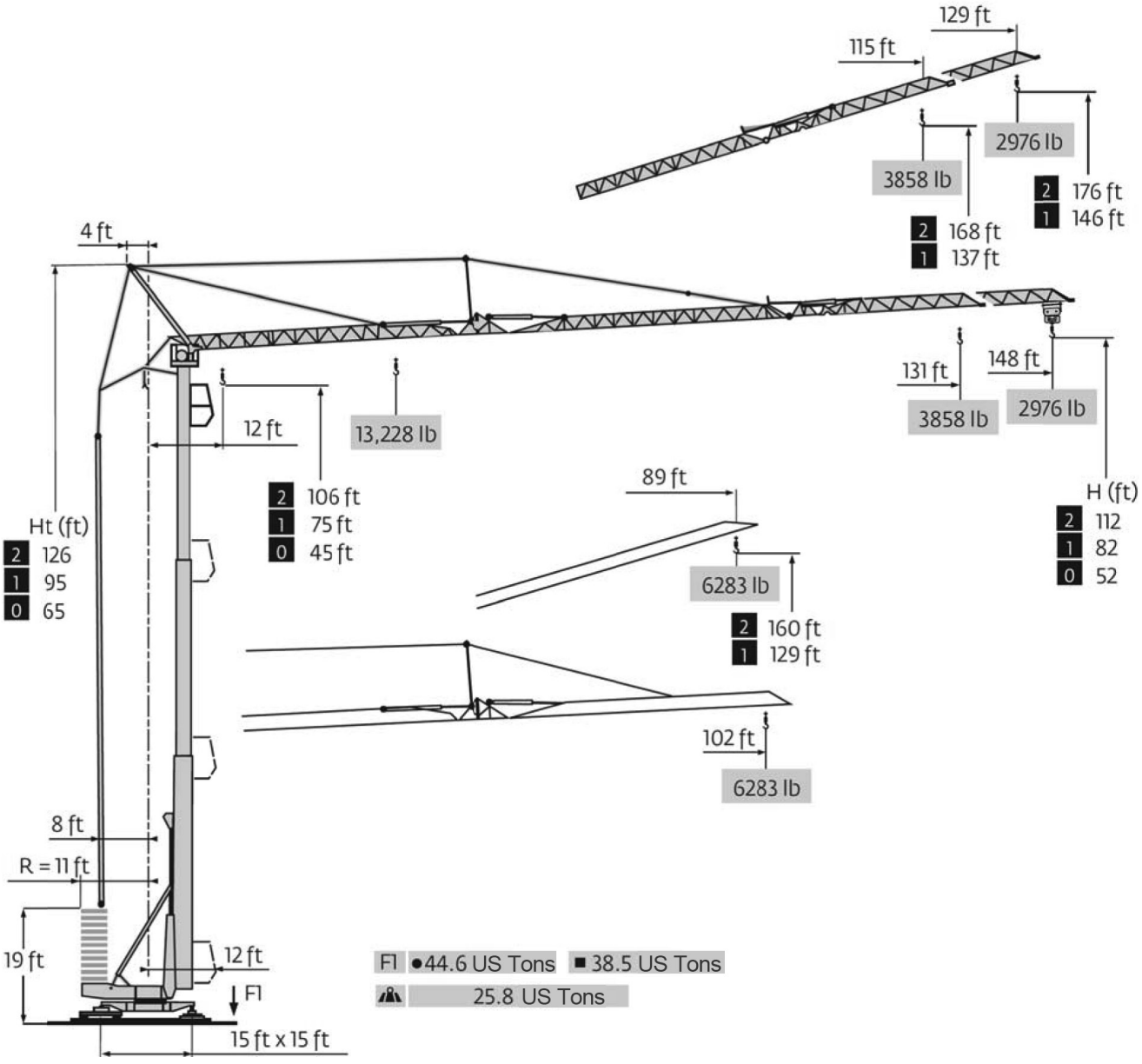
on outriggers with spindle jacks
maximum hook height: 181 ft *(55.1m)*

HOOK HEIGHTS

Tower Configuration	*Stationary on spindle jacks with Jibs @ 0°*		*50m Jib @ 30°*	
	ft	*m*	ft	*m*
Fully retracted	54	*16.5*	124	*37.8*
Intermediate position	80	*24.4*	150	*45.7*
Fully extended	95	*29.0*	165	*50.3*
Fully extended + 1 STS	103	*31.4*	173	*52.7*
Fully extended + 2 STS	111	*33.8*	181	*55.1*

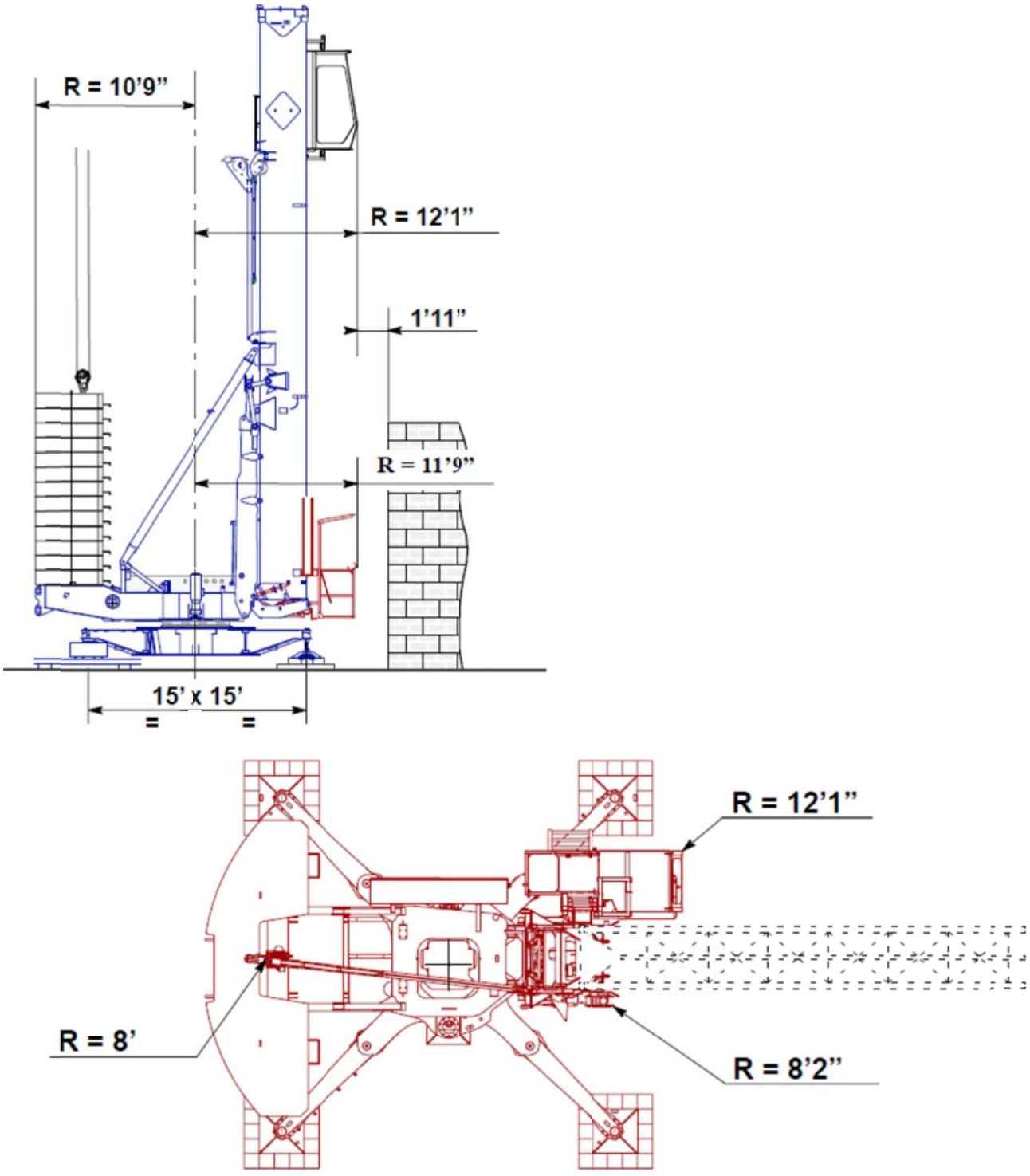
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Self-Erector Technical Data B



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Self-Erector Technical Data C

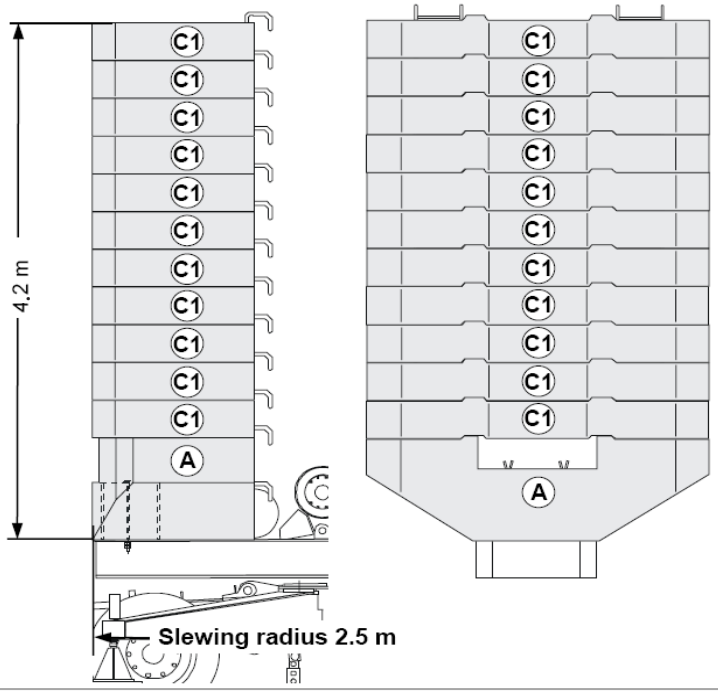


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Self-Erector Technical Data D

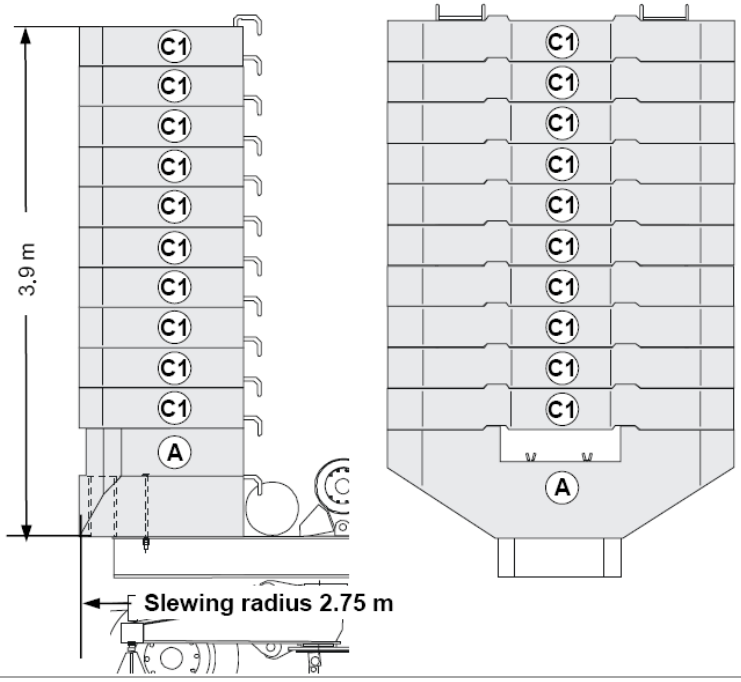
Counterballast

1 Slab "A"	=	3000 kg
11 Slabs "C1" each 1750 kg	=	19250 kg
total		**22250 kg**



Counterballast

1 Slab "A"	=	3000 kg
10 Slabs "C1" each 1750 kg	=	17500 kg
total		**20500 kg**



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