



**NATIONAL COMMISSION FOR THE  
CERTIFICATION OF CRANE OPERATORS (NCCCO)**

# **TOWER CRANE REFERENCE MANUAL**

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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 for 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**

# 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 square foot (psf)	x	0.047 880 258 98	=	kilopascals (or kN/m <sup>2</sup> )
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

## 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 <sup>3</sup> )	x	16.387 064	=	cubic centimeters (cm <sup>3</sup> )	
cubic feet (ft <sup>3</sup> )	x	0.028 316 846	=	cubic meters (m <sup>3</sup> )	
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	

# 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 <sup>1</sup>	171 pounds per cubic foot
Cast Iron <sup>1</sup>	450 pounds per cubic foot
Cement <sup>2</sup>	94 pounds per cubic foot
Concrete <sup>2</sup>	150 pounds per cubic foot
Crushed Stone <sup>2</sup>	2,500 pounds per cubic yard
Gravel <sup>2</sup>	2,700 pounds per cubic yard
Gypsum or plaster board <sup>3</sup>	
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 <sup>3</sup>	
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) <sup>4</sup>	
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

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

Masonry Walls <sup>5</sup>		
	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 <sup>3</sup>		
	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 <sup>5</sup>		
	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 <sup>2</sup>		
	Bank sand	2,500 pounds per cubic yard
	Torpedo Sand	2,700 pounds per cubic yard
Steel <sup>1</sup>		
		490 pounds per cubic foot

Table 2. Bulk density of selected products<sup>6</sup>

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**

# Hammerhead Tower Crane

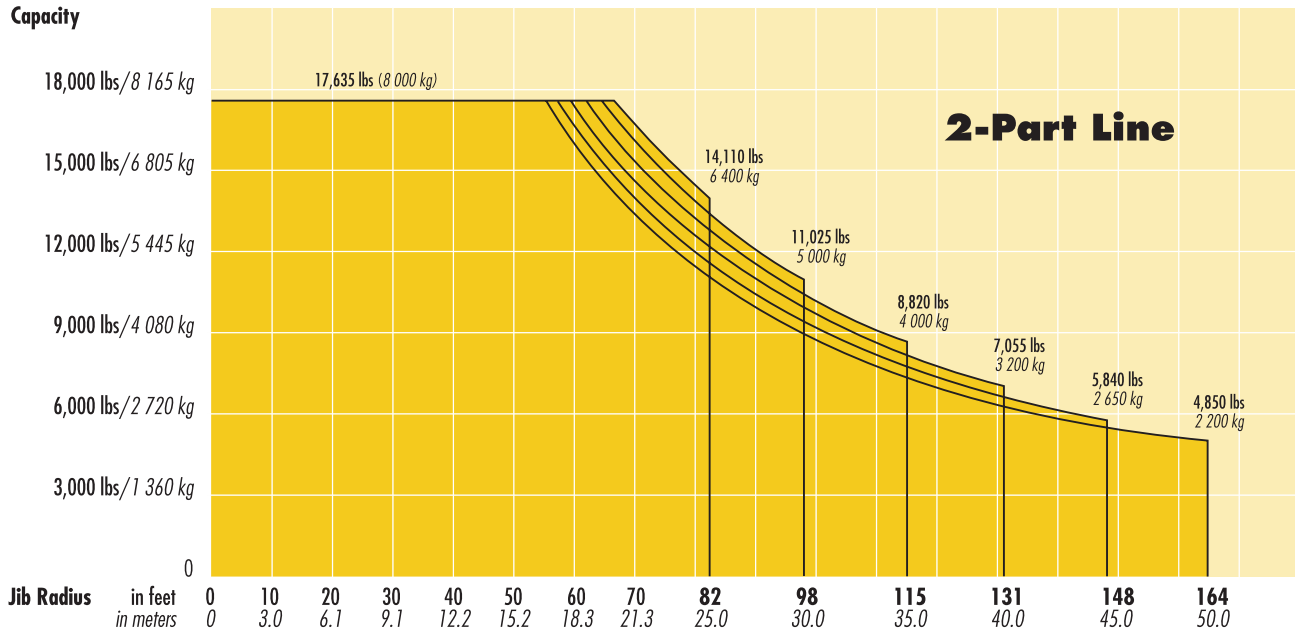
## Chart A

### 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**

### Capacity



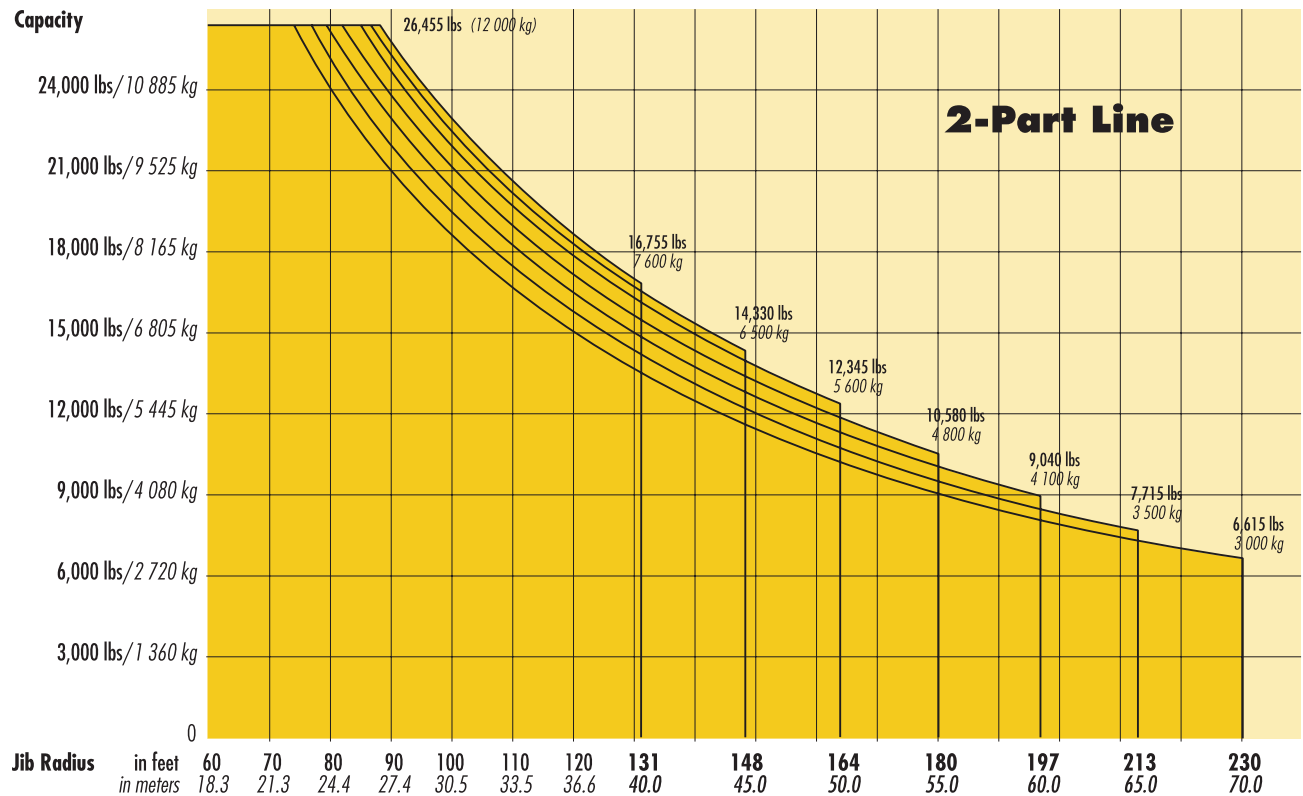
# Hammerhead Tower Crane

## 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	<b>6,615</b> <b>3 000</b>
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	<b>7,715</b> <b>3 500</b>	
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	<b>9,040</b> <b>4 100</b>		
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	<b>10,580</b> <b>4 800</b>				
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	<b>12,345</b> <b>5 600</b>					
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	<b>14,330</b> <b>6 500</b>							
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	<b>16,755</b> <b>7 600</b>									

**2-Part Line**



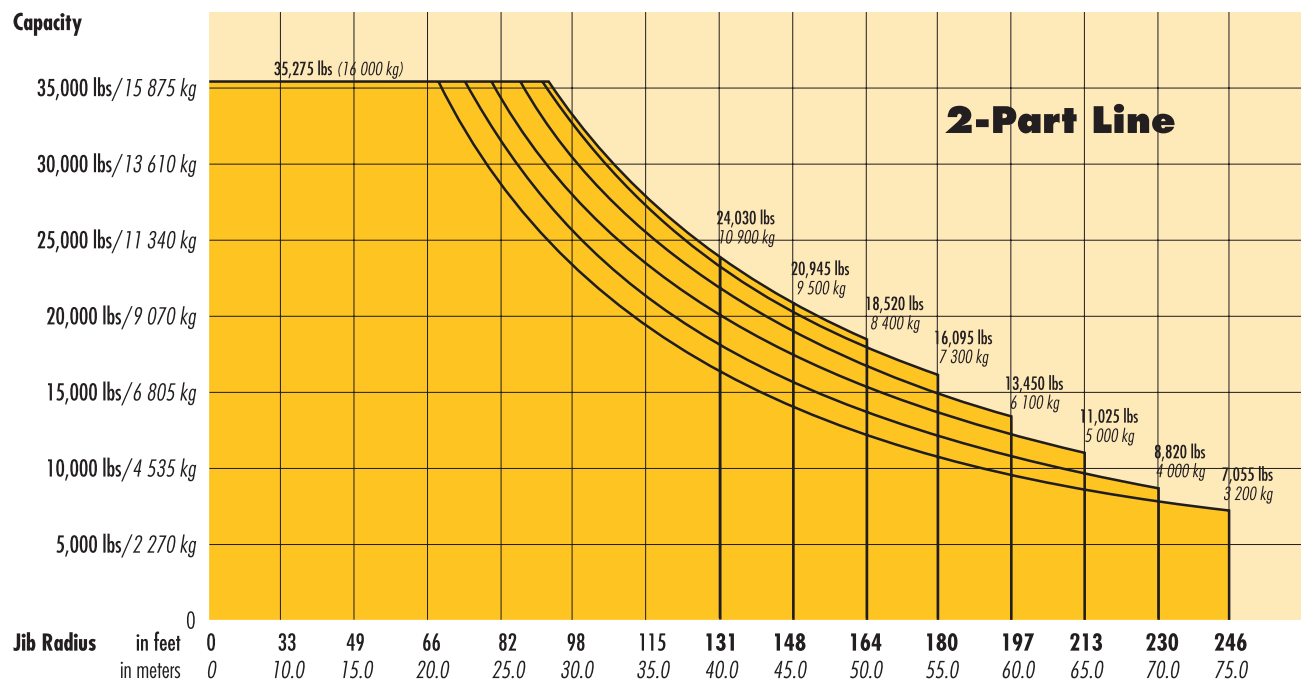
# Hammerhead Tower Crane

## 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	<b>7,055</b> <b>3 200</b>
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	<b>8,820</b> <b>4 000</b>	
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	<b>11,025</b> <b>5 000</b>		
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	<b>13,450</b> <b>6 100</b>			
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	<b>16,095</b> <b>7 300</b>				
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	<b>18,520</b> <b>8 400</b>					
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	<b>20,945</b> <b>9 500</b>						
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	<b>24,030</b> <b>10 900</b>							

**2-Part Line**



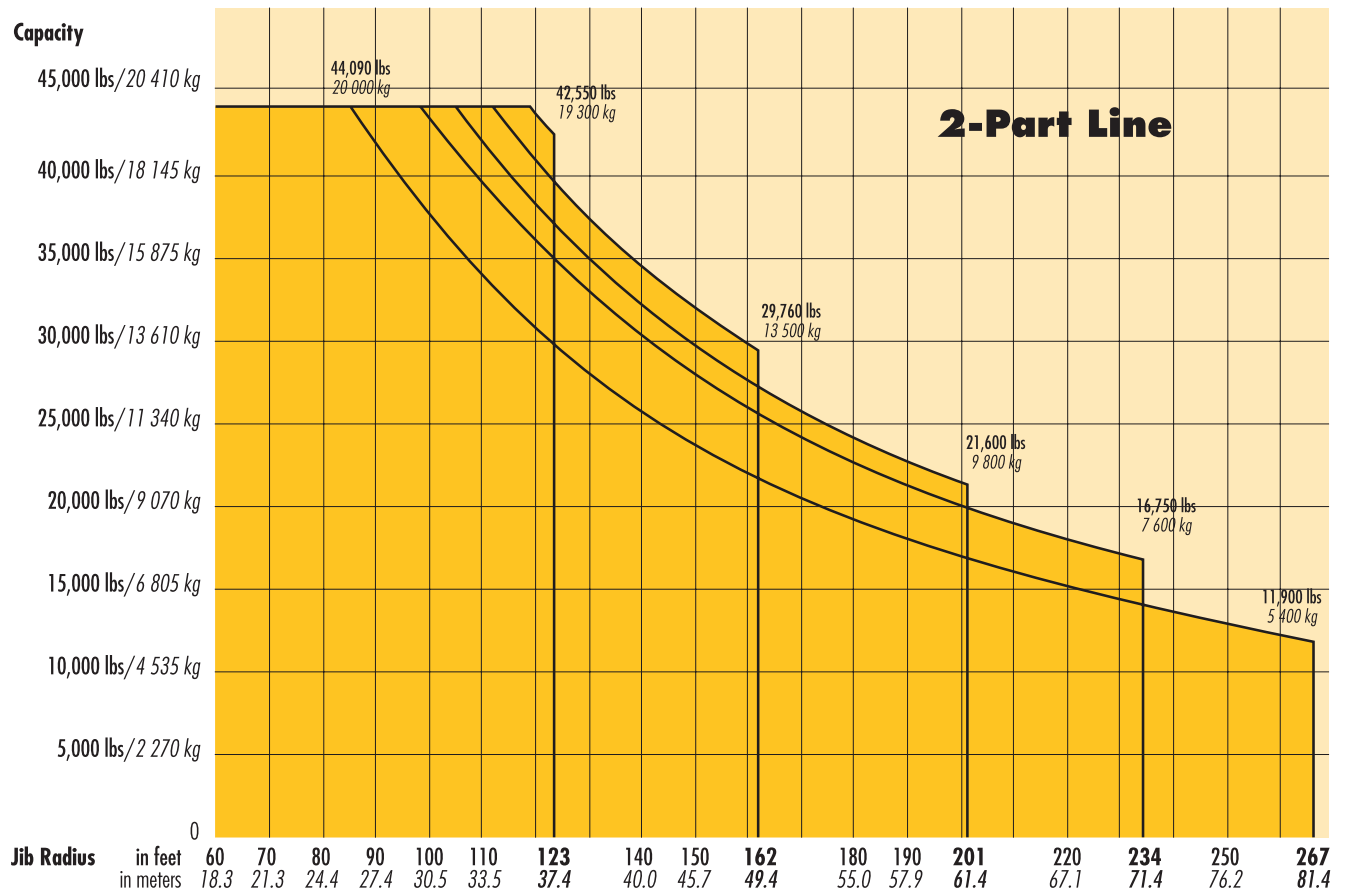
# Hammerhead Tower Crane

## 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**



# Hammerhead Tower Crane

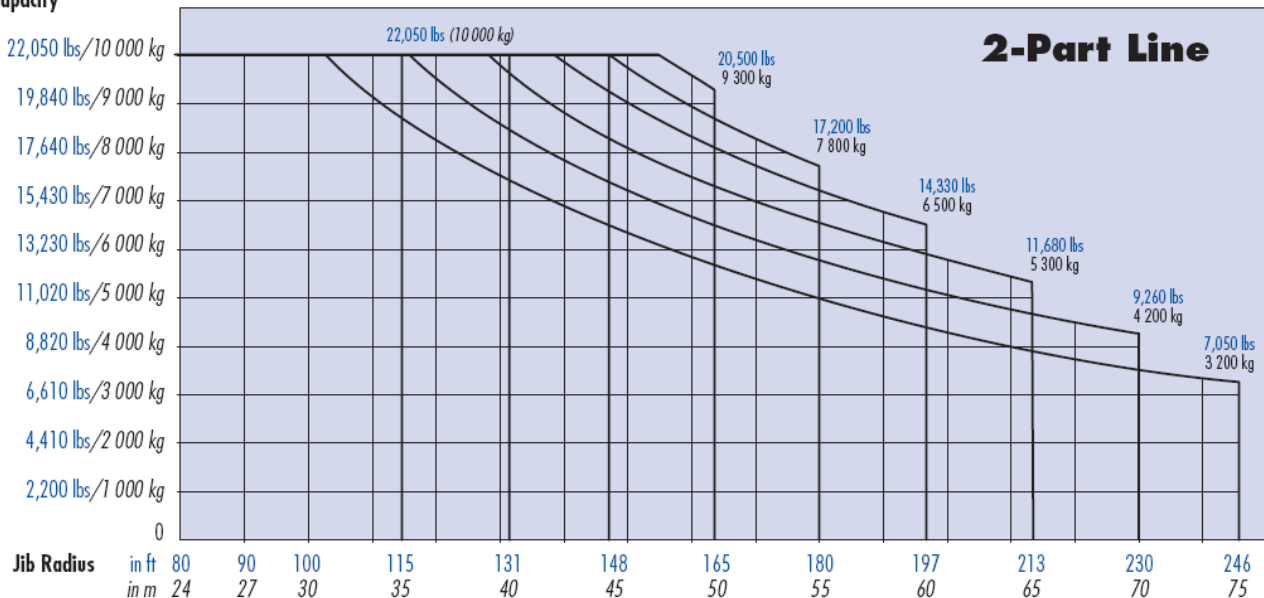
## Chart E

### 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								



### Capacity



# Luffing Boom Tower Crane

## Chart F-1

### Radius and Capacities

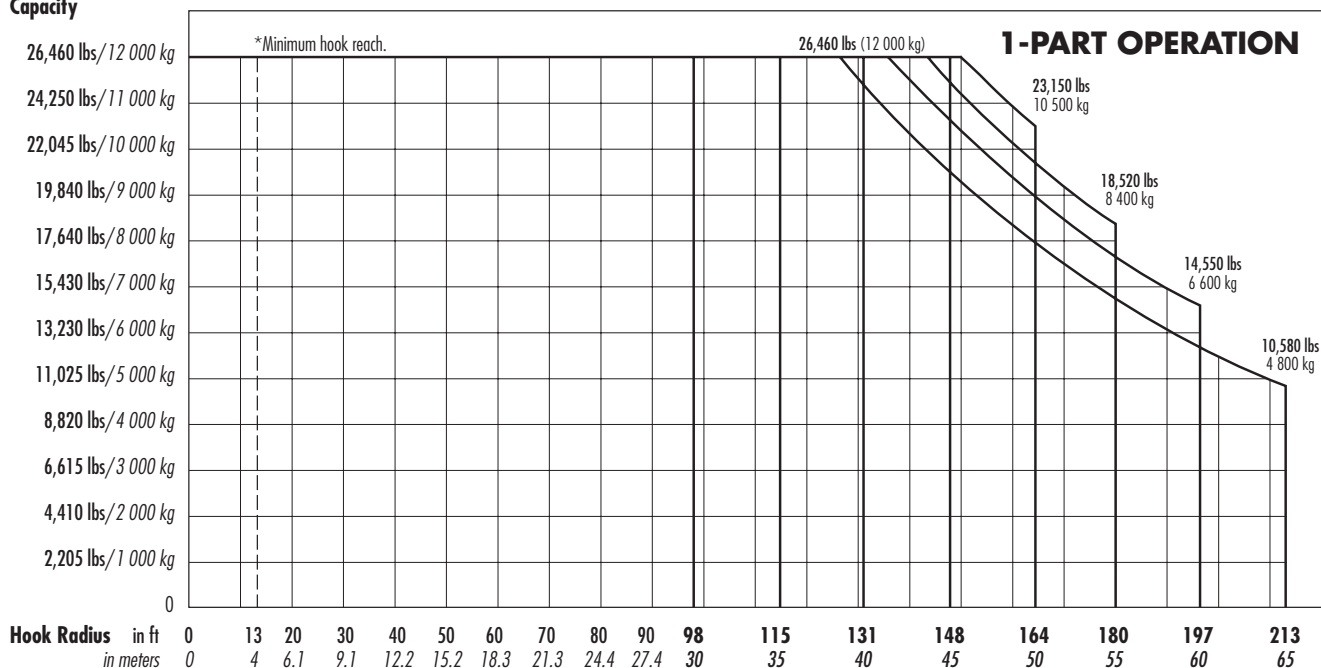
Hook Reach	Maximum Capacity – Radius	ft m	13* 4*	66 20	98 30	107 32.5	115 35	123 37.5	131 40	139 42.5	148 45	156 47.5	164 50	172 52.5	180 55	189 57.5	197 60	205 62.5	213 65
213 ft 65m	26,460 lbs – 127 ft 12 000 kg – 38.8m	lbs kg	26,460 12 000	26,460 12 000	26,460 12 000	26,460 12 000	26,460 12 000	26,460 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**



### Capacity



# Luffing Boom Tower Crane

## Chart F-2

### Radius and Capacities

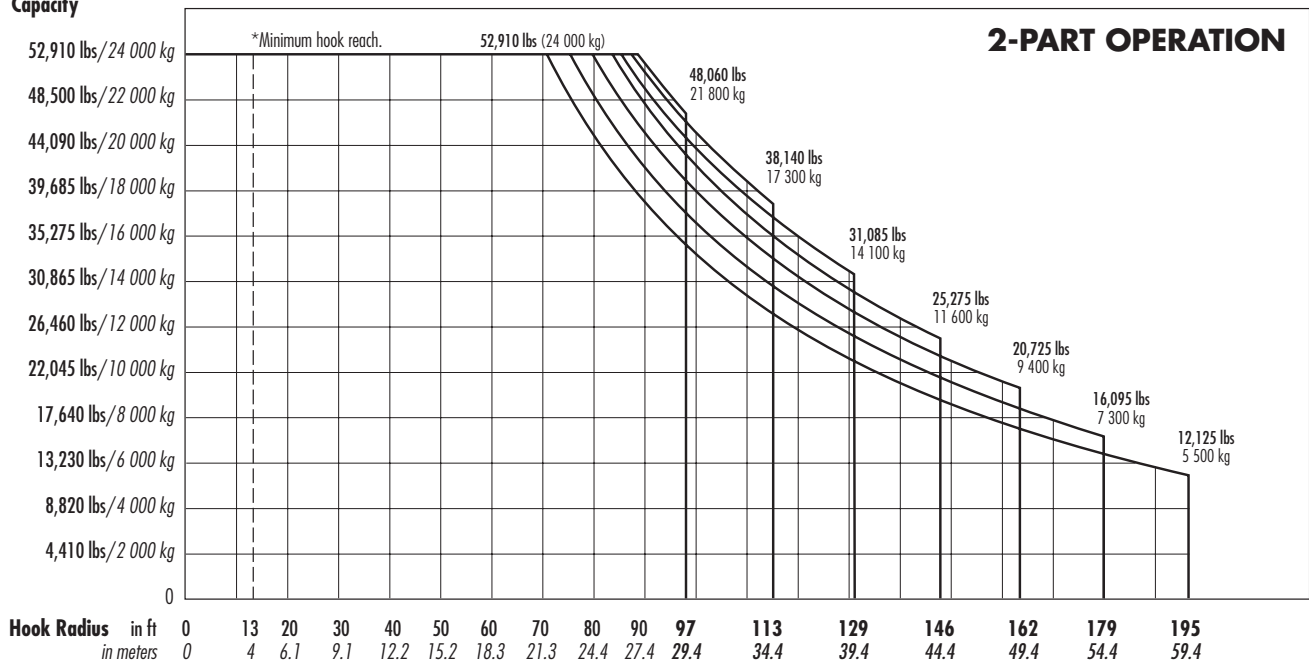
Boom Length	Hook Reach	Maximum Capacity – Radius	ft m	13* 4*	82 25	90 27.5	97 29.4	107 32.5	113 34.4	123 37.5	129 39.4	139 42.5	146 44.4	156 47.5	162 49.4	172 52.5	179 54.4	189 57.5	195 59.4
197 ft 60m	195 ft 59.4m	52,910 lbs – 71 ft 24 000 kg – 21.6m	lbs kg	52,910 24 000	43,650 19 800	38,490 17 460	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.

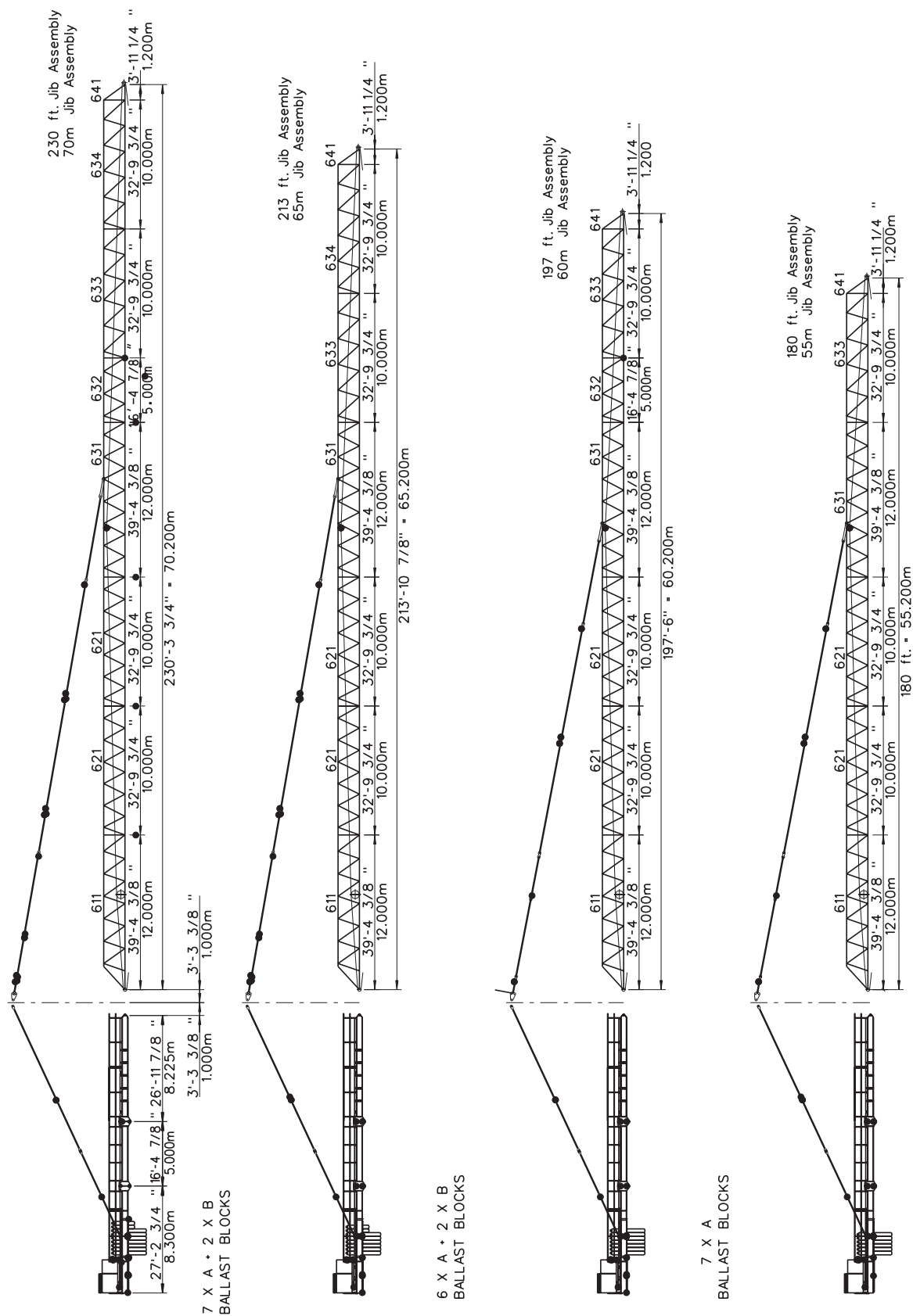
**2-PART OPERATION**



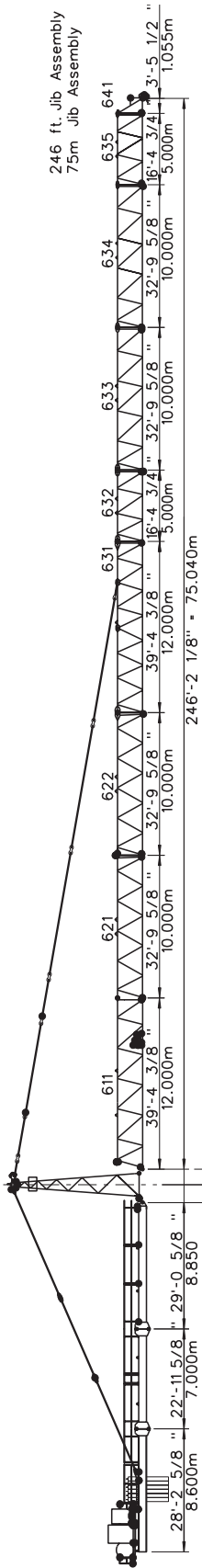
### Capacity



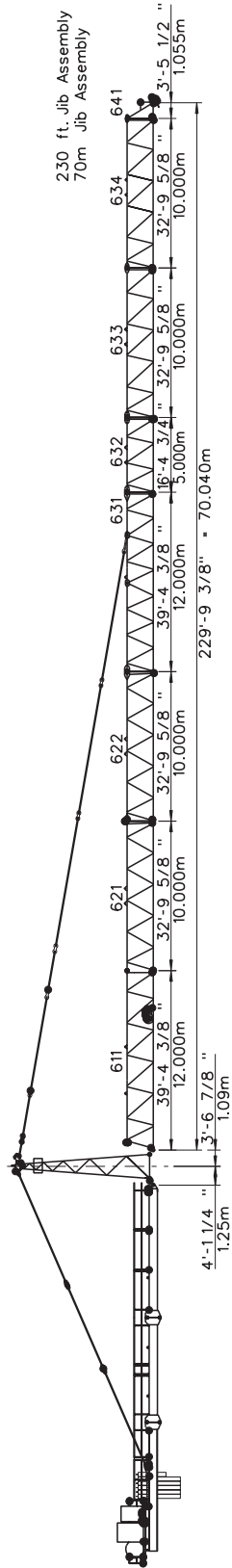




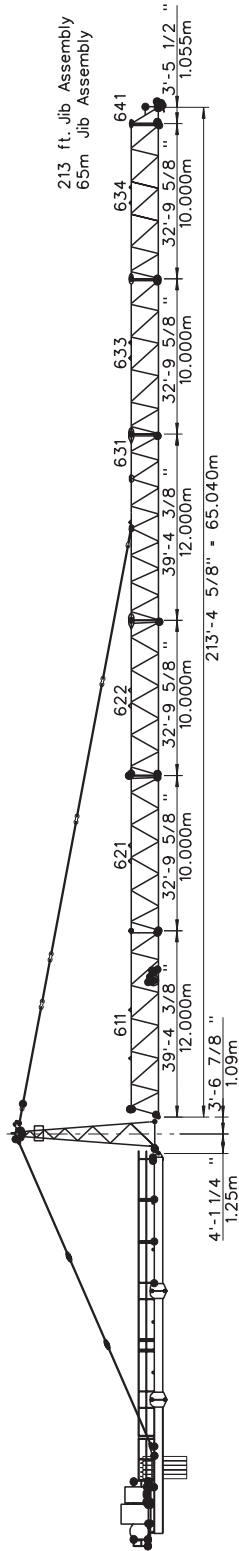
## Jib and Counterjib Configurations Crane B



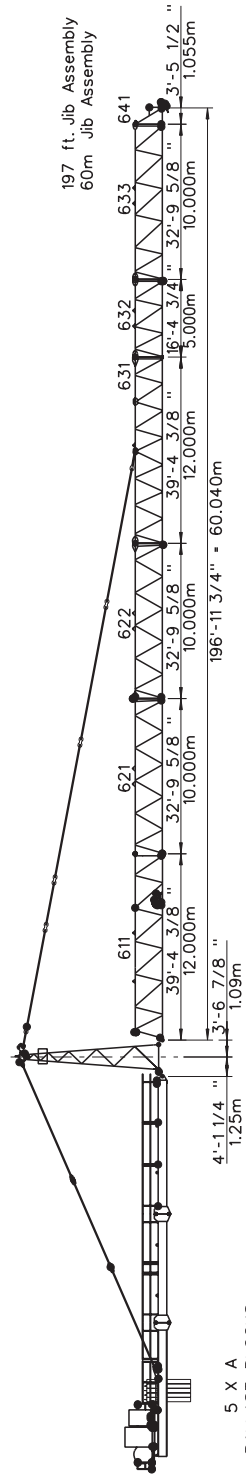
6 X A  
BALLAST BLOCKS



5 X A + 1 X B  
BALLAST BLOCKS

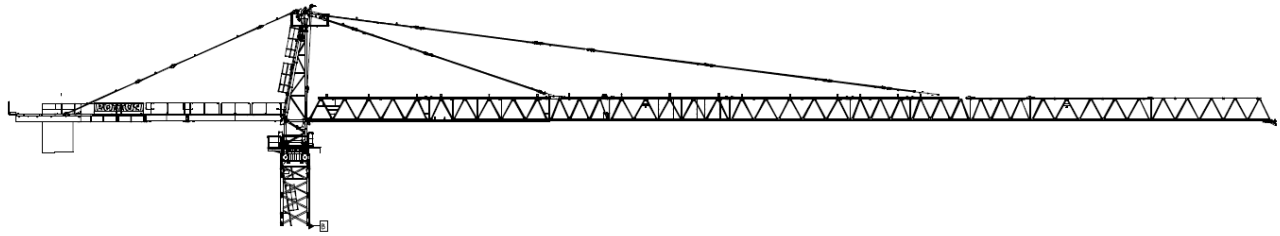


5 X A  
BALLAST BLOCKS



5 X A  
BALLAST BLOCKS

# Counterweight Arrangement A



LENGTH		BLOCK ( kg )			COUNTERWEIGHT FOR CRANE WORK AND TELESCOPING
					 ± 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

# 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 <sup>*)</sup> )  WiW 280 VZ 402 – 2 speed FU <sup>**)</sup> – 65 kW WiW 300 VZ 401 – 3 speed FU <sup>**)</sup> – 110 kW									
81.5 / 82.3	four-part 25.735 m	6xC + 1xA +	b	1xD = 29.04 t →	D	C	C	C	C	C	A
71.5 / 72.3	(two intermediate sections)	5xC + 1xA +	e	1xD = 25.08 t →	D	C	C	C	C	C	A
61.5 / 62.3		4xC + 1xA +	n	1xD = 21.12 t →	D	C	C	C	C	A	
51.5 / 52.3	three-part 20.735 m (one intermediate section)	5xC + 2xA +	e	1xD = 27.96 t →	D	C	C	C	C	C	A
41.5 / 42.3 <sup>!)</sup>		4xC + 2xA +	a	1xD = 24.00 t →	D	C	C	C	C	A	A
35.9 / 36.7 <sup>!*)</sup>		4xC	t	1xD = 18.24 t →	D	C	C	C	C		
29.8 / 30.6 <sup>!*)</sup>	two-part 15.735 m (without intermediate section)	5xC +	h	1xD = 22.20 t →	D	C	C	C	C	C	
24.3 / 25.1 <sup>!*)</sup>		3xC + 1xA +	f	1xD = 17.16 t →	D	C	C	C	A		

<sup>\*)</sup> – Special jib → only load moment curve LM 1.

<sup>!)</sup> – Install wind sail, see chapter 3.

<sup>\*\*\*)</sup> – Frequency converter.



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



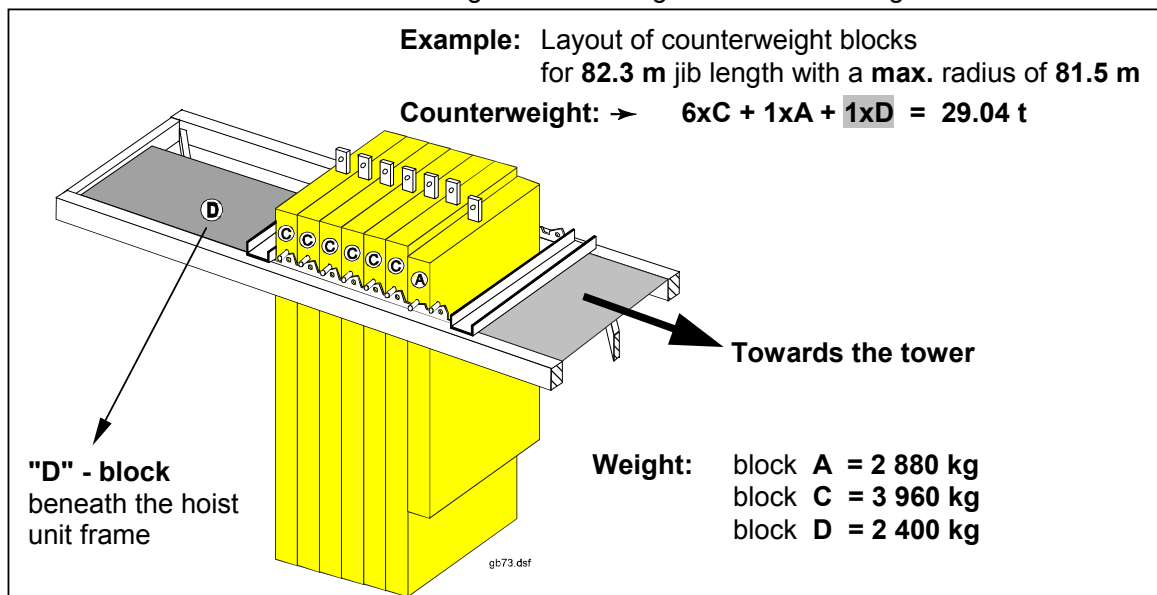
**The counterweight blocks must be installed across the opening, starting at the rear or farthest point from the crane tower !**

**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/m<sup>3</sup>.

**Recommendation** → Weigh the blocks again before installing.



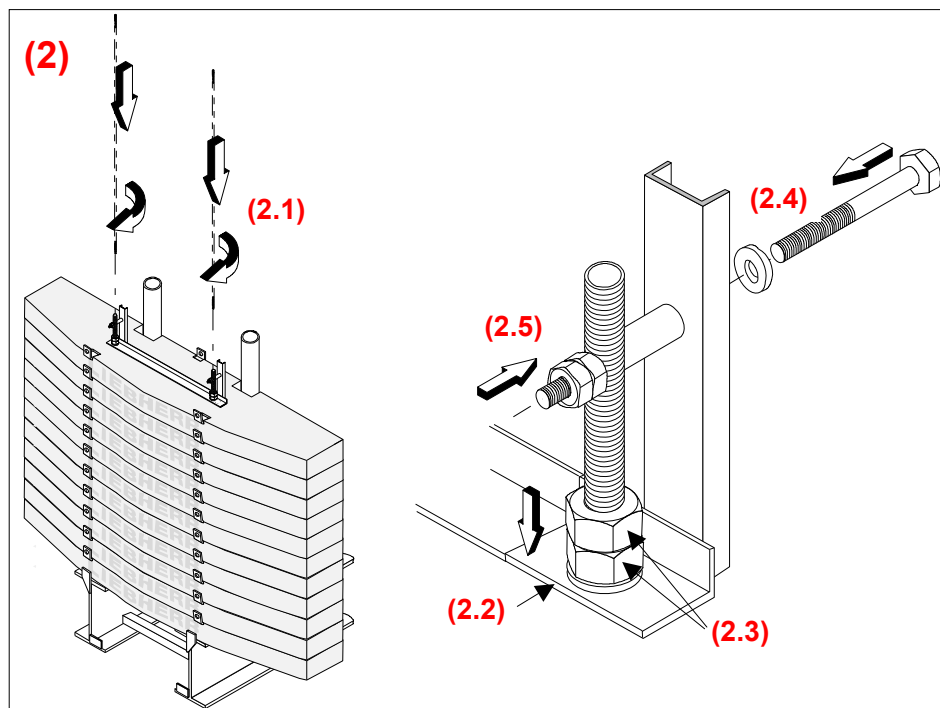
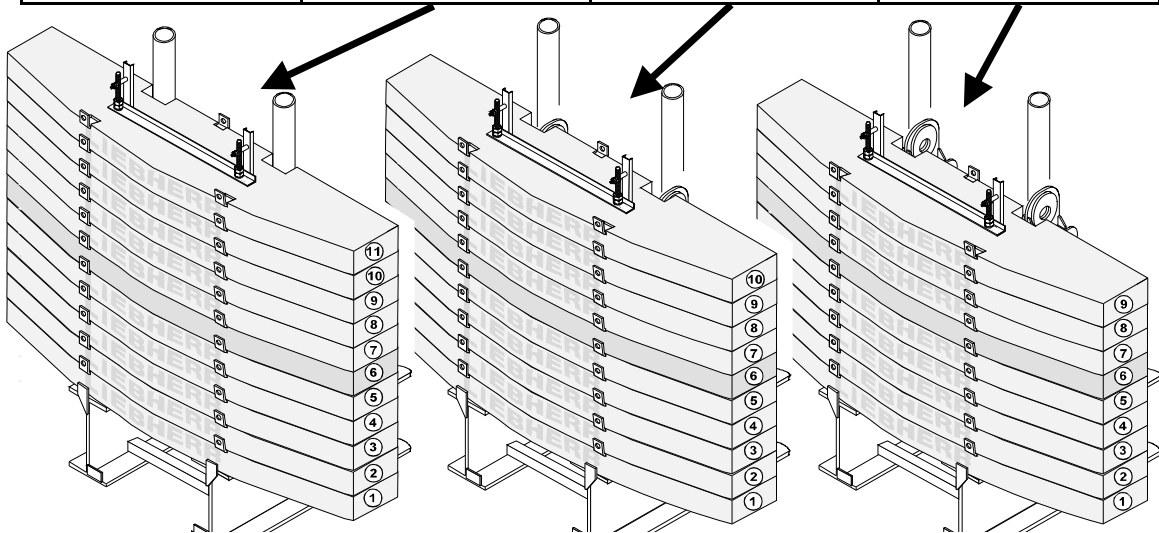
# Counterweight Arrangement C

## Installing the counterweight (steel counterweight)

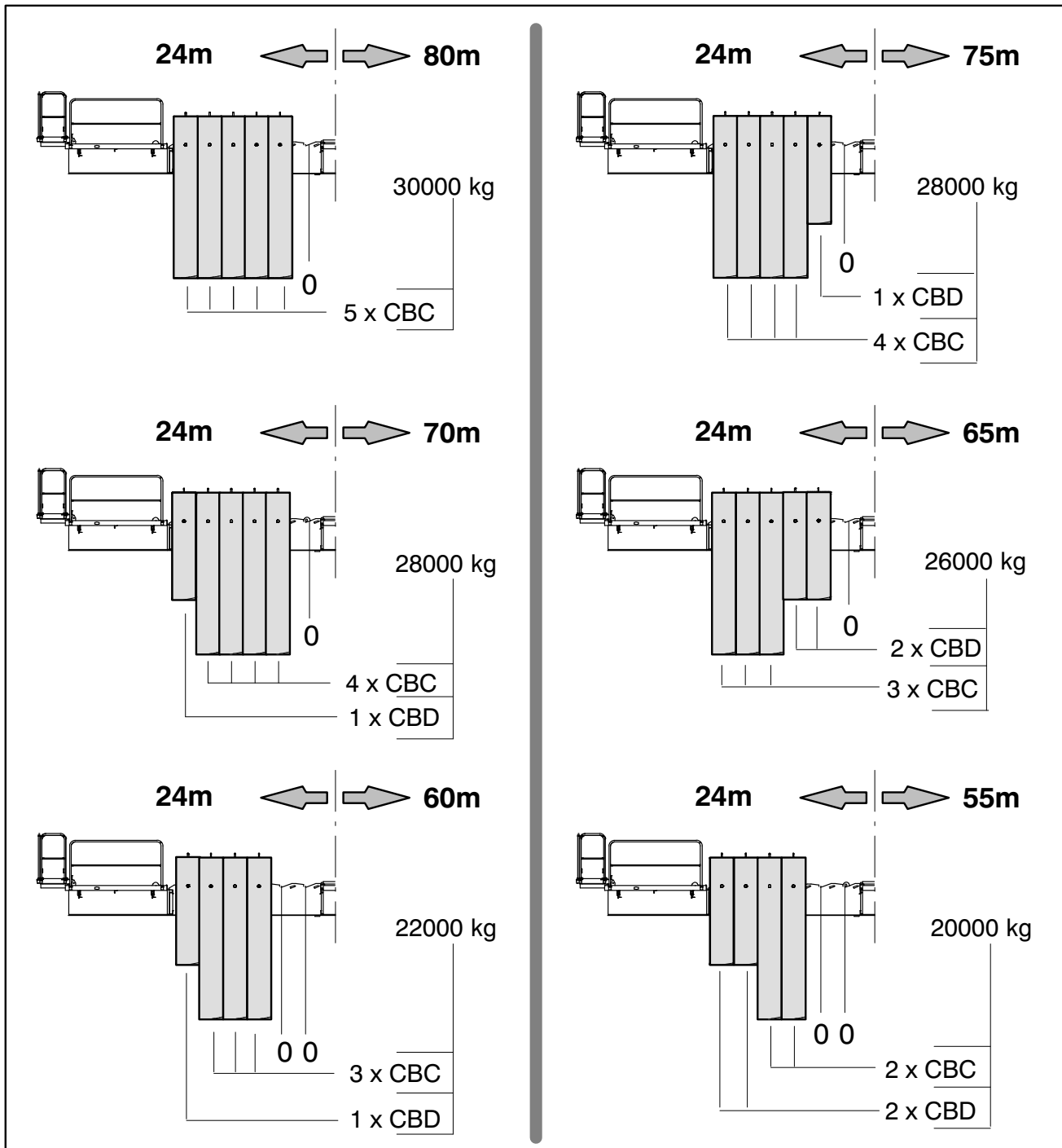


6 counterweight blocks have been placed onto the gear platform and secured before installing the boom!

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



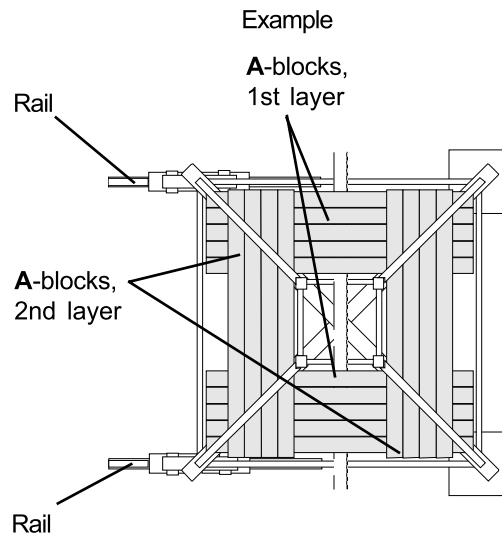
# Counterweight Arrangement D



# 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

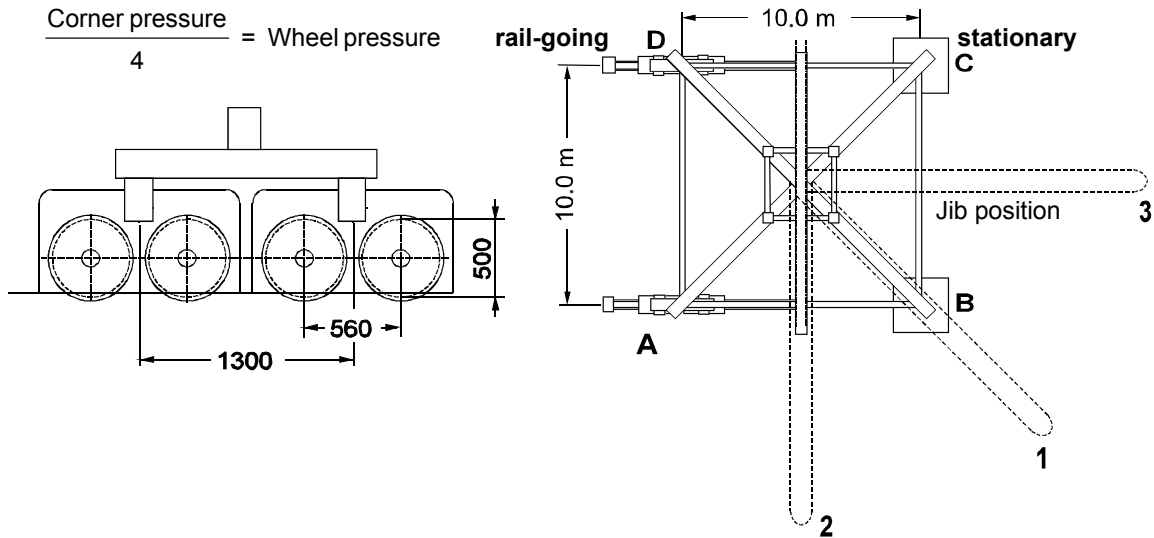


The central ballast blocks must be installed in the prescribed order (refer to the illustration).



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

# Central Ballast Sheet B



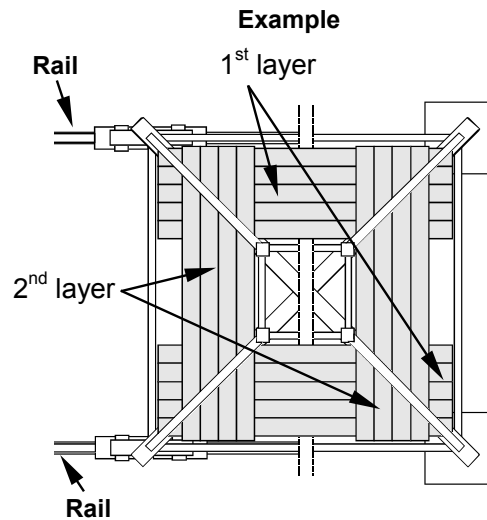
Arrangement of the central ballast blocks:



- 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



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!



# Central Ballast Sheet C

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

Radius: **35.93m**

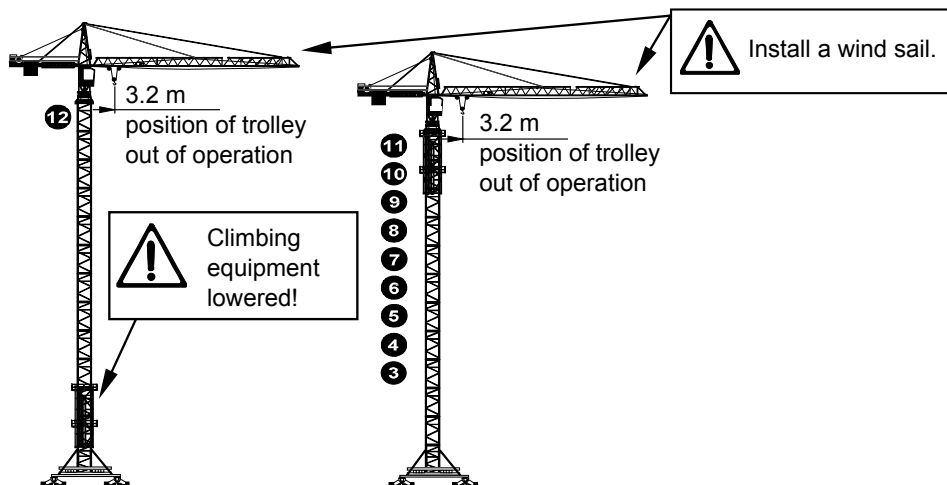
Track: **10.0m**

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				
			Corner	Position of jib			Hor. force [kN]	Corner	Position of jib			Hor. force [kN]
3	28.10	21.600	A	413	664	126	76	A	362	329	394	140
			B	<b>821</b>	737	700		B	324	329	329	
			C	413	163	700		C	362	394	329	
			D	5	90	126		D	<b>399</b>	394	394	
4	33.90	21.600	A	429	686	128	80	A	374	404	344	160
			B	<b>859</b>	775	731		B	<b>429</b>	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	<b>905</b>	815	762		B	<b>518</b>	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	<b>954</b>	883	821		B	<b>641</b>	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	<b>1034</b>	953	882		B	<b>770</b>	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	<b>1104</b>	1025	943		B	<b>906</b>	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	<b>1176</b>	1098	1005		B	<b>1049</b>	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	<b>1281</b>	1199	1095		B	<b>1225</b>	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	<b>1359</b>	1274	1160		B	<b>1414</b>	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	<b>1386</b>	1306	1185		B	<b>1464</b>	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!



# 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 equipment 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.***

# 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																															
Bi-weekly	16	Overload units	I/L																															
			I																															
	1	Hook block and sheaves	I/L																															
	3	Pillow blocks	L																															
Monthly	4	Trolley wheels																																
	5	Slewing brake																																
	10	limit switch drives and switches	I																															
	15	Wire ropes	L																															
Monthly			L																															
	2	Slewing ring ball races	L																															
	7	Slipping 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 slipping)	I																															
	22	Control Panel and electrical cables	I																															
	23	Counterweights	I																															
		Telescopic current supply bars	I																															
		Daily hours of operation																																

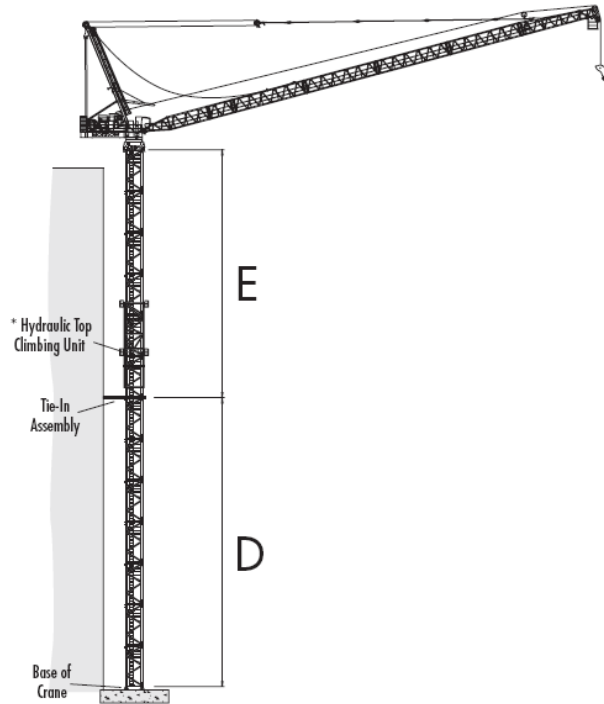
Note! Refer to the lubrication chart and operation manual for information on specific items. Operator: \_\_\_\_\_ Date checked: \_\_\_\_\_ Technician: \_\_\_\_\_

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

# Tie-in Spacing A

## Tie-in configurations

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



### TOP CLIMBING

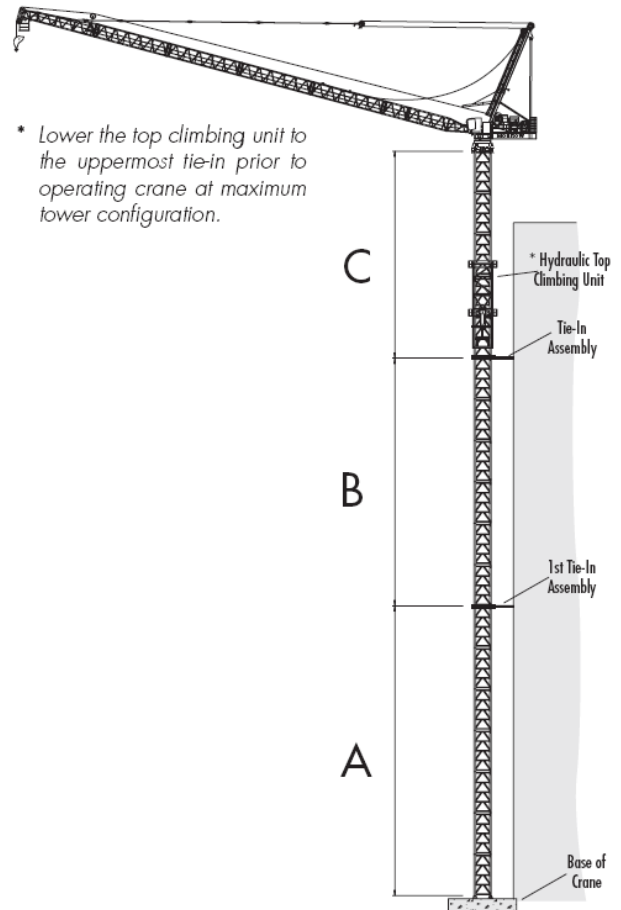
Tied to structure with 1 tie-in

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



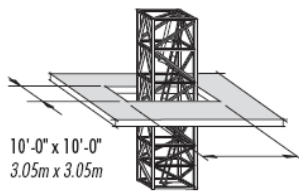
### TOP CLIMBING

Tied to structure with 2 tie-ins

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

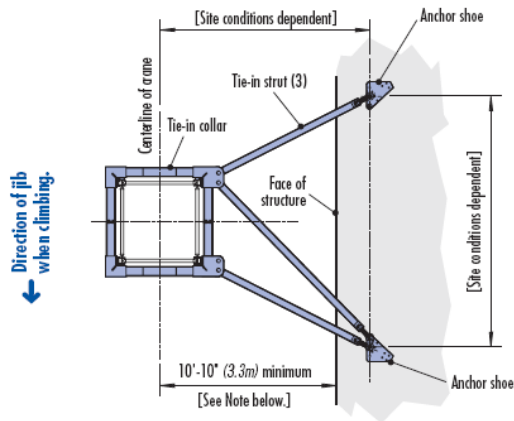
# Tie-in Spacing B

## Tie-in Details

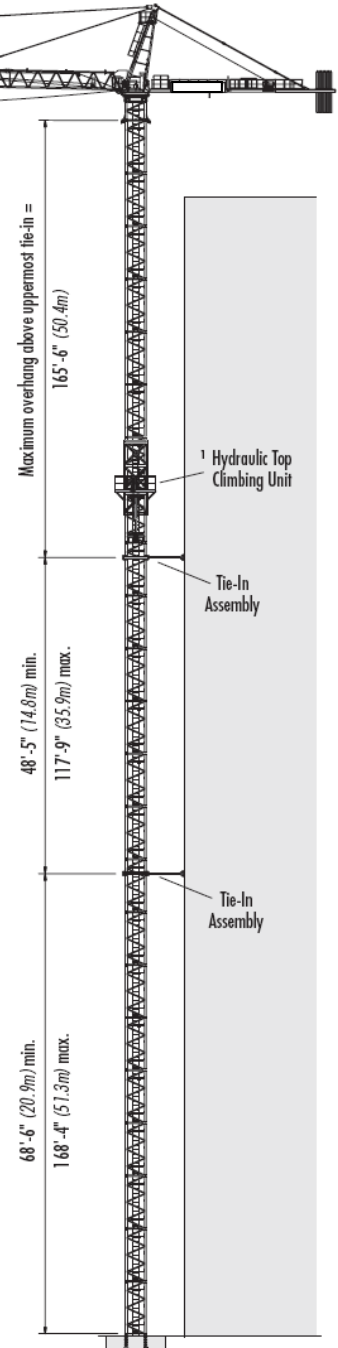


### SLAB OPENING

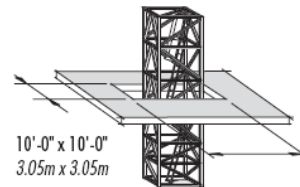
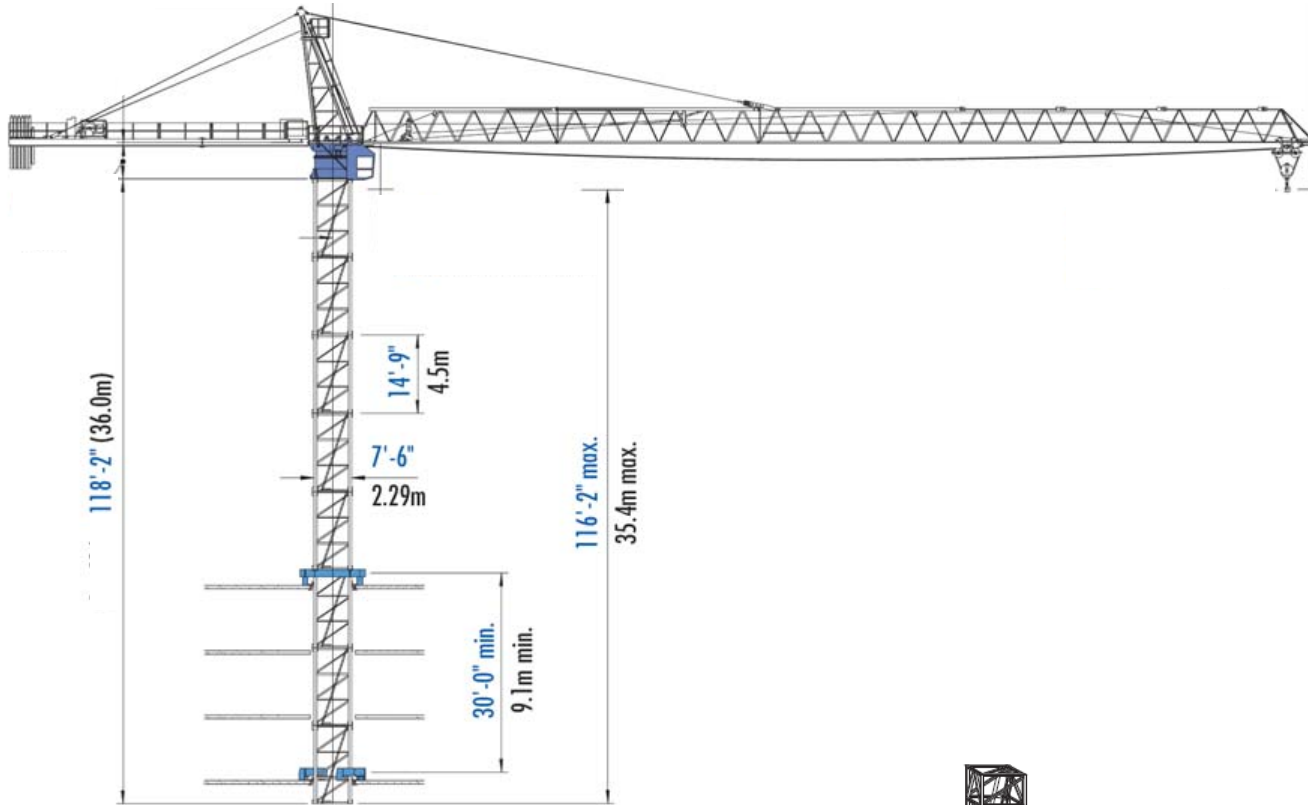
Recommended  
(TS 212/S 35)



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



# Bottom Climbing



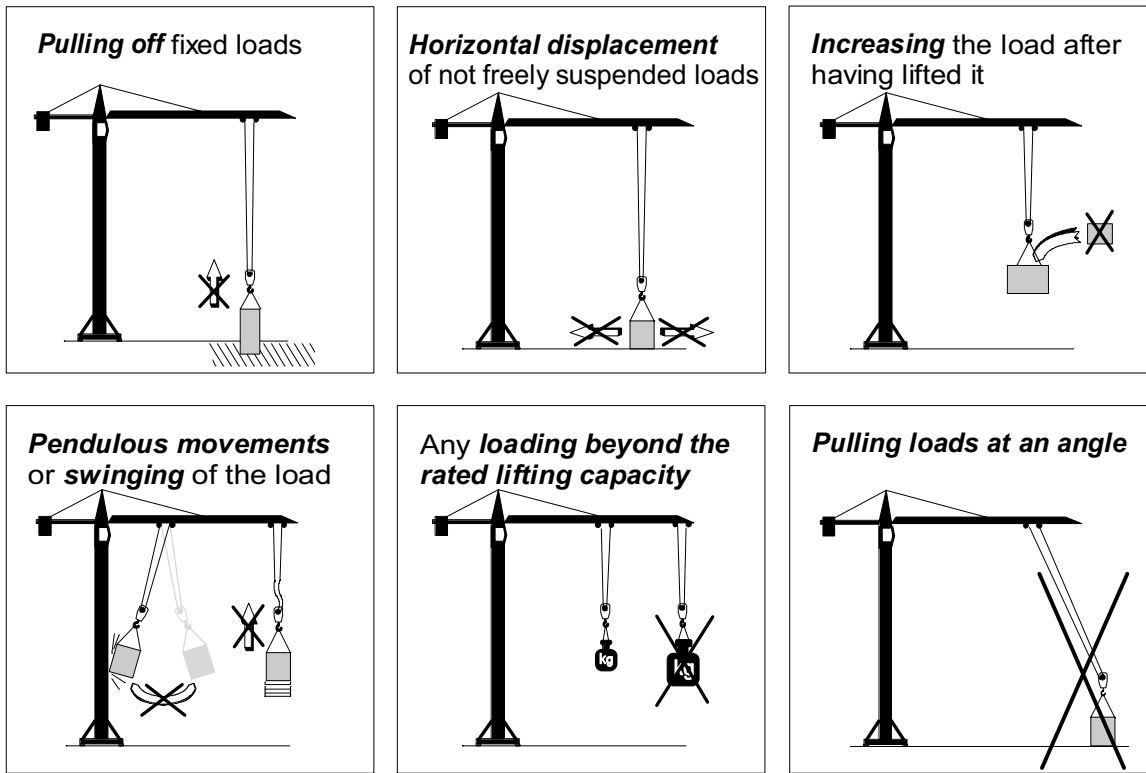
## SLAB OPENING

Recommended  
(TS 212/S 35)




## **Chapter 3: Crane Operations**

- 1** **Avoid** any operation that might be a risk to the **stability** of the crane!  
as for example:



- 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.

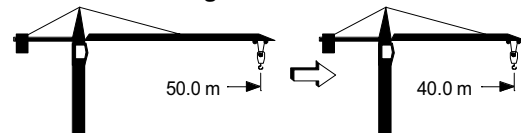
- 3** No **unauthorized** persons are allowed to board the crane.


- 4**  **Do not submit the hoist gear to additional load !**  
Perform gear shifting **only** with the hoist gear at a standstill.

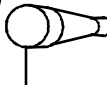
- 5** The overload protection **must not be used** to switch off the hoist gear and trolley travel gear. → **must not be employed as a balance**

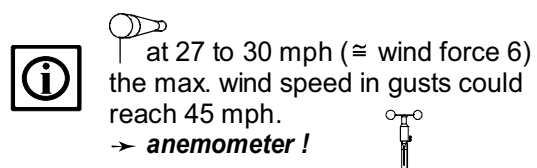


- 6** When changing the operating mode of the crane, reset the **overload cut-outs** to the **new lifting capacity** or **load moment ranges**.



- 7**  Safety devices (limit switches):  
→ **do not bridge them !**  
→ **do not change their setting !**

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





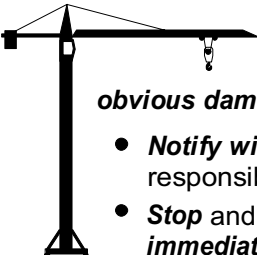
## Operating instructions

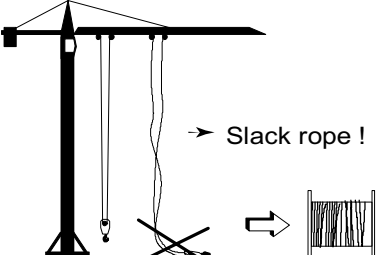
Sheet 2 of 4

- 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**.

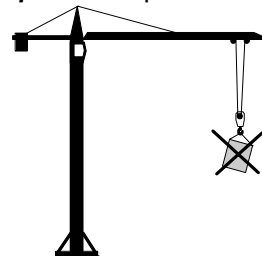
- 11** Before beginning work, make yourself familiar with the circumstances of the site.
- ➔ **obstacles** in the working and travelling area?
  - ➔ required barriers separating the construction site from public roads?

- 12**  daily
- obvious damage and defects:**
- **Notify without delay** the responsible person
  - **Stop and secure** the crane **immediately**

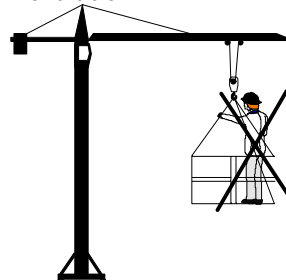
- 13** **Do not land** the hook block.
- 
- ➔ Slack rope !

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

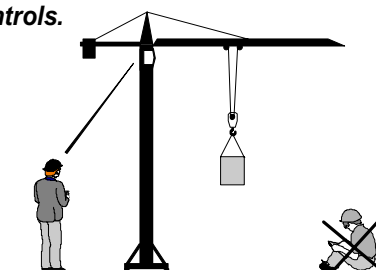
- 15** **Slinging** of loads should be entrusted to **experienced** persons only.



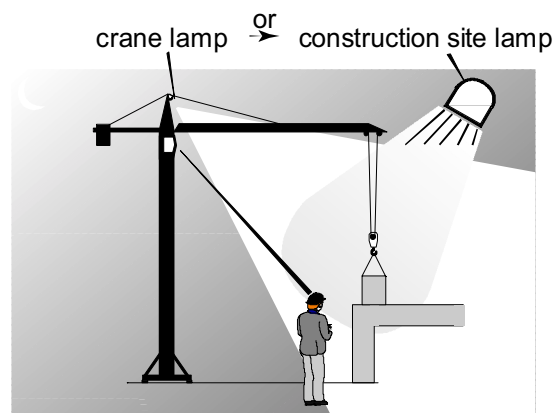
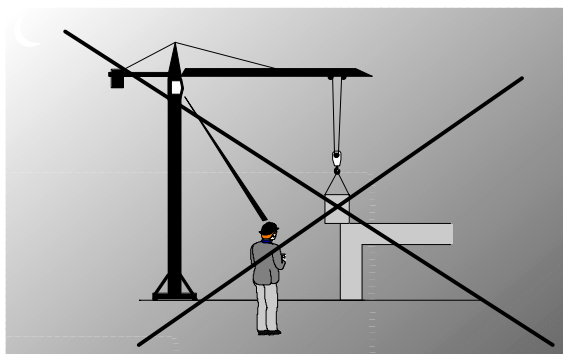
- 16** The **carriage** of persons with the load is **forbidden**.



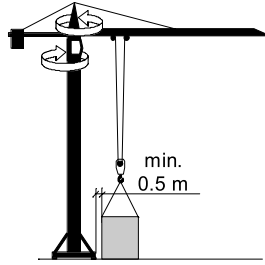
- 17** Whenever a load is suspended from the hook, the operator must **remain at the controls**.



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



## 19 Maintain the safety distance:



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

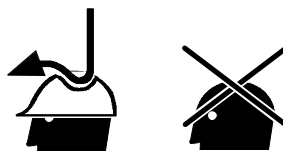
## 21 Uncontrolled movement

The response to uncontrolled movement is to engage the emergency stop button on the remote or control 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**.

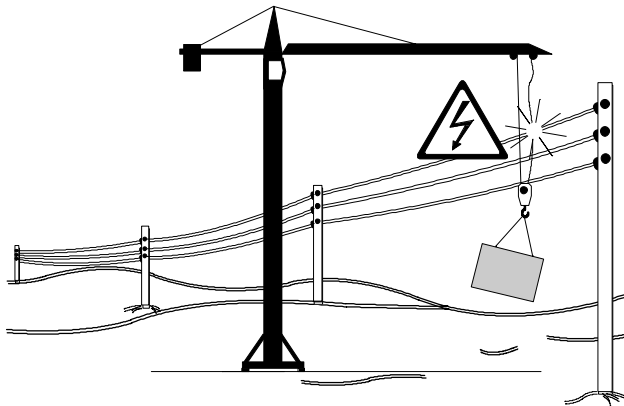
## 24 **WARNING: Suspended loads**



25



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

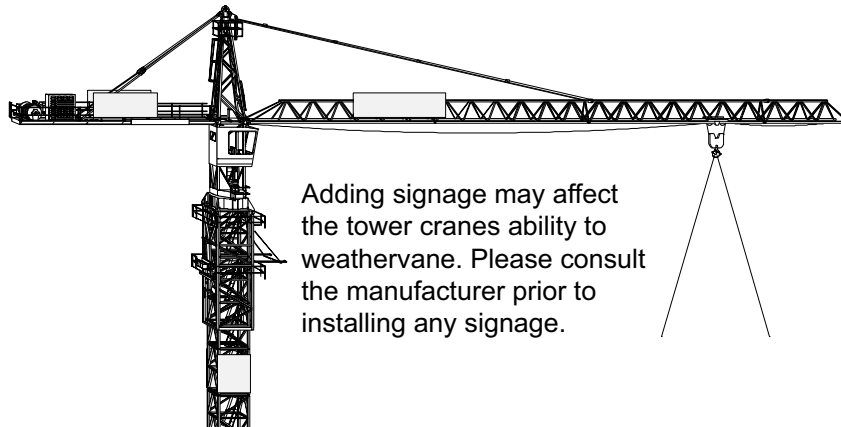


- Do not leave the tower crane.
- Do not touch the steel construction of the tower crane.
- If practicable, drive the crane out of the hazard zone.
- Warn others against approaching and touching the crane.
- Arrange to have the power switched off in the contacted / damaged line.
- Do not leave the tower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

26



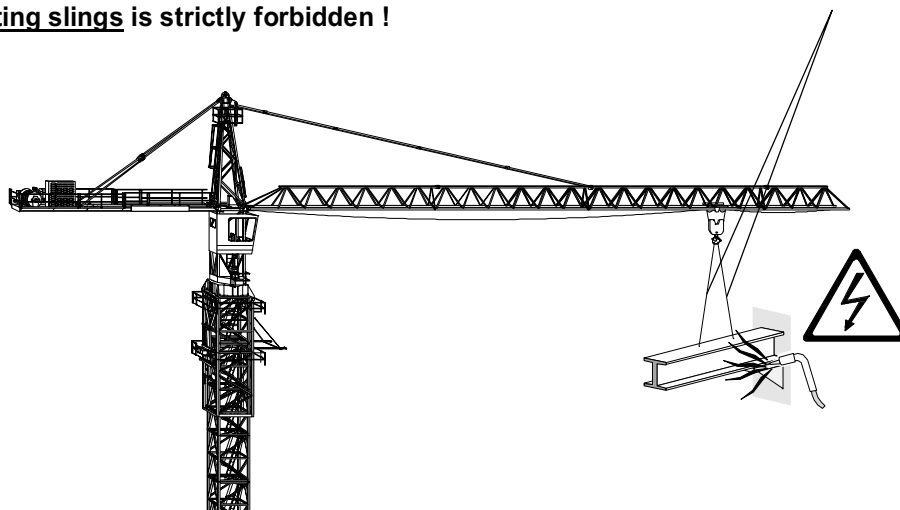
Do not make any changes, install or modify anything without permission from the manufacturer ! (e.g.: welding work on structural steelwork, putting up advertisement boards, or anchoring jibs)



27



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





## Daily Inspections

Sheet 1 of 1

Switchgear cabinet

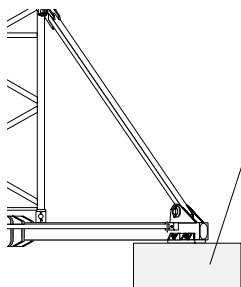
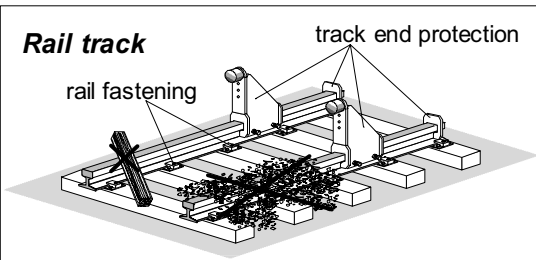


**nominal voltage** supplied?

**Rail track**

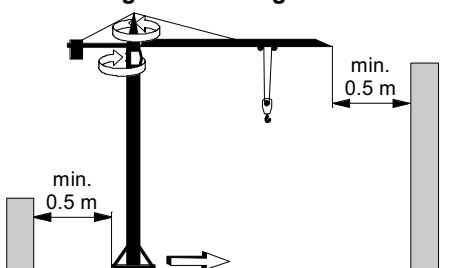
rail fastening

track end protection



**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!**

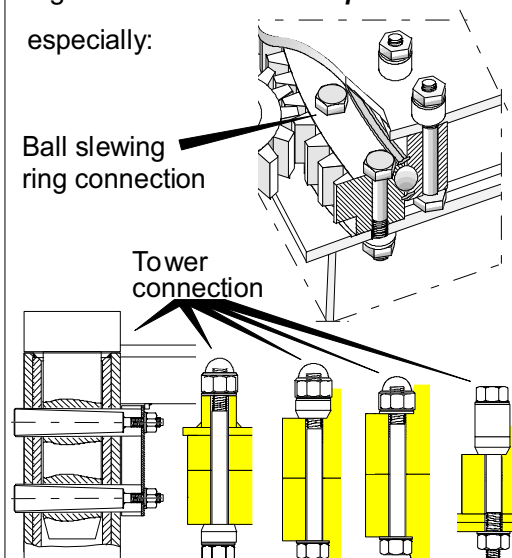
Are all **open gear wheels** lubricated?

Tightness of all **bolts and pins**

especially:

Ball slewing ring connection

Tower connection



**Ropes**

correctly reeved?



Ropes run correctly in the rope pulleys?

**Rope pulley grooves**

free from hardened grease?

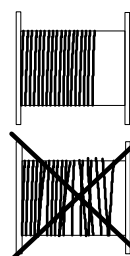
well-greased?



damaged?



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

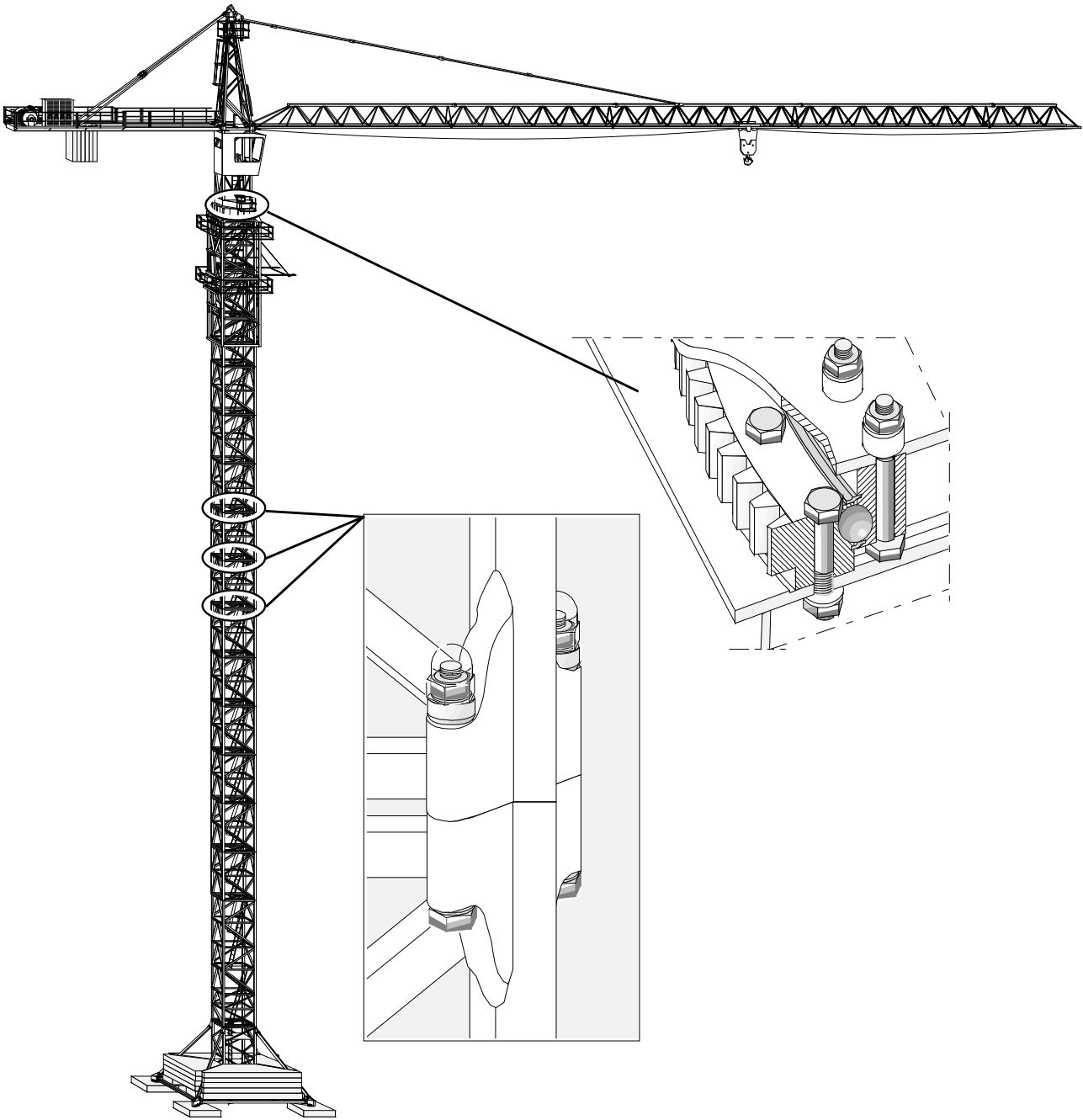


**Required maintenance work** performed?



## **Chapter 4: Bolting Procedures**

# Prestressed High-Tensile Strength Bolt Connections



## 1. General on high-tensile strength bolt connections



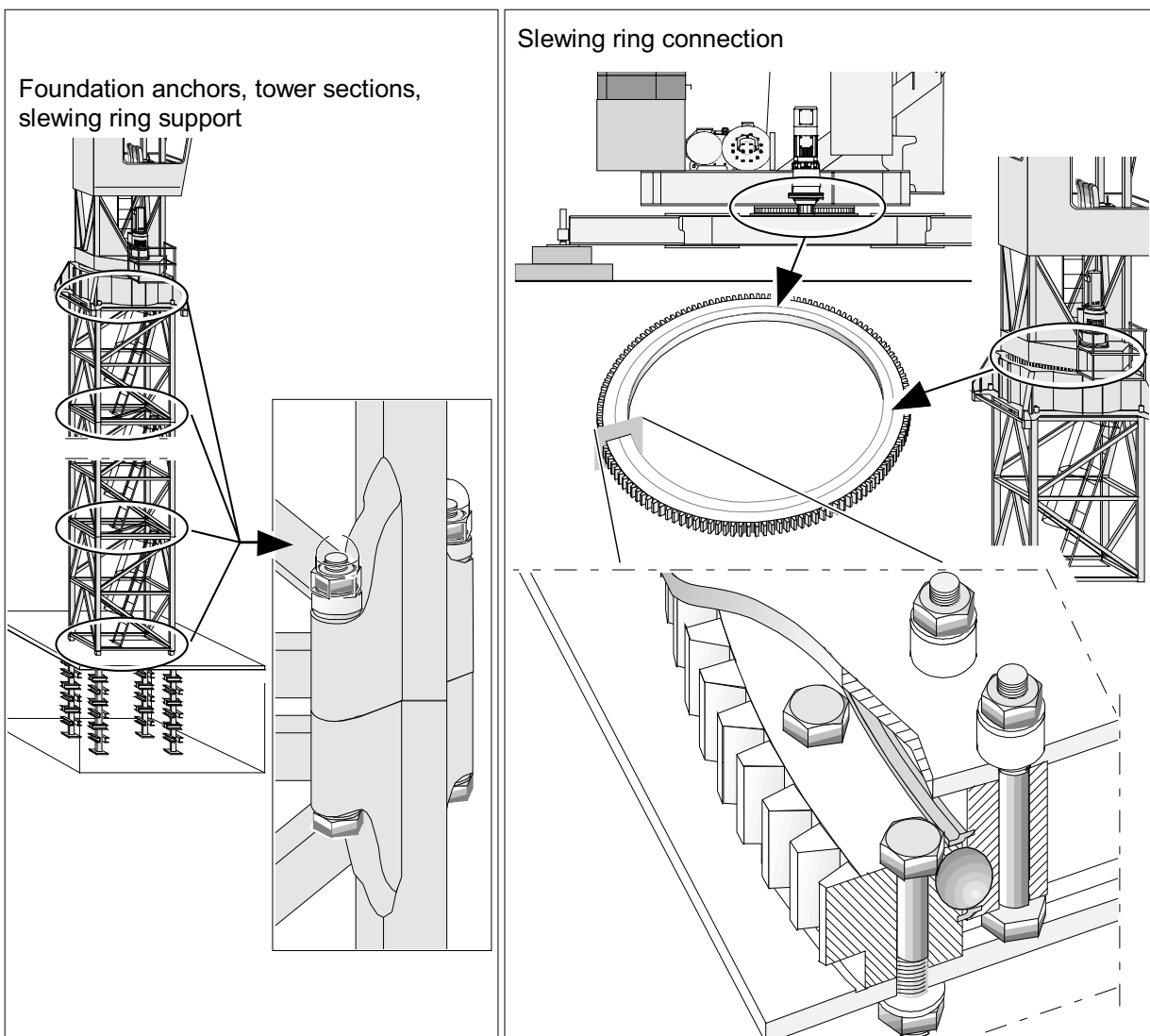
When correct, prestressed high-tensile bolts can transmit big (external) tensile forces in the direction of the bolt axis. The preload of the bolt is increased only slightly. This has a favourable effect on the fatigue strength especially in case of alternating loads. For that reason it is of importance,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

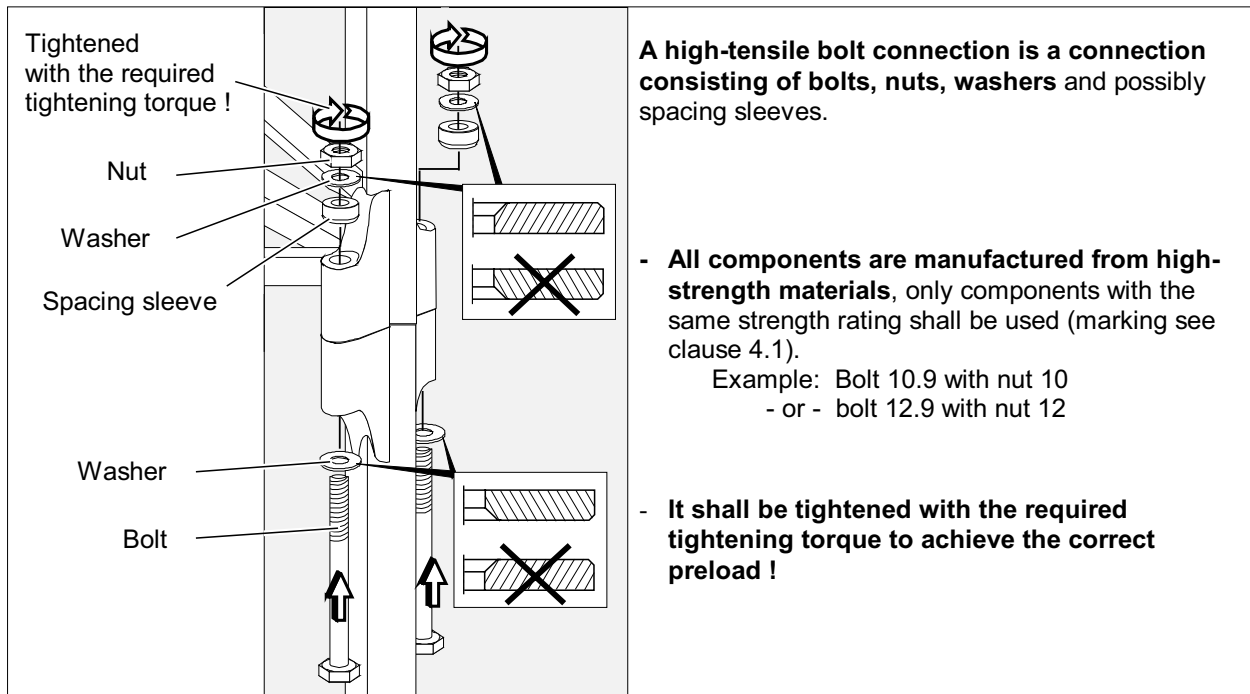
Task of high-tensile bolt connections:

**Connecting components and transmitting forces !**

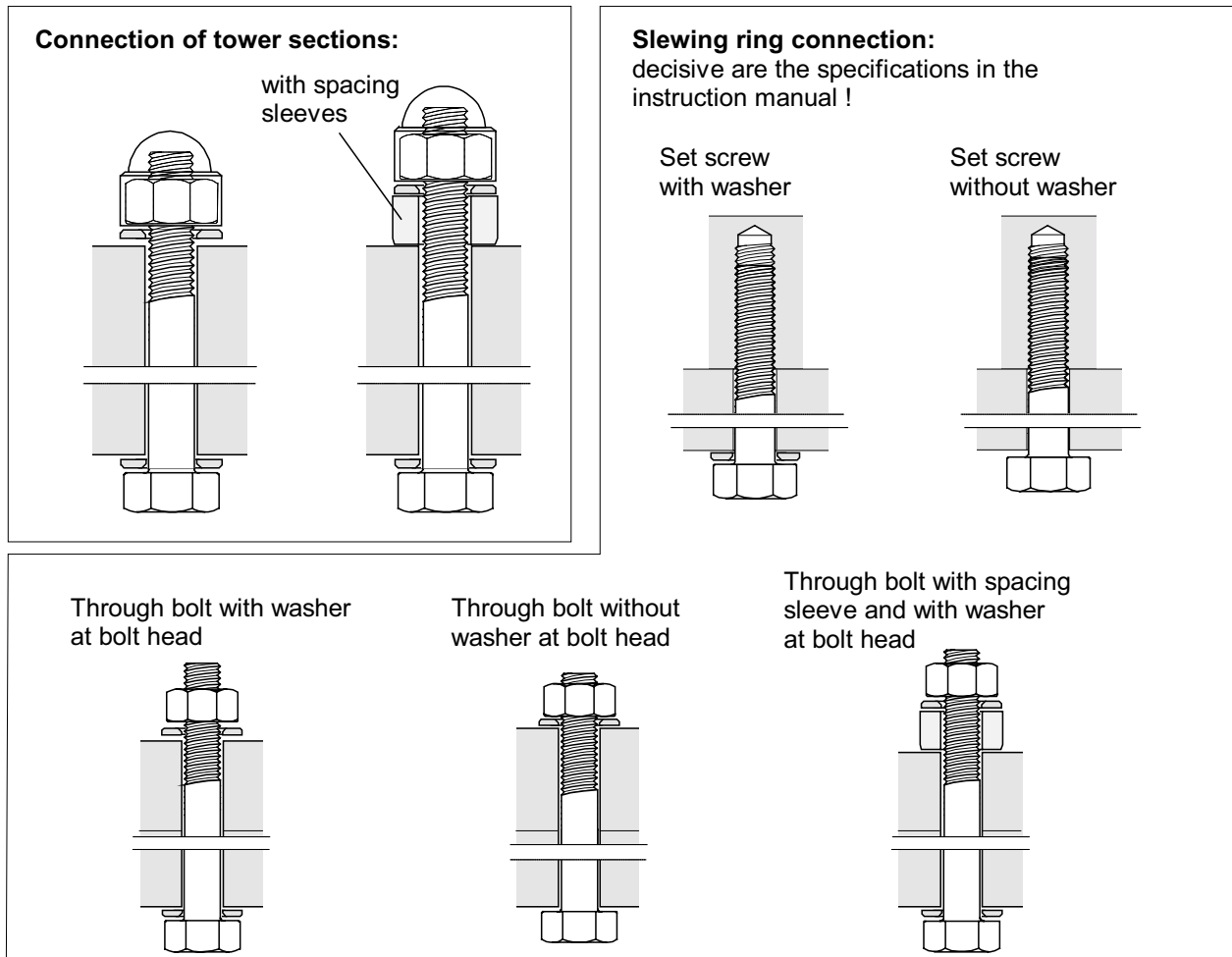
**Essentially these are the following components:**



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



## 3. Different kinds of high-tensile strength bolt connections





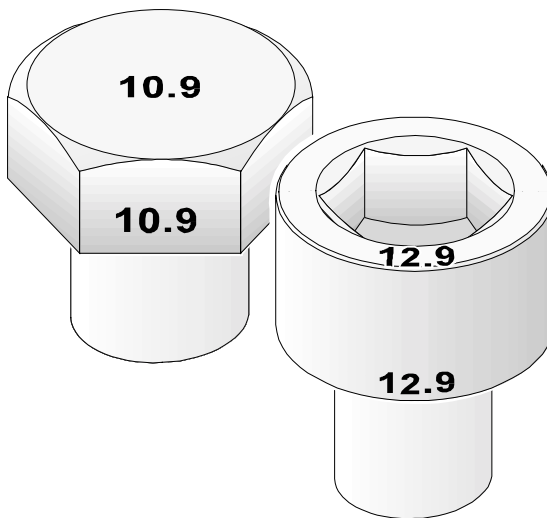
## 4. Components and marking of a high-tensile strength bolt connection

### 4.1 Marking

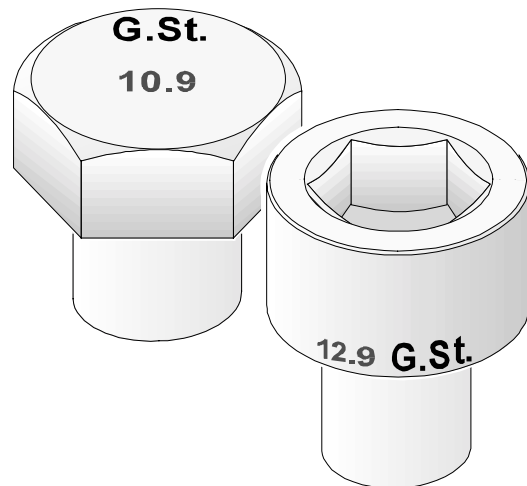
All components are specifically marked. The grade and marking requirements result from national and international standards.

### 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.



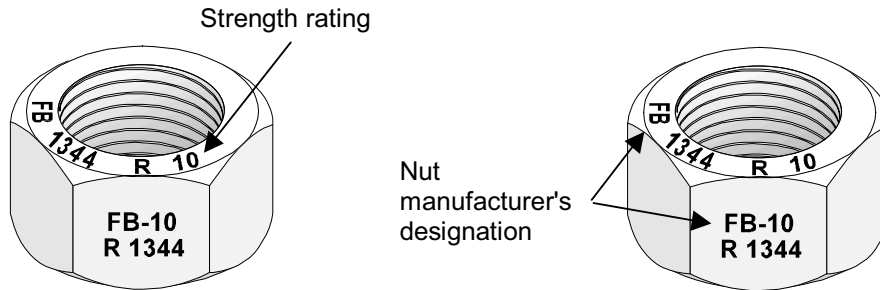
In addition, bolts shall be marked with the bolt manufacturer's designation. This designation generally appears near the strength rating identification.



### 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 its 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

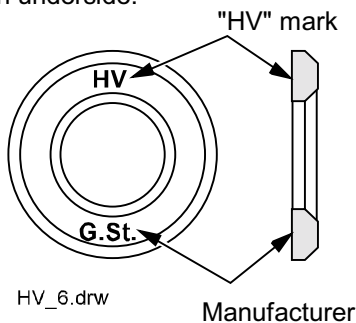
Since there is not yet an ISO standard for washers, washers manufactured in Germany for use on high-tensile bolt connections are marked "HV".



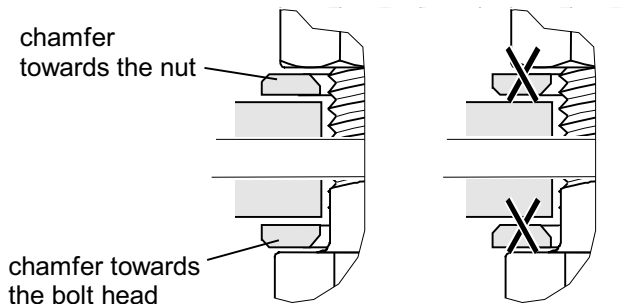
**For high-tensile strength bolt connections only washers with "HV" marking shall be used AND always make sure that its execution matches that of the bolt and the nut!**

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

on underside:



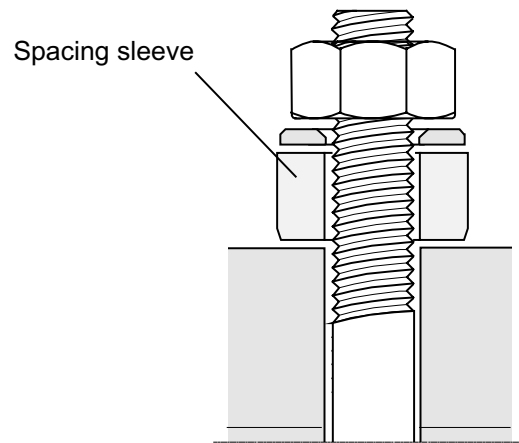
**Observe the correct fitting !**



## 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.**



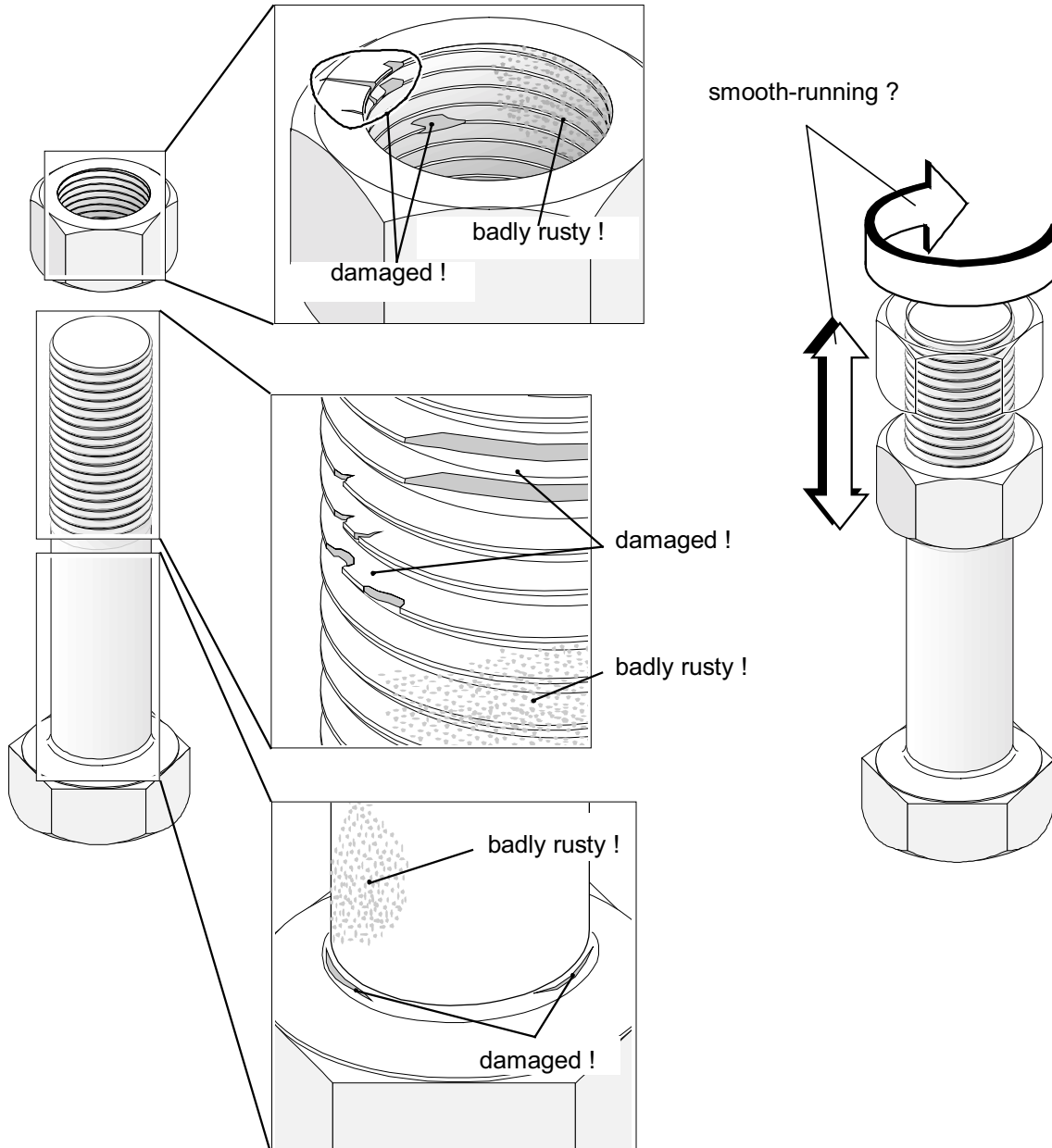
## 5. Inspecting high-tensile strength bolt connection components before installation

### 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 !**

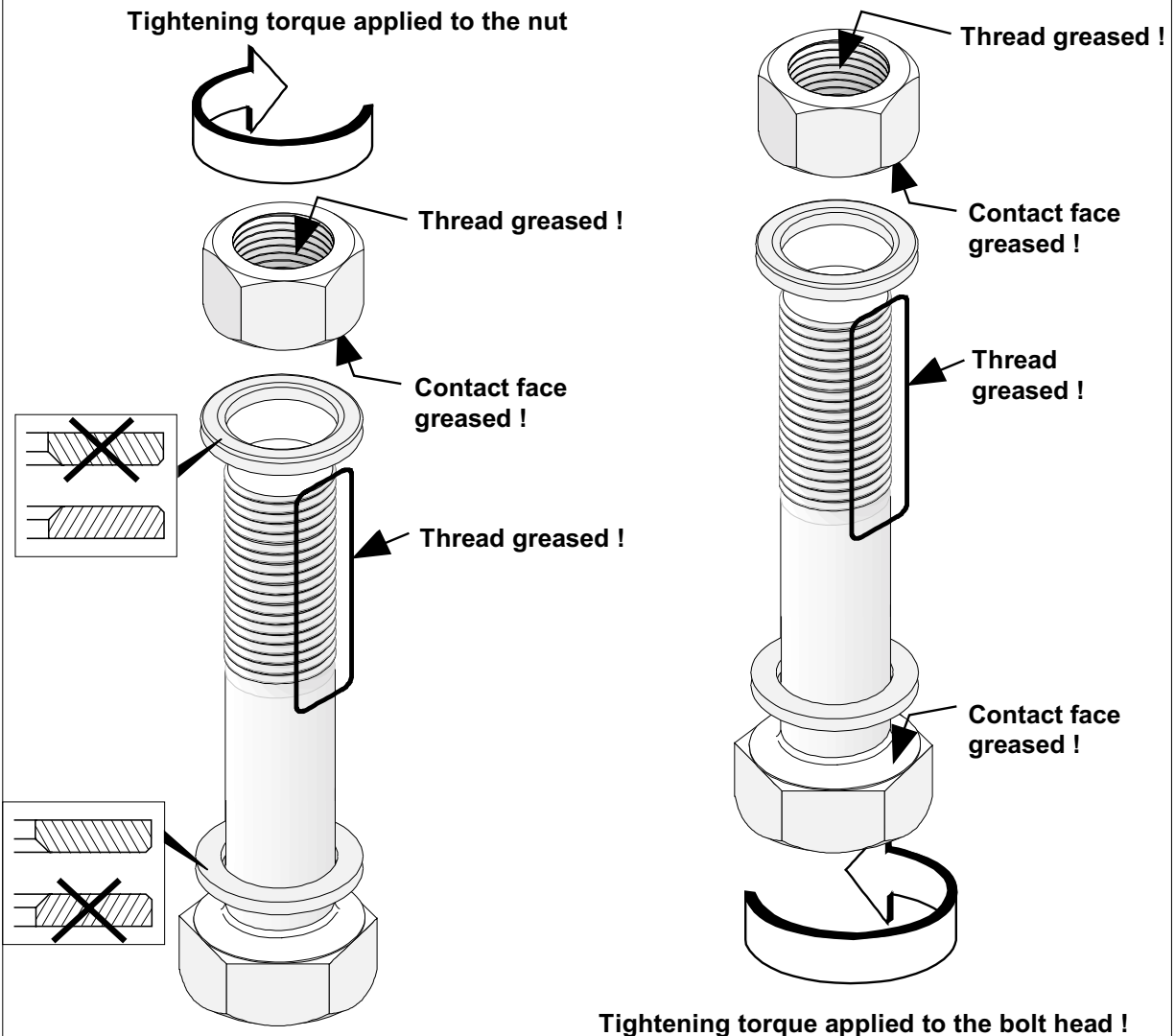


**High-tensile bolts and nuts which are damaged or show signs of damage and/or are badly rusty, shall not be used !**

## 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 !**

## 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.**

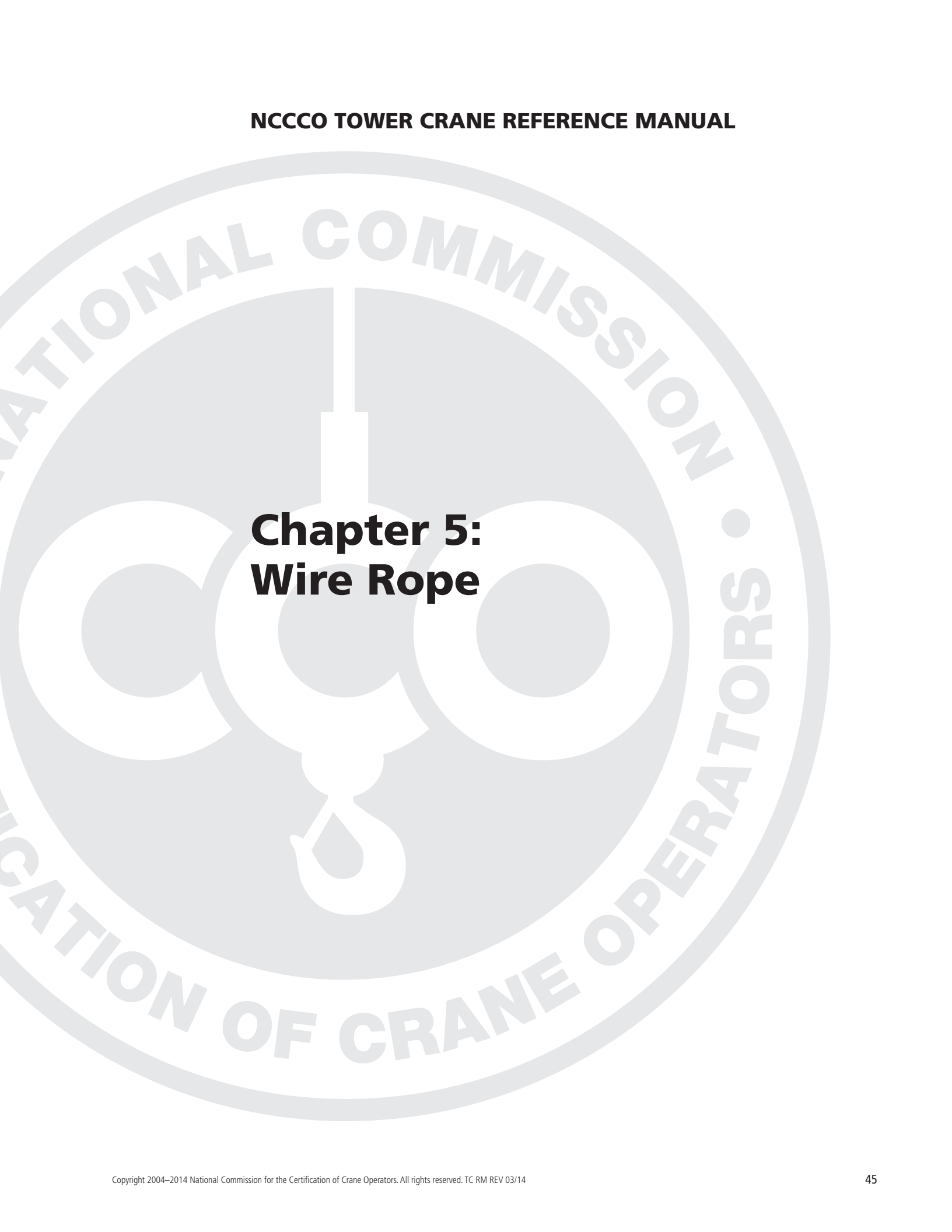
**Never use un-greased bolts or nuts for high-tensile strength bolt connections!**

### 6.2 Tightening torque

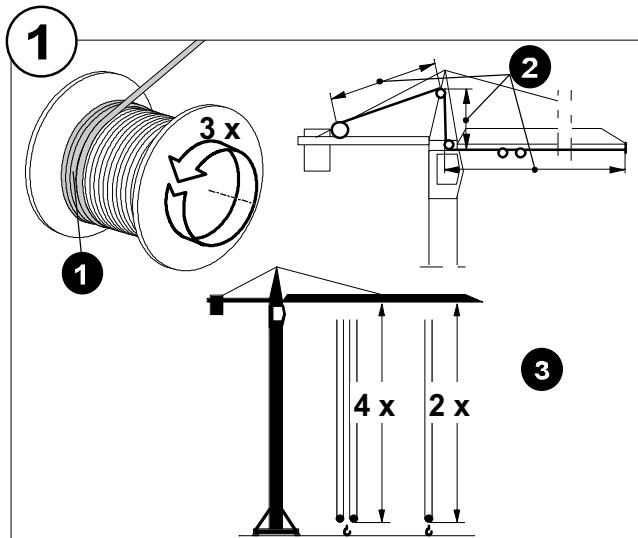
**Each high-tensile bolt connection shall be tightened with the correct torque value.**

**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.

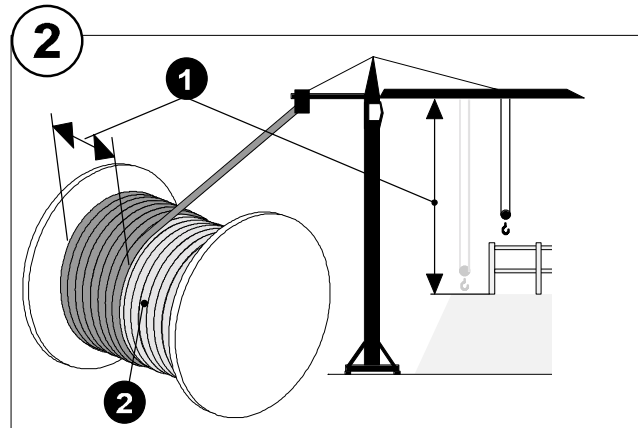


## **Chapter 5: Wire Rope**



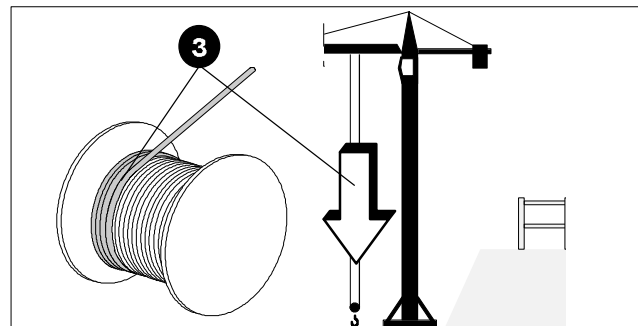
**Rope length matched precisely to the crane installation height !**

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

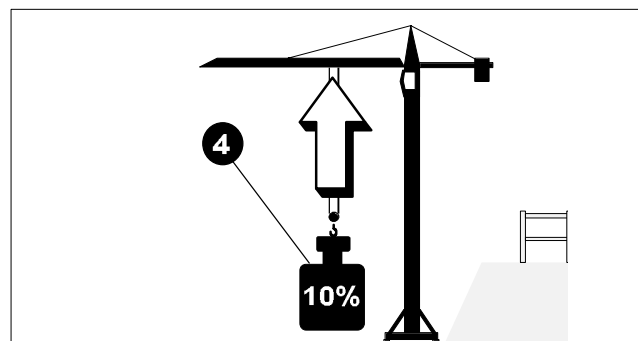


**If the lower wraps are not used (dead wraps), unwind the hoist rope and wind it back under pretension (approx. 10% of the max. load) !**  
(e.g.: working area in same condition over long period of time !)

1. Working area in same condition
2. Dead wraps



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



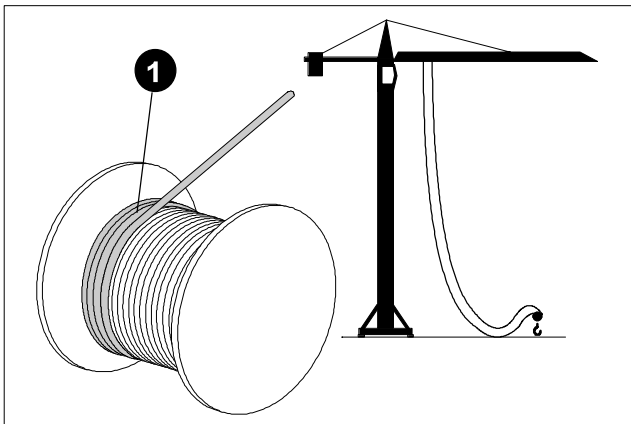
4. Wind in the hoist rope with approx. 10% of the maximum permissible load



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

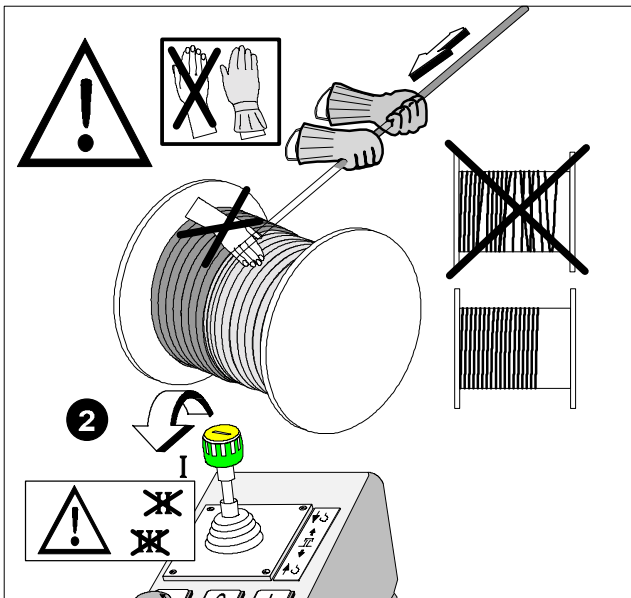


3

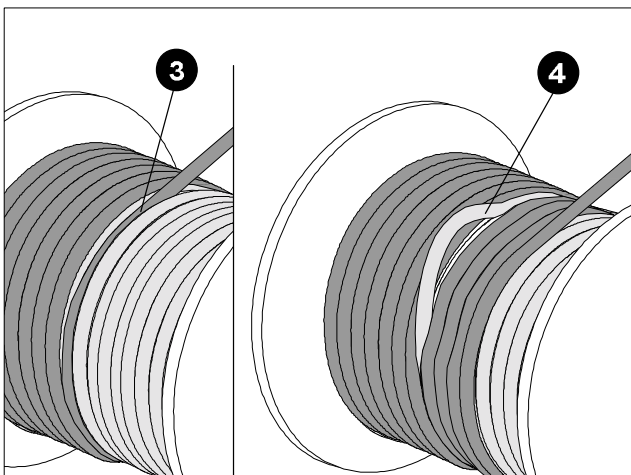


If the rope cannot be wound in under pretension:

1. Unwind the entire hoist rope except 3 safety turns



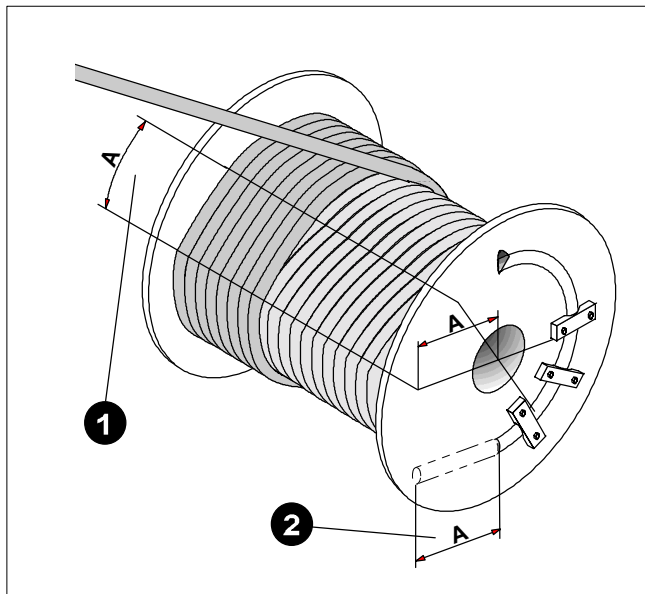
2. Wind in and guide the hoist rope in stage 1



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:

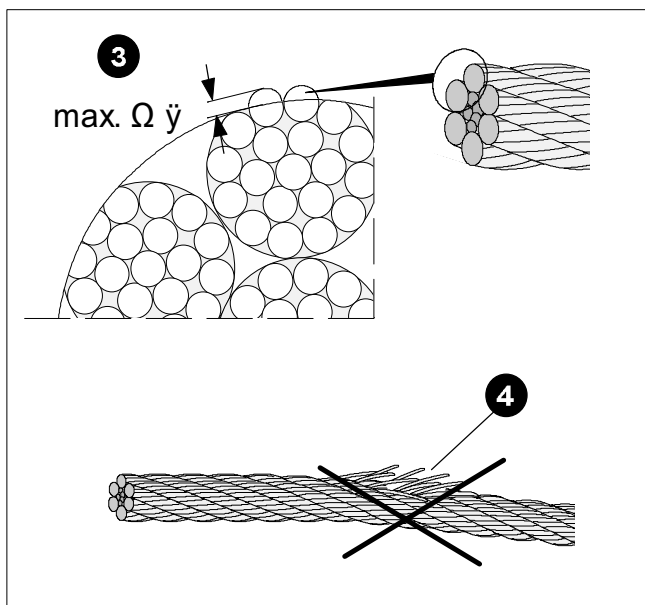
3. e.g.: "interlacing" with lower rope turns !
4. or: formation of loops among lower rope turns !

4



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

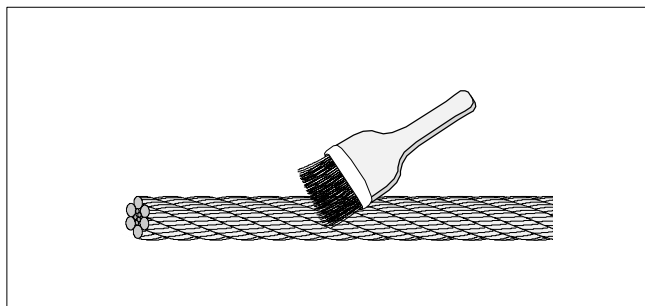
2. **Displace the rope !**  
(can generally be done twice).  
Shorten the rope by approx. half the drum diameter.



**When to displace the rope:**

3. Flattenings are at most half the wire strength.

4. and still no wire fractures.



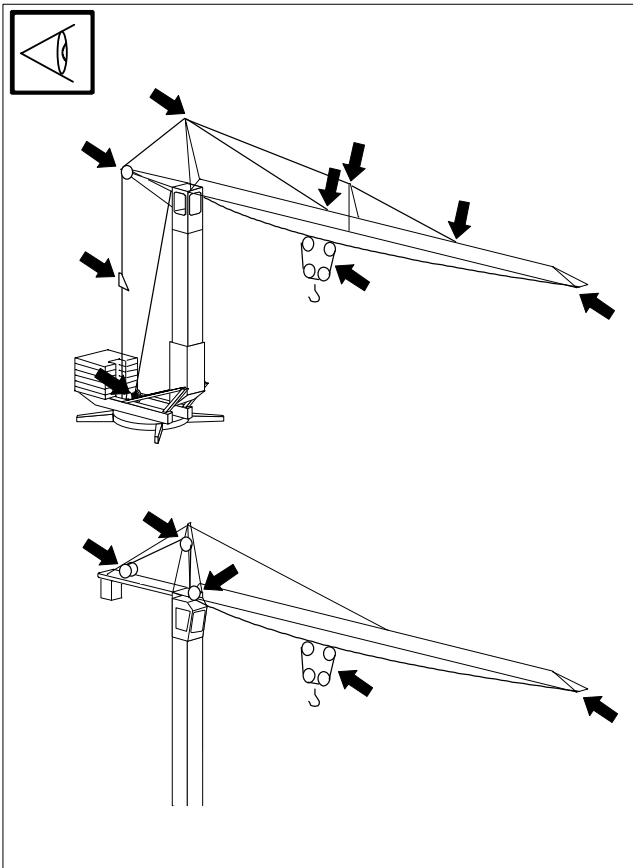
**Lubricate at regular intervals !**

**See Maintenance: Ropes**

## 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 occurred** 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 !

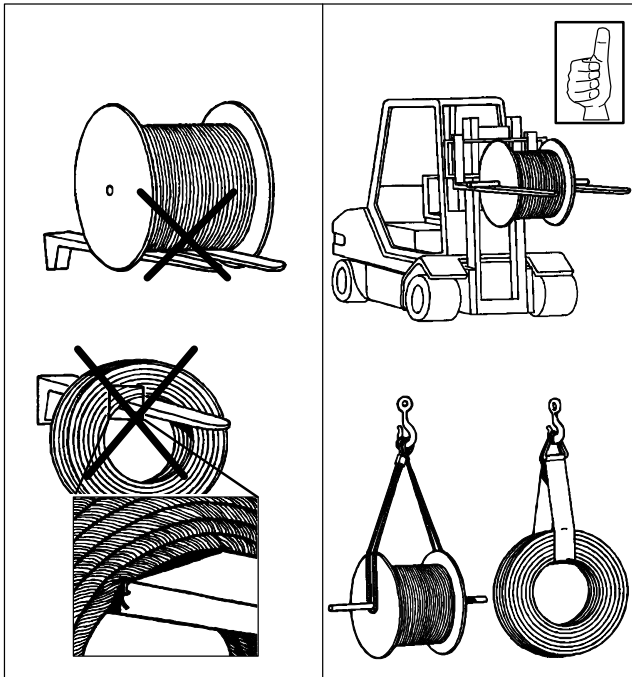
Pay close attention to initial changes in the behaviour of the rope !

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 !

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

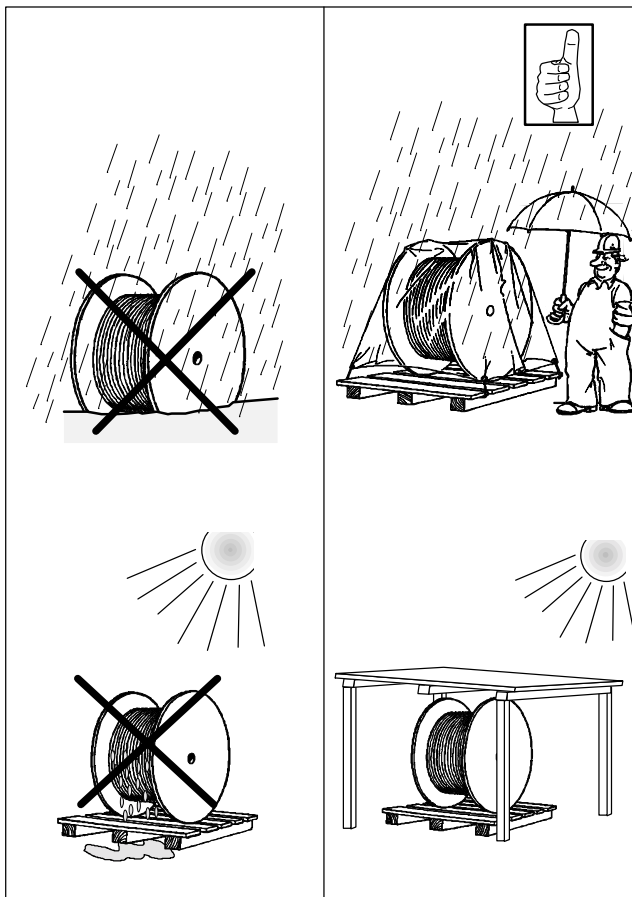


## Ropes: Handling !

### Unloading:

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

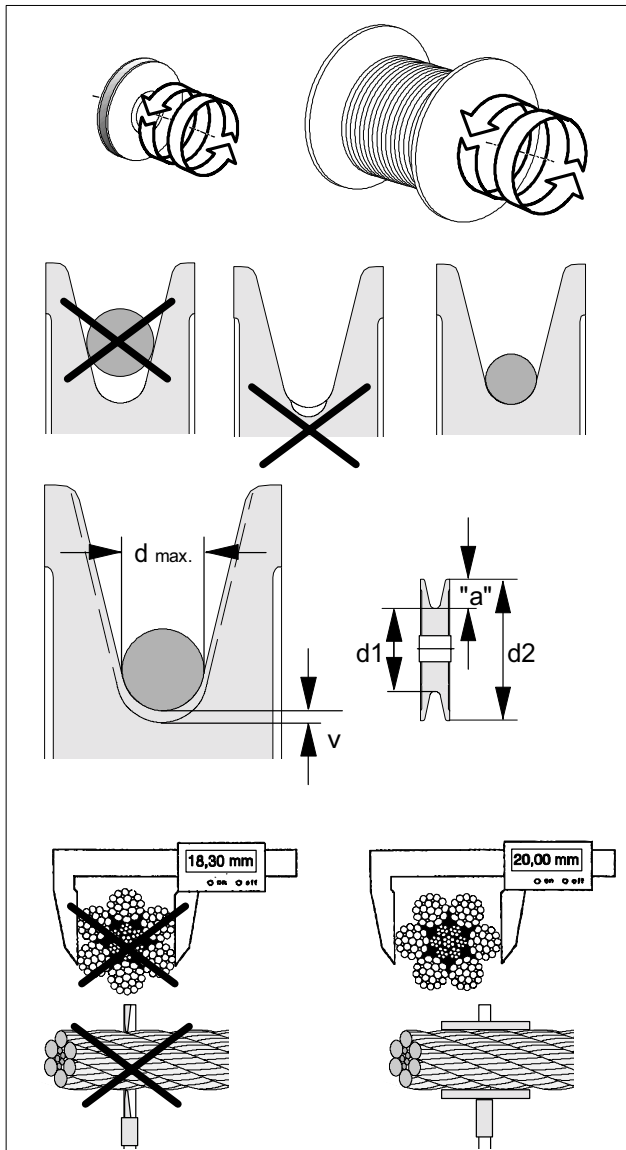
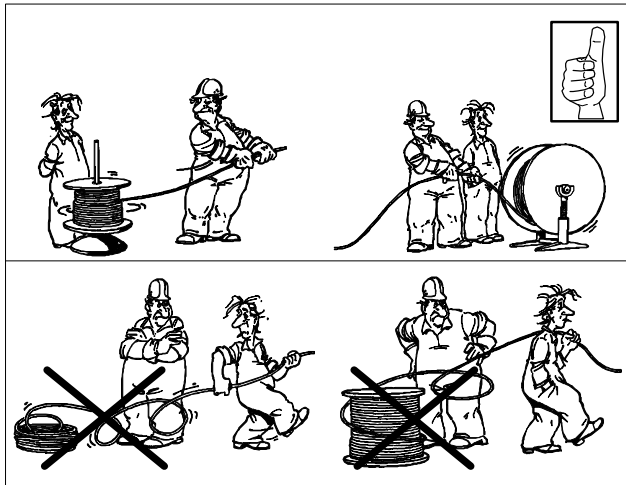
e.g. Lift by the rod passed through the bore of the reel - or - with the help of wide lifting straps.



### 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)

# 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 !



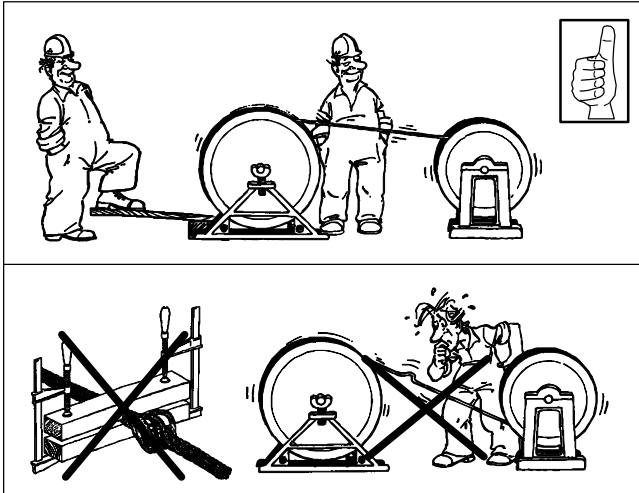
### Before installing the rope, check:

- 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  
 $0.53 \times 20 = 10.6$  radius  
(can be measured with radius gauge)
- **Check for wear!**  
Use the following guide value:  
Example: Rope diameter 20 mm  
 $v = 0.15 \times 20 \text{ mm} = 3 \text{ mm}$
- **Determine the rope pulley diameter:**  
 $d_2 - 2 \times "a" = d_1$   
e.g. Ser 10.38 (see spare parts list)  
 $d_1 = 380 \text{ mm}$   
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 !**

## 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** !

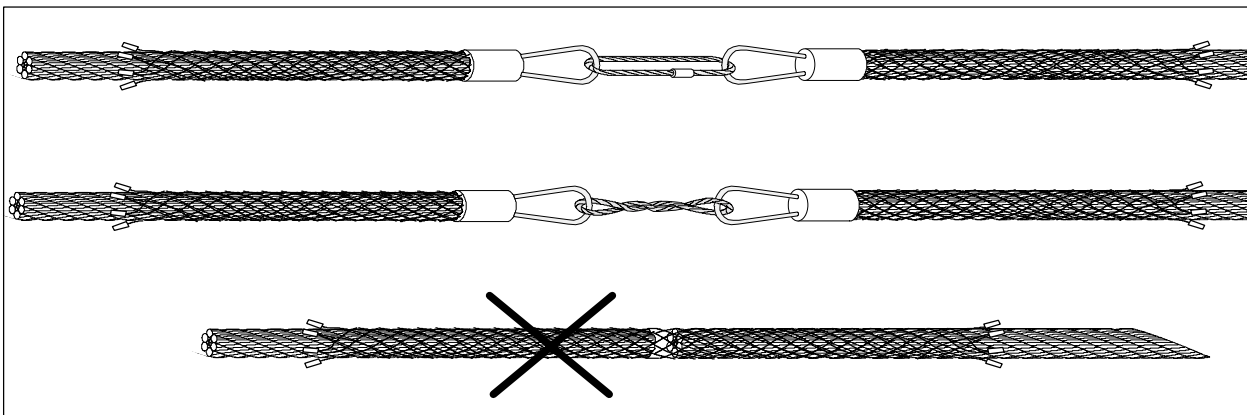
**Do not draw the rope over square-edged components** ! (line the danger areas with wood)

**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 !



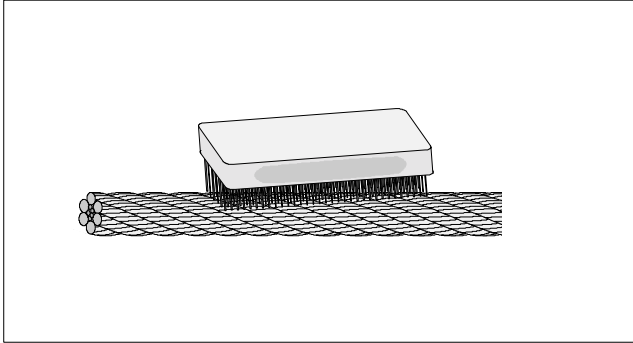
**Where reeving with several runs**, the hoist rope and the drum must have the **same direction** !

If a certain length of rope has to be 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 !

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

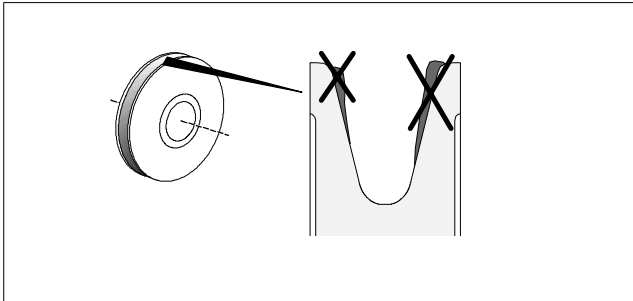


## Clean wire ropes !

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

Do not use solvents !

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

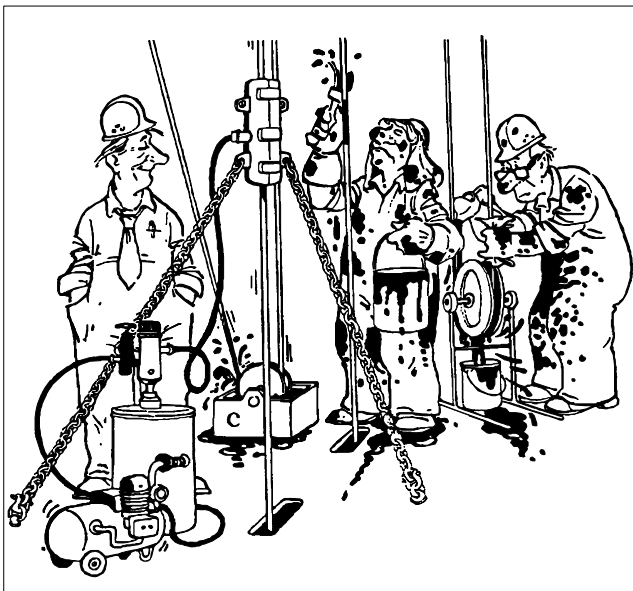


## Clean rope pulleys !

Remove grease residue !

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

Check for signs of wear !



## Lubricate wire ropes !

**Lubricate wire ropes every 200 operation hours !**

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

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

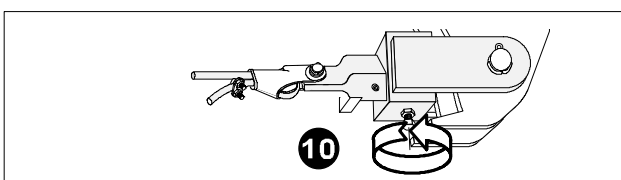
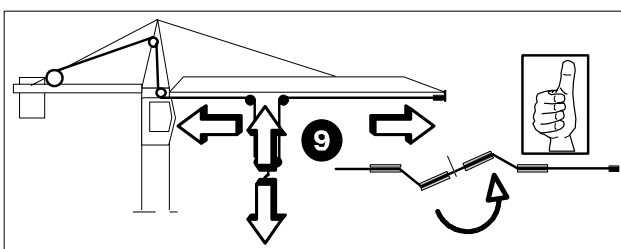
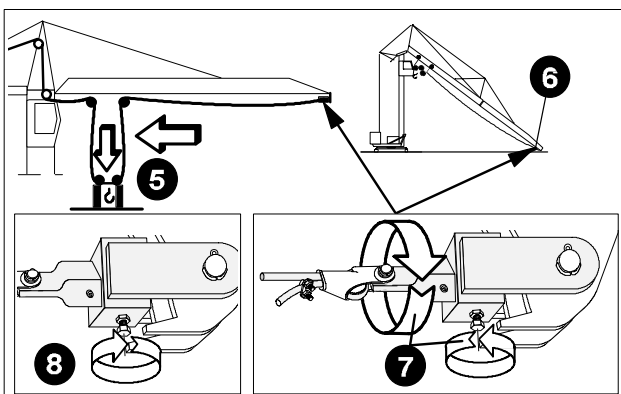
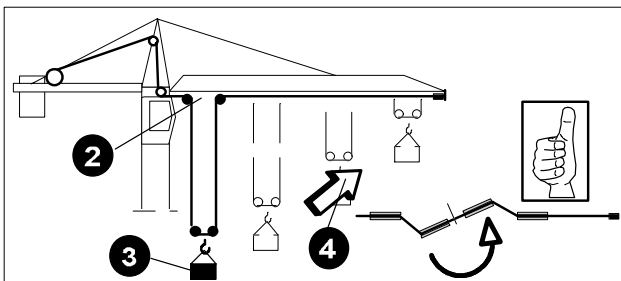
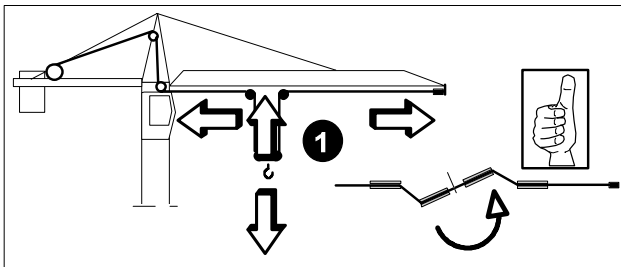
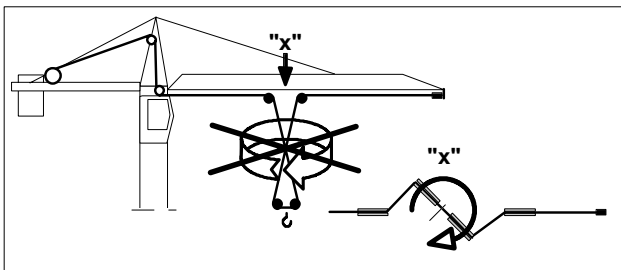
**Ensure** that the lubricant used for regreasing is compatible with the lubricant already present on the rope !

For recommended lubricants.

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



## 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 expert knowledge and patience 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 !

The twist compensator should generally be open if the hoist rope is twistfree !



# 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

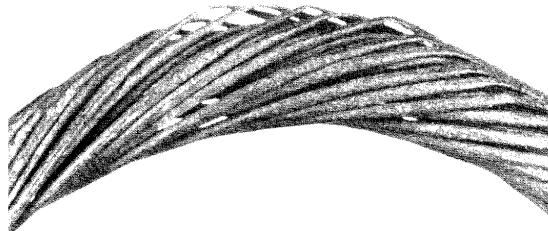


Fig. 4 - Wire rope with individual wires loosened by corrosion and abrasion



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

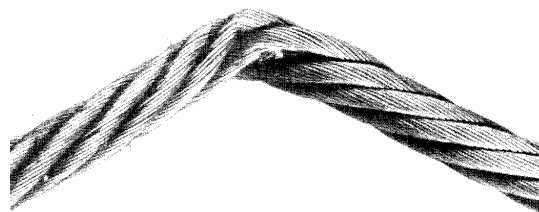


Fig. 8 - Wire rope with bend caused by mechanical effect

## 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  $\frac{1}{3}$  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.

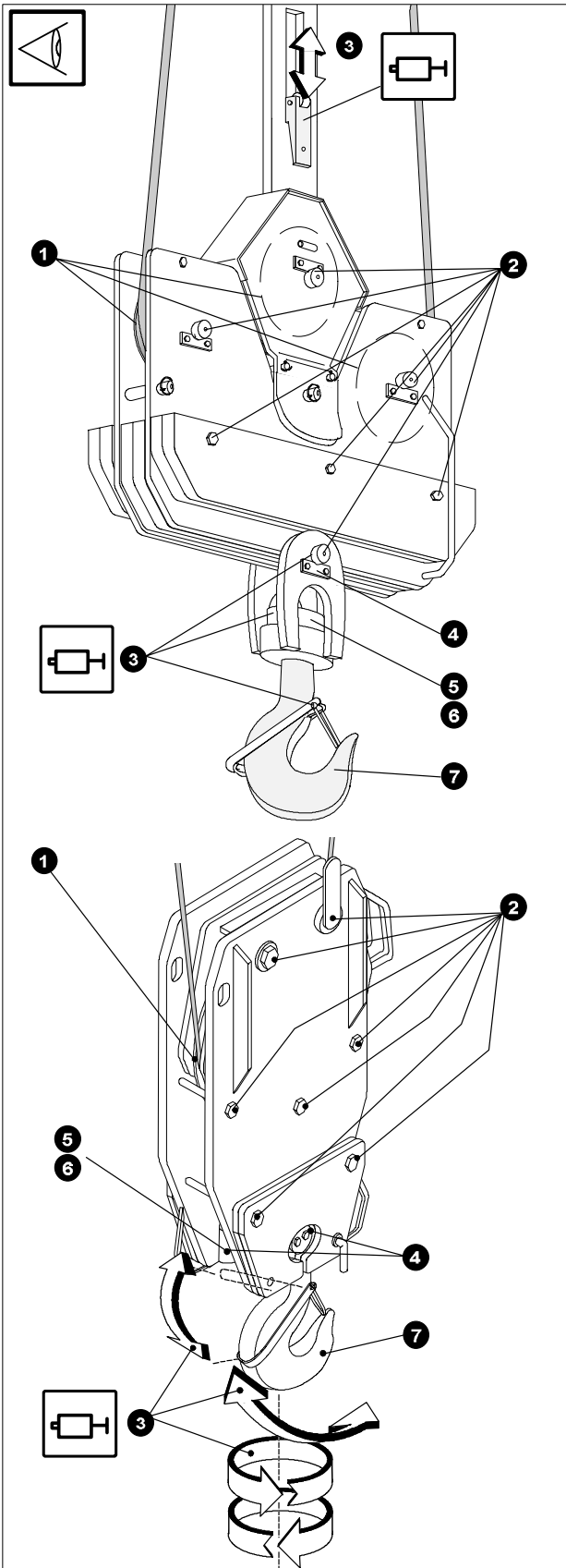
**If you are in any doubt as to the further operational safety of the crane rope, remove the rope or consult an expert for a second opinion.**

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

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 $\ddot{y}$	30 x rope $\ddot{y}$
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 $\ddot{y}$		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

# 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.

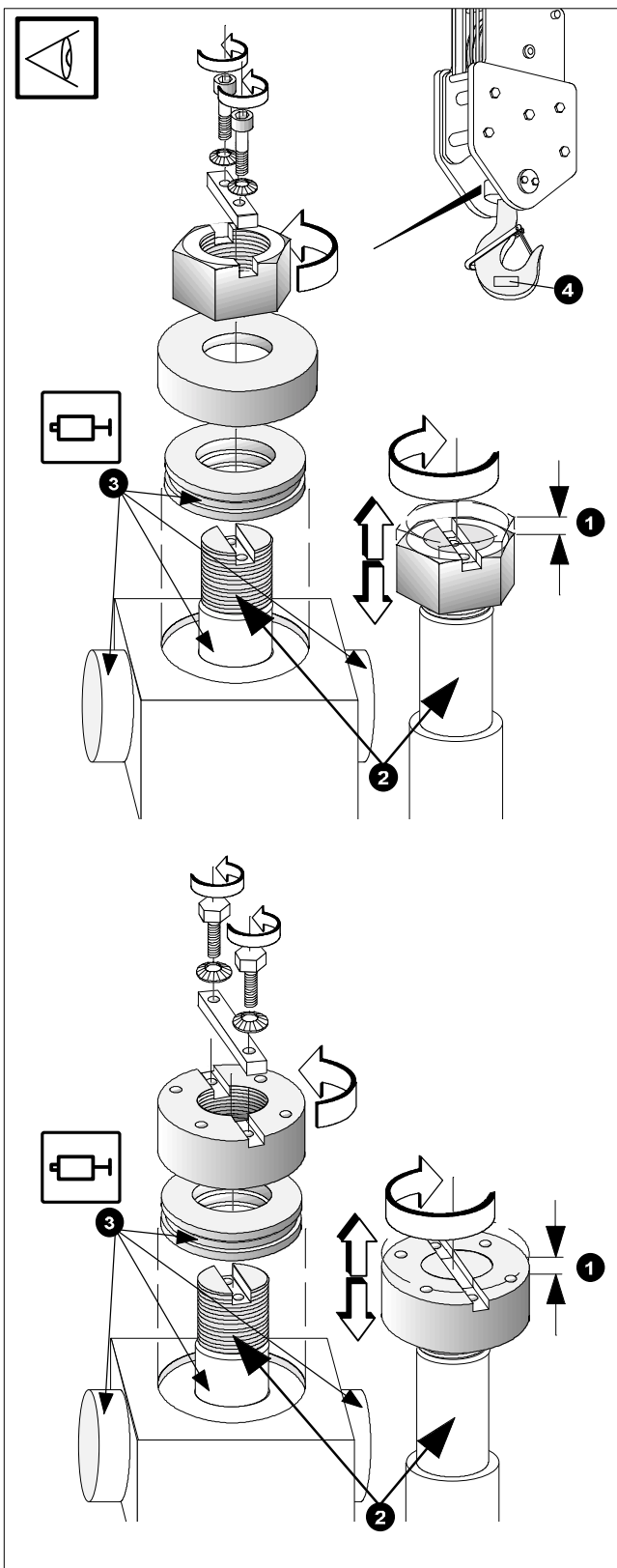
#### 6. Load hook - cross-head connection:

- 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.

# 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.

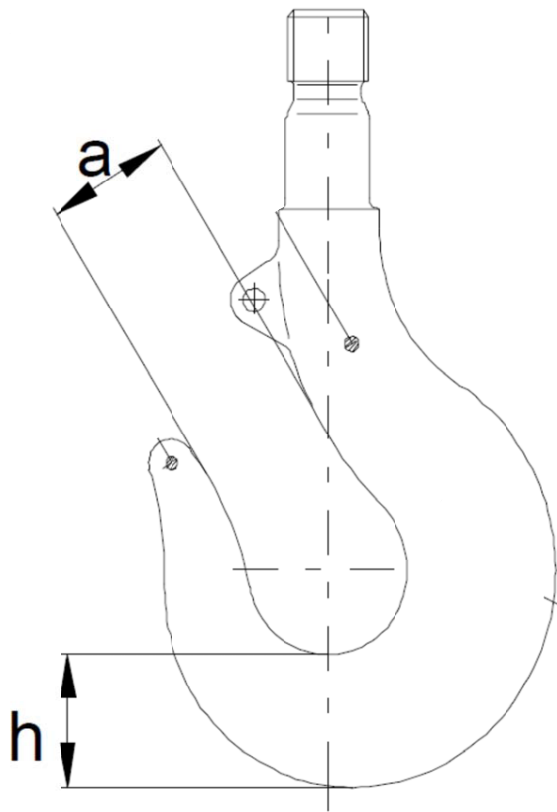
Axial play 1			
Load hook	Hook no.	Permissible axial play	Threads
Lah 010 ...	RSN 08	0.13	M 24
Lah 020 ...	RSN 1.6	0.14	M 30
Lah 030 ...	RSN 2.5	0.15	M 36
Lah 050 ...	RSN 4	0.16	M 42
Lah 063 ...	RSN 5	0.16	M 45
Lah 080 ...	RSN 6	0.10	Rd 50x6
Lah 100 ...	RSN 8	0.10	Rd 56x6
Lah 125 ...	RSN 10	0.10	Rd 64x8
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 !**

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

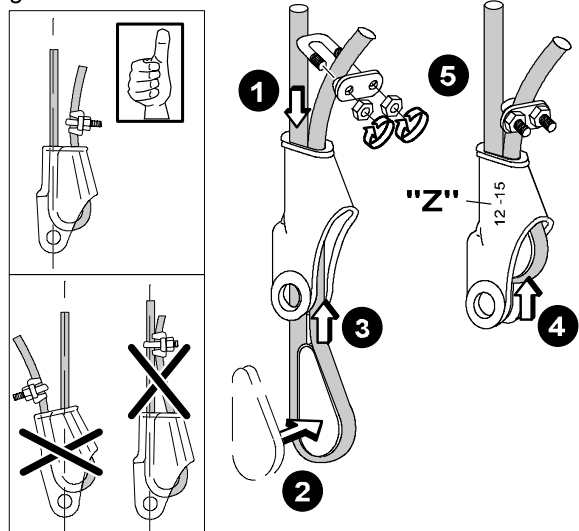


a = This dimension must not exceed 5% in throat opening or distortion from original new dimension up to a maximum 1/4" or within the recommendations of the manufacturer.

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

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

Figure 1



## Installation, inspection and maintenance of wedge sockets !

Page 1 of 2



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:

correct ! too small ! too large !

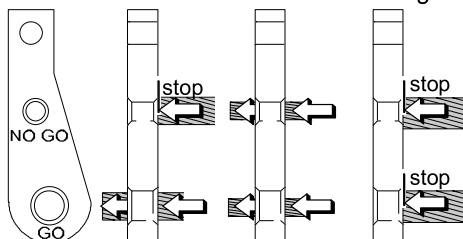
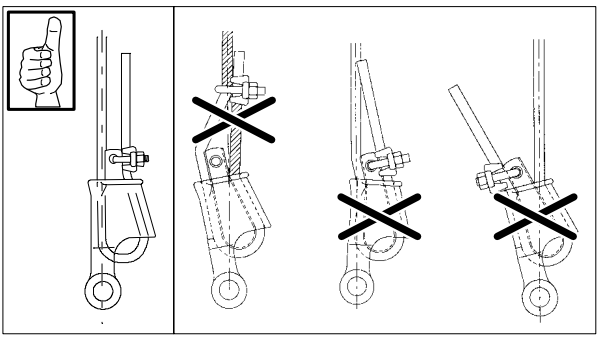
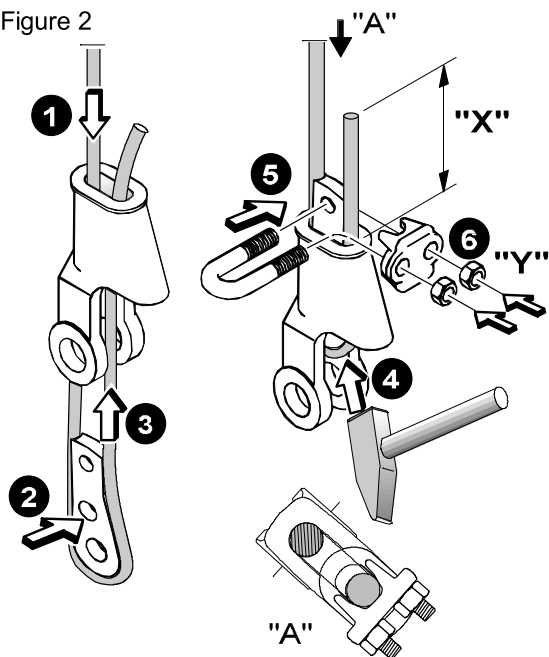
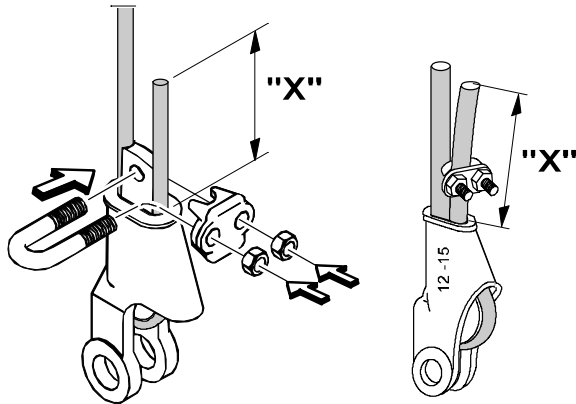


Figure 2



## 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**



# 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.

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.

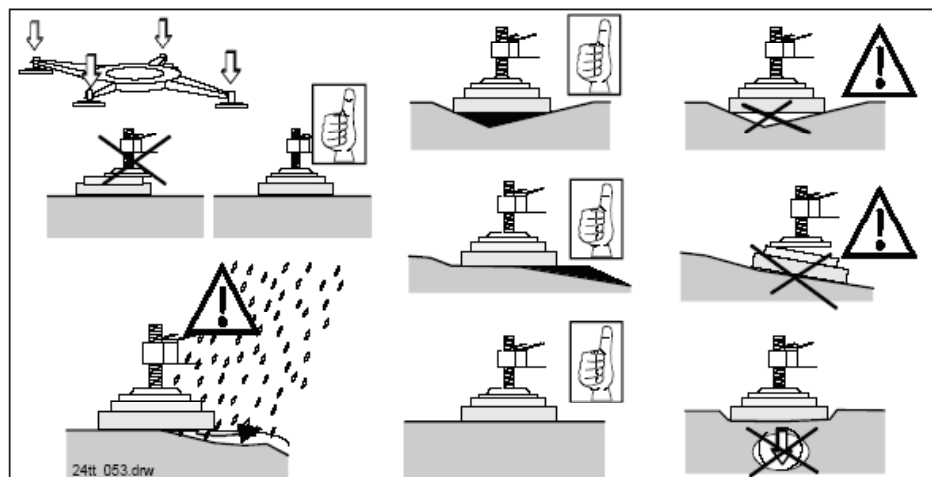


Figure 1

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.

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.

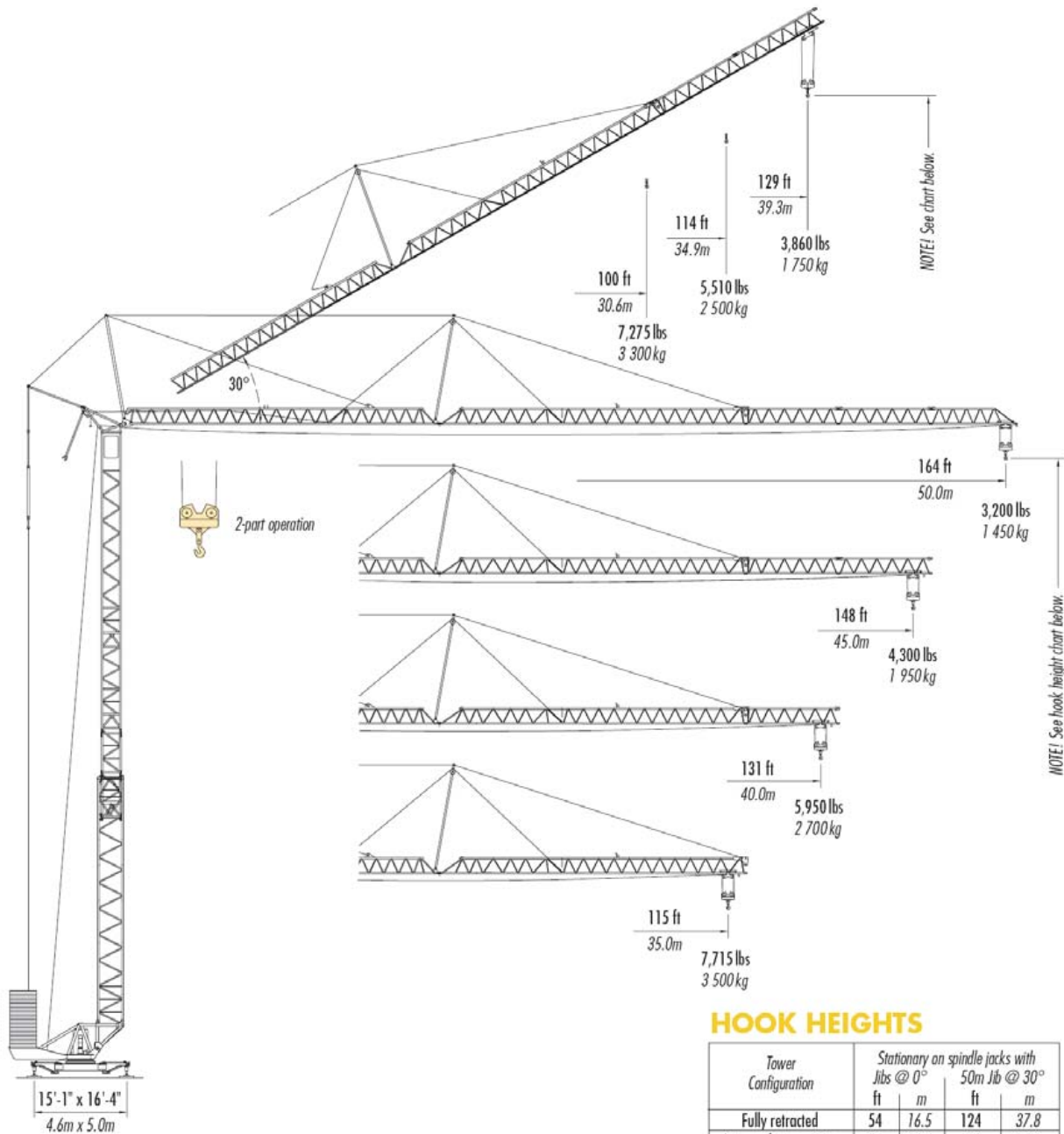
## **Dismantling**

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.

# Self-Erector Technical Data A



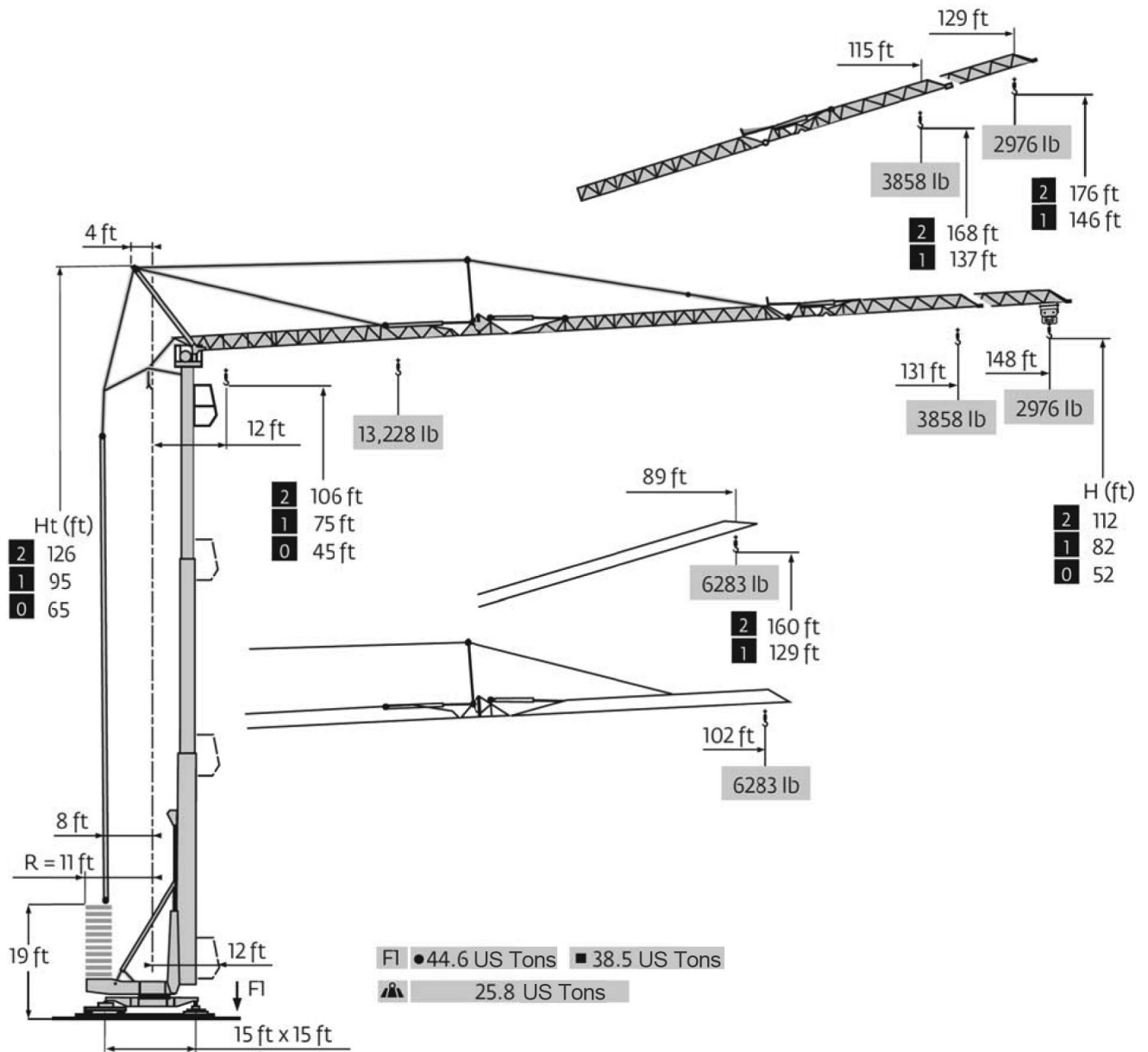
## STATIONARY

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

## HOOK HEIGHTS

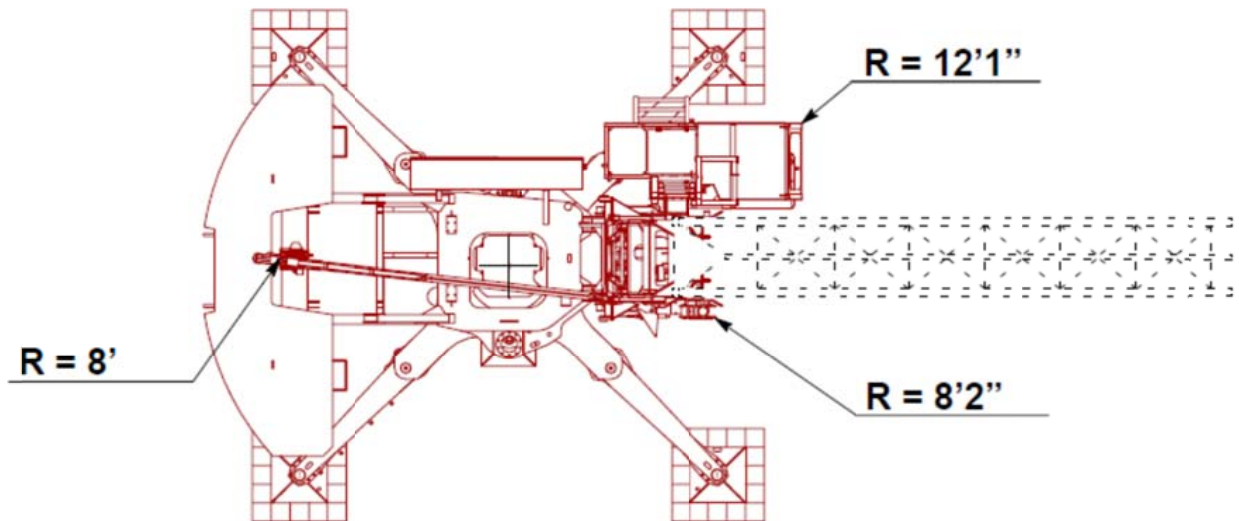
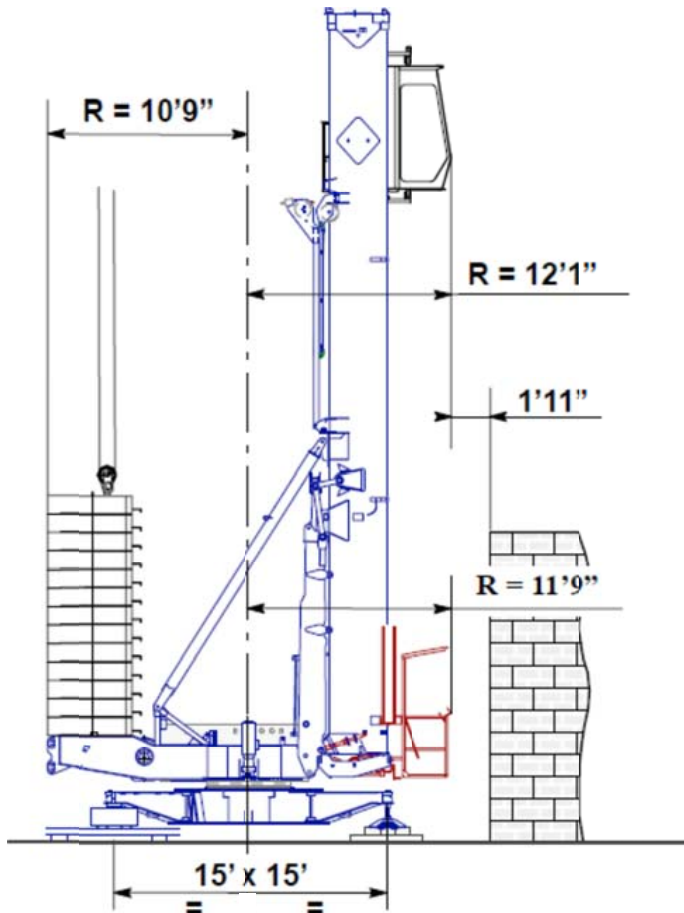
Tower Configuration	Stationary on spindle jacks with			
	Jibs @ 0°		50m Jib @ 30°	
	ft	m	ft	m
Fully retracted	54	16.5	124	37.8
Intermediate position	80	24.4	150	45.7
Fully extended	95	29.0	165	50.3
Fully extended + 1 STS	103	31.4	173	52.7
Fully extended + 2 STS	111	33.8	181	55.1

# Self-Erector Technical Data B



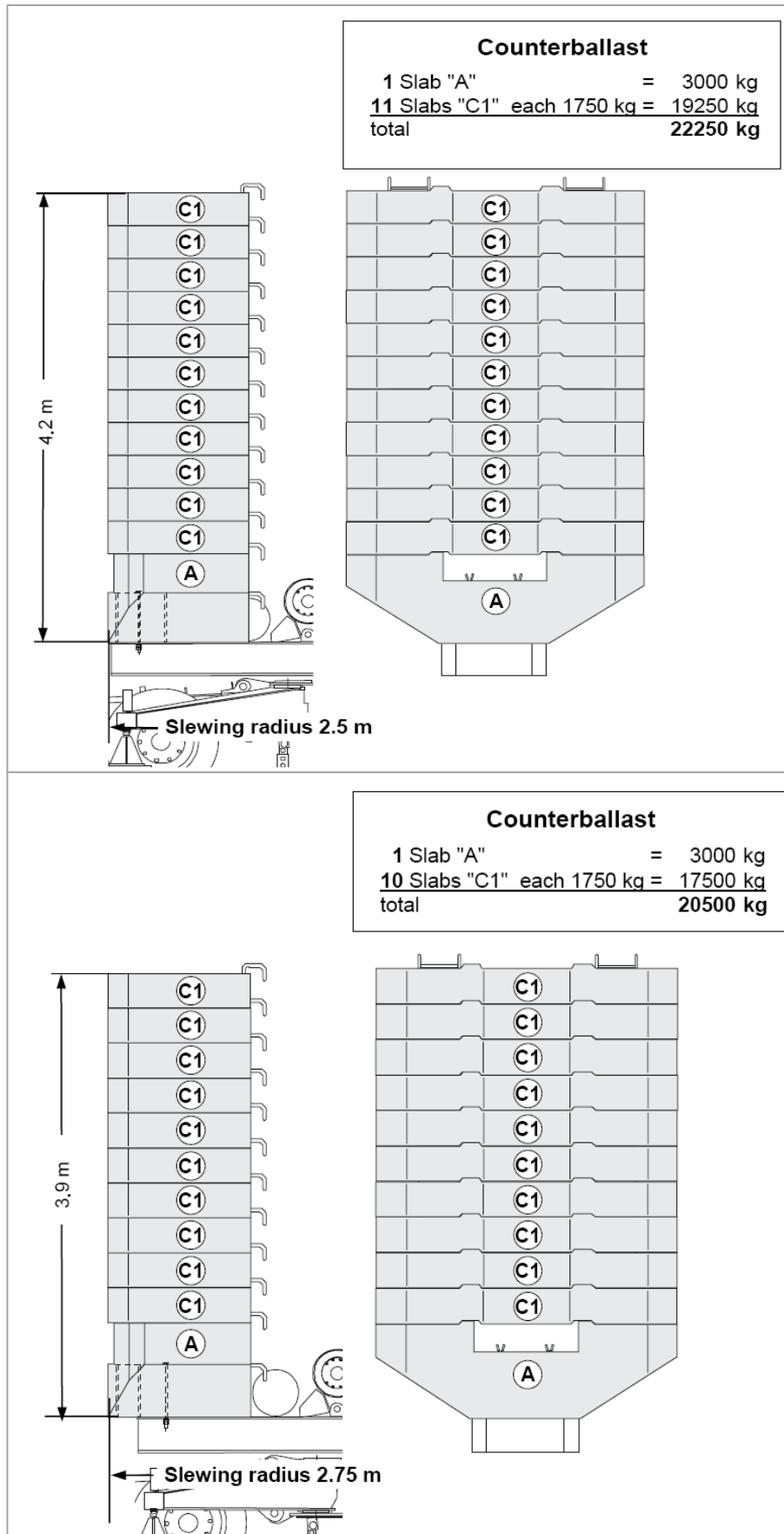


# Self-Erector Technical Data C





# Self-Erector Technical Data D





**NATIONAL COMMISSION FOR THE  
CERTIFICATION OF CRANE OPERATORS**

2750 Prosperity Avenue, Suite 505  
Fairfax, VA 22031-4312

Phone: 703-560-2391

Fax: 703-560-2392

[info@nccco.org](mailto:info@nccco.org)

[www.nccco.org](http://www.nccco.org)