THE CRANE CORNER

Navy Crane Center Technical Bulletin

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A WORD FROM TOPSIDE

Sam Bevins

Navy shore activities had another very safe year in fiscal year 2011 (FY11) in the performance of weight handling operations. Only three crane accidents met the OPNAV Instruction 5102.1 reporting threshold, and all three were Class C mishaps. Well done!

A major factor for this success is the attention we all pay to the small events in order to prevent the serious events from happening. Our crane and rigging gear accident definitions encompass a "wide aperture" of virtually any unplanned event, including those that might not result in injury or property damage. By learning from these more frequent minor accidents, we can prevent the more serious accidents from occurring.

I encourage all activities to "dig down" below our defined accidents and identify, report, investigate, and share with the workforce the near misses and unsafe practices that could have resulted in accidents, e.g., personnel in pinch points or walking beneath suspended loads, hoists being side loaded, chafing protection not utilized on sharp edges, operators engaging the incorrect controller. Many activities have instituted this practice of identifying such events. Crane accident near miss reports increased by 77 percent in FY11. Recognizing that for every accident there are usually multiple omissions or unsafe practices, it would be great if we would see more near miss reports than accident reports. We are not there yet. Keep in mind that mission execution efficiency can be achieved through identification of near misses and human behaviors that can lead to accidents. Every potential accident prevented not only improves the safety of personnel but also significantly improves operational efficiency by avoiding the inherent schedule disruption and cost associated with accident recovery actions.

On another note, Change 1 to the December 2009 edition of NAVFAC P-307 included new load test procedures for mobile cranes. The new procedures eliminate some tests while still providing a thorough test for the crane and at the same time enhancing safety by reducing the test load percentage from 110 percent 105 percent. All activities that test mobile cranes should now be using these procedures. Recent audits (and some accident reports) indicate many activities do not fully understand the new procedures, particularly those for telescopic boom mobile cranes. The concept of "load moment" is new to most load test directors. Load moments are not shown on load charts but must be calculated by multiplying the rated load by its radius. For most cranes, the maximum load moment is not at the minimum radius, where the rated load is greatest, nor at the maximum radius, but somewhere in between. The selection of the correct boom length to use for the test may also be challenging, particularly for newer cranes with multiple

Inside This Issue

boom extension configurations. When the proper load and radius combination are selected, the load test director must then ensure the test load will safely clear the outriggers and other crane components, and if not, select a longer radius. We are preparing a guide that will provide illustrative examples of the steps required to perform this test, which we will post on our web site. In the meantime, if load test directors have any questions, feel free to call our In Service Engineering Division. Our folks will be happy to guide you through the steps for your particular cranes.

Finally, as crane teams return from extended holiday leave, I urge supervisors and managers to take preemptive actions to heighten the awareness of the teams to the tasks at hand. This also applies to supervisors and managers of in-shop category 3 crane operators. In some locations, climatic conditions will have changed presenting new challenges of frigid temperatures, icy walking and working surfaces, and longer hours of darkness. Recognizing these hazards and mitigating them through proper lift planning and communication will help ensure a safe lift. We must continue to remind our folks that no task is so important or urgent that it cannot be done SAFELY.

CRANE SAFETY ADVISORIES AND EQUIPMENT DEFICIENCY MEMORANDA

We receive reports of equipment deficiencies, component failures, crane accidents, and other potentially unsafe conditions and practices. When applicable to other activities, we issue a Crane Safety Advisory (CSA) or an Equipment Deficiency Memorandum (EDM). A CSA is a directive and often requires feedback from the activities receiving the advisory. An EDM is provided for information and can include deficiencies to non-load bearing or non-load controlling parts.

CRANE SAFETY ADVISORIES (CSA)

CSA 201, Failure of Johnson DS 3018 Caliper Brake Actuator Spring Guides

Background:

A. The purpose of this CSA is to alert activities to the failure of Johnson Industries Model DS 3018 caliper brake actuator spring guides, identified as part No. A4 on Johnson Industries Drawing A3379-AP 2.0. Three different activities have recently experienced the failure of a spring guide on their Westmont 60-Ton portal crane whip hoist caliper brake. The spring guide failure is fail-safe with respect to the overall operation of the brake and the brake sets upon spring guide failure.

B. Failure analyses are currently being performed by the activities and the OEM. All of the failures have occurred on spring guides operated in excess of 200,000 cycles. In addition to the DS 3018 caliper brakes, this type of spring guide is also found in the DS 3040, DS 1050D, DS 3025D, DS 2050, and DS 1050 caliper brakes. These caliper brakes are installed on Samsung, Amclyde, Craft, and Westmont portal cranes and may also be utilized on other cranes. The caliper brakes on the Westmont 60-Ton portal cranes are frequently cycled as they act as both emergency brakes and the secondary hoist holding brake. The caliper brakes on the Samsung, Amclyde, and Craft cranes act as emergency brakes only.

Direction:

A. Based on the number of cycles to failure, activities with Johnson Model DS caliper brakes identified in paragraph B above, shall remove hoists from service and replace spring guides before reaching 125,000 cycles.

B. Additional guidance will be provided, upon completion of ongoing failure analyses, in a revision to this CSA.

CSA 202, Slings Using ESCO One-Quarter Inch Stainless Steel, One-Piece Duplex Sleeves Not Meeting the Required Design Factor

Background:

A. The purpose of this CSA is to alert activities of the potential for one-quarter inch diameter slings utilizing ESCO one-quarter inch stainless steel one-piece duplex sleeves not developing the required design factor. An activity reported discovering a wire rope sling achieving less than the required efficiency.

B. Review of ESCO product literature found the manufacturing process for one-quarter inch stainless steel one-piece duplex sleeves was changed in 2005 from a wrought stainless steel tubing (ESCO Part Number 4005962) to an investment casting (ESCO Part Number 5128245). Further testing by the activity was conducted on a sample consisting of 20 wire rope slings, half utilizing the wrought sleeves (4005962) and half utilizing the investment cast sleeves (5128245). Results indicate all of the pendants with the wrought sleeves developed the required efficiency, while 90 percent of the pendants with the investment cast sleeves failed prior to achieving the required efficiency.

C. ESCO was notified of the issue prompting their investigation. ESCO determined the ESCO swaging manual was not updated for the change in swaging process for one-quarter inch stainless steel investment cast one-piece duplex sleeves. ESCO's stainless steel duplex sleeves product update indicates that the investment cast sleeve be rotated 45 degrees between swages to ensure proper performance.

D. ESCO's stainless steel duplex sleeves product update is available for download from ESCO's literature library at http://www.escocorp.com/lit_library.html. Alternatively, it can be found as attachments to this CSA on the Navy Crane Center website at https://portal.navfac.navy.mil/ncc.

Direction:

A. Activities shall remove all slings utilizing ESCO one-quarter inch stainless steel investment cast one-piece duplex sleeves (Part Number 5128245) from service. Slings that are verified to have been fabricated per the instructions provided in ESCO stainless steel duplex sleeves product update may remain in service.

B. Activities shall follow instructions provided in the ESCO stainless steel duplex sleeves product update for swaging ESCO one-quarter inch stainless steel one-piece duplex sleeves. ■

Mobile Crane Load Moment Testing

Change 1 of the 2009 edition of the NAVFAC P-307, issued in March of 2011, included significant changes to the Appendix E load test procedures for mobile cranes. One significant change was the development of the load moment test. As activities began implementing the new procedures questions concerning determining the boom length and radius for the load moment test have arisen.

The configuration for the load moment test requires that the boom length be the "shortest length where all sections are partially extended, but not less than 50 percent of the total powered boom length (or latching boom length)". In other words:

- the main boom length must be at least 50 percent of the maximum main boom length from the crane's load chart or working range diagram, with all boom sections at least partially extended;
- this does not to include power pin flys or jibs;
- the boom length selected for the test will be the shortest boom length that meets these conditions.

Cranes equipped with multiple boom modes must have multiple load charts checked to ensure the maximum load moment is selected. Though this may sound cumbersome, many of the boom modes or charts will be able to be eliminated simply due to the fact that all sections are not at least partially extended.

The radius for the load moment test is determined by calculating the maximum load moment at the determined boom length. Starting at the first radius that will clear the outriggers and crane carrier, calculate the load moment by multiplying the rated load times the radius. Perform the calculations at increasing radii until the resulting load moment decreases. Use the radius that results in the maximum load moment. Also, when determining the load moment test configuration the load test director will have to consider the wire rope as reeved, wire rope line pull, and winch performance as necessary.

Example 1 demonstrates boom length and radius selection for a LinkBelt RTC 8090 II. The RTC 8090 II has a latching boom with three modes of operation; therefore, the first step will be to select the correct boom mode.

Example 2 demonstrates boom length and radius selection for a Grove RT 865. The RT 865 has a single mode synchronous boom with all sections extending simultaneously only requiring the review of a single load chart.
The load moment test shall be started over the side of the crane prior to rotating over each outrigger. Be aware, especially on truck cranes, that as the load is rotated over the front or rear of the crane the flex in the crane will relax (deflection in the carrier will decrease) bringing the load closer to the crane. No booming functions should be performed during crane rotation, therefore, if it is anticipated that the load will come too close to the crane, select the next longer radius on the load chart for the test, even though the resulting load moment might be less than the maximum. Depending on the specific crane configuration, this radius may be in either the "structural" or "stability" range of the load chart, either of which is acceptable.

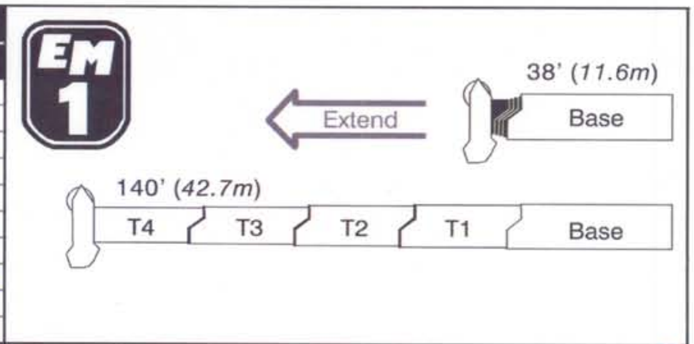
Example 3 demonstrates the radius selection for a Terex HC 110 lattice boom crawler crane and the importance of being aware of the crane dimensions and deflection characteristics when selecting the correct load moment radius.

(Examples 1, 2, and 3 shown on the following pages).

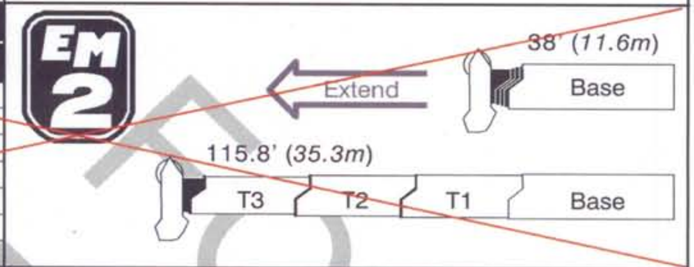
It is recognized that there will be some cranes and configurations that will provide difficulty in determining the load moment configuration. If there are questions concerning the proper load test configuration, contact NAVCRANECEN In-Service Engineering for assistance. This article is also available for download at https://portal.navfac.navy.mil/ncc. ■

Boom Extend Modes

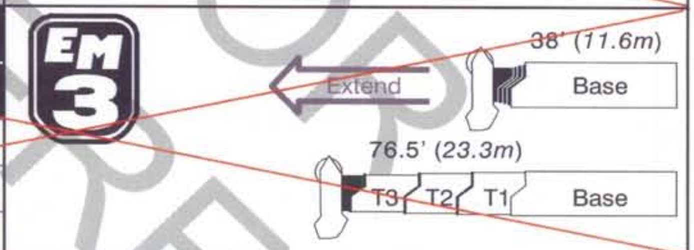
Boom Length (ft)	Boom Telescope Length (ft)							
	T4	%	T3	%	T2	%	T1	%
50	12.0	50						
60	22.0	91						
70	24.2	100	7.8	31				
80	24.2	100	17.8	71				
90	24.2	100	25.1	100	2.7	10		
100	24.2	100	25.1	100	12.7	49		
110	24.2	100	25.1	100	22.7	88		
120	24.2	100	25.1	100	25.9	100	6.8	25
130	24.2	100	25.1	100	25.9	100	16.8	63
140	24.2	100	25.1	100	25.9	100	26.8	100



Boom Length (ft)	Boom Telescope Length (ft)							
	T4	%	T3	%	T2	%	T1	%
50			12.0	48				
60			22.0	88				
70			25.1	100	6.9	27		
80			25.1	100	16.9	65		
90			25.1	100	25.9	100	1.0	4
100			25.1	100	25.9	100	11.0	41
115.8			25.1	100	25.9	100	26.8	100



Boom Length (ft)	Boom Fixed Length (ft)							
	T4	%	T3	%	T2	%	T1	%
50.7			12.7	51				
63.7			12.7	51	13.0	50		
76.5			12.7	51	13.0	50	12.8	48



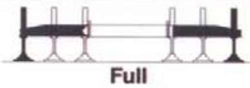
FOR REFERENCE ONLY

In this boom extend mode chart for a LinkBelt RTC 8090 II, boom modes EM2 and EM3 can be eliminated since section T4 is at not partially extended for all boom lengths. In boom mode EM1 the first length where all sections are partially extended is at 120 feet and would be the selected boom length for the load moment test.

RTC-8090 II Mode EM1

EXAMPLE 1 Cont.

Rated Lifting Capacities In Pounds



Load Radius (ft)	100.0 ft			110.0 ft			120.0 ft		
	∡°	360°	Over Front	∡°	360°	Over Front	∡°	360°	Over Front
20	77.5	32,100	32,100	79.0	27,200	27,200			
25	75.0	32,100	32,100	76.5	27,200	27,200	78.0	28,000	28,000
30	72.0	32,100	32,100	74.0	27,200	27,200	76.0	28,000	28,000
35	69.0	29,700	29,700	71.5	27,200	27,200	73.5	28,000	28,000
40	66.0	27,100	27,100	69.0	27,200	27,200	71.5	28,000	28,000
45	62.5	24,900	24,900	66.0	25,800	25,800	69.0	26,100	26,100
50	59.5	23,000	23,000	63.0	23,800	23,800	66.5	24,100	24,100
55	56.0	21,300	21,300	60.0	21,700	21,900	63.5	21,300	21,700
60	52.0	18,800	19,200	56.5	18,700	19,100	60.5	18,300	18,700
65	48.0	16,400	16,800	53.0	16,300	16,600	57.5	15,900	16,300
70									14,300
75									12,700
80									11,200
85									10,000
90									8,900
95									8,000
100									7,100
105									6,300
110									5,700
Min.Bm. Ang./Cap.	0.0	6,600					0.0	4,300	4,300
Radius (ft)		93.0						113.0	

BOOM LENGTH/RADIUS

From the Boom Mode Chart for the RTC 8090 II, the selected boom length is 120 feet in boom mode EM1. At 120 foot boom length the rated load from 25 to 40 feet radius is 28,000 lbs. Starting the load moment calculations at 40 ft, which gives adequate clearance for the outriggers/carrier, and continuing down the load chart every 5 ft until the load moment decrease, shows that the max load moment occurs at 50 ft radius.

LOAD MOMENT

40 ft X 28,000 lbs = 1,120,000 ft-lbs
45 ft X 26,100 lbs = 1,174,500 ft-lbs
50 ft X 24,100 lbs = 1,205,000 ft-lbs
55 ft X 21,300 lbs = 1,171,500 ft-lbs

Load Radius (ft)	13			140.0 ft		
	∡°	3			360°	Over Front
25	79.5	26,900	26,900			
30	77.5	26,500	26,500	78.5	24,400	24,400
35	75.5	26,300	26,300	77.0	24,100	24,100
40	73.5	26,100	26,100	75.0	24,000	24,000
45	71.5	25,900	25,900	73.5	23,800	23,800
50	69.0	24,600	25,100	71.5	23,700	23,700
55	66.5	20,900	21,300	69.0	20,500	20,900
60	63.5	17,900	18,300	66.5	17,600	18,000
65	61.0	15,500	15,900	64.0	15,100	15,500
70	58.0	13,500	13,900	61.5	13,200	13,500
75	55.0	12,000	12,300	58.5	11,600	12,000
80	52.0	10,500	10,900	56.0	10,200	10,600
85	49.0	9,300	9,600	53.0	9,000	9,300
90	45.5	8,200	8,500	50.5	7,900	8,200
95	42.0	7,300	7,600	47.5	7,000	7,300
100	38.5	6,500	6,700	44.0	6,200	6,400
105	34.0	5,700	6,000	41.0	5,400	5,700
110	29.5	5,100	5,300	37.0	4,700	5,000
115	23.5	4,500	4,700	33.0	4,200	4,400
120	16.0	3,900	4,100	28.5	3,600	3,900
125				23.0	3,100	3,300
130				15.5	2,700	2,900
Min.Bm. Ang./Cap.	0.0	3,300	3,300	0.0	2,300	2,300
Radius (ft)		123.0			133.0	

Grove RT 865

EXAMPLE 2

Rated Lifting Capacities in Pounds
40 FT. – 125FT. Boom
ON OUTRIGGERS FULLY EXTENDED -360 °

For Training Only

Radius in Feet	#0001 Main Boom Length in Feet									
	40	45	55	65	75	85	95	105	115	125
10	130,000 (70)	105,000 (72.5)								
12	111,000 (67)	105,000 (70)	94,600 (74)							
15	91,450 (61.5)	91,000 (65.5)	88,250 (70.5)	71,050 (74)						
20	69,550 (52.5)	69,050 (58)	68,400 (65)	60,400 (69)	55,250 (72.5)	48,150 (75)				
25	55,050 (41.5)	54,600 (49.5)	53,950 (58.5)	53,450 (64.5)	47,950 (68.5)	41,700 (71.5)	38,000 (73.5)	33,350 (75.5)		
30	42,950 (26)	42,450 (39.5)	41,700 (52)	41,200 (59)	41,950 (64)	36,700 (67.5)	33,300 (70.5)	30,750 (72.5)	24,550 (75)	•23,700 (76.5)
35		33,700 (26)	33,300 (44.5)	32,500 (53.5)	33,250 (59.5)	32,600 (64)	29,550 (67)	27,300 (69.5)	21,700 (72)	21,900 (74)
40	See Note 16		26,650 (35.5)	26,150 (47.5)	26,900 (54.5)	27,850 (60)	26,450 (63.5)	24,450 (66.5)	19,350 (69.5)	20,300 (71.5)
45			21,750 (23)	21,300 (40.5)	22,050 (49.5)	23,000 (55.5)	23,700 (60)	22,000 (63.5)	17,450 (66.5)	18,800 (69)
50				17,500 (32.5)	18,250 (44)	19,150 (51.5)	19,900 (56.5)	19,850 (60.5)	15,800 (64)	17,050 (66.5)
60					12,400 (30)	13,250 (41.5)	14,100 (48.5)	14,650 (53.5)	13,250 (58)	14,150 (61.5)
70						9,190 (28.5)	9,910 (39)	10,400 (46)	10,850 (51.5)	11,350 (55.5)
80							6,930 (27)	6,740 (37)	7,850 (44.5)	8,290 (49.5)
90								5,170 (25.5)	5,600 (36)	6,010 (42.5)
100										4,250 (34.5)
110										2,840 (24)
Minimum boom angle (deg.) for indicated length (no load)										0
Maximum boom length (ft.) at 0 degree boom angle (no load)										125

BOOM LENGTH

From this load chart for a Grove RT 865, 50 % of the maximum boom length on this load chart is 62.5 feet, therefore, assuming that all sections are partially extended, the selected boom length should be 65 feet.

RADIUS

On the Grove RT 865, determined from the crane specifications, the radius required to clear the outriggers/carrier is approximately 18 feet, therefore load moment calculations should begin at least at 25 feet, which happens to result in the maximum load moment. If the test load will not safely clear the crane at 25 feet due to the size of the load, the test can be performed at 30 feet.

LOAD MOMENT

25 ft X 53,450 lbs = 1,336,250 ft-lbs

30 ft X 41,200 lbs = 1,236,000 ftl-bs

MAX load moment is at 25 ft radius.

NOTE: () Boom angles are in degrees.

* Based on maximum obtainable boom angle.

\# LMI operating code. Refer to LMI manual for operating instructions.

Grove RT865B Rough Terrain Hydraulic
Load Chart Package –
For Training Only

TEREX HC 110

CRAWLER CRANE

HC 110

EXAMPLE 3

WITH 59HI OFFSET TIP BOOM - 4 SHEAVE TIP

52,900 lb + 23,000 lb SC | 360° | **ANSI B 30.5**

50' (15.2 m) Boom length

Radius (Feet)	Boom Angle (Degrees)	Side Frames Extended (Pounds)	From Boom Pt. to Ground (Feet)
13	79.9	220,000*	56
15	77.6	190,080*	55
20	71.6	123,290	54
25	65.4	87,670	52
30	58.9	67,640	49
35	51.9	54,900	46
40	44.1	46,010	41
50	22.7	34,480	26

60' (18.3 m) Boom length

Radius (Feet)	Boom Angle (Degrees)	Side Frames Extended (Pounds)	From Boom Pt. to Ground (Feet)
14	80.7	203,570*	66
15	79.7	189,950*	65
20	74.8	123,100	64
25	69.7	87,490	63
30	64.5	67,430	61
35	59.1	54,700	58
40	53.3	45,790	54
50	40.0	34,250	45
60	20.6	27,130	27

70' (21.3 m) Boom length

Radius (Feet)	Boom Angle (Degrees)	Side Frames Extended (Pounds)	From Boom Pt. to Ground (Feet)
16	80.3	177,910*	75
20	77.0	122,950	75
25	72.8	87,320	73
30	68.4	67,250	71
35	63.9	54,530	69
40	59.2	45,620	67
50	49.0	34,050	59
60	36.9	26,960	48
70	19.0	22,070	29

80' (24.4 m) Boom length

Radius (Feet)	Boom Angle (Degrees)	Side Frames Extended (Pounds)	From Boom Pt. to Ground (Feet)
17	80.8	161,850	85
20	78.7	122,740	85
25	75.0	87,130	84
30			
35			
40			
50			
60			
70			
80			

90' (27.4 m) Boom length

Radius (Feet)	Boom Angle (Degrees)	Side Frames Extended (Pounds)	From Boom Pt. to Ground (Feet)
19	80.6	133,440	95
20	79.9	122,580	95
25	76.7	86,970	94
30	73.4	66,860	93
35	70.0	54,150	91
40	66.6	45,210	89
50	59.4	33,630	84
60	51.6	26,570	77
70	42.9	21,670	68
80	32.3	18,120	55
90	16.7	15,440	32

100' (30.5 m) Boom length

Radius (Feet)	Boom Angle (Degrees)	Side Frames Extended (Pounds)	From Boom Pt. to Ground (Feet)
20	80.9	122,380	105
25	78.0	86,760	104
30	75.1	66,630	103
35	72.1	53,930	102
40	69.0	44,980	100
50	62.7	33,380	95
60	56.0	26,340	89
70	48.8	21,430	82
80	40.6	17,880	71
90	30.6	15,190	57
100	15.8	13,090	34

110' (33.5 m) Boom length

Radius (Feet)	Boom Angle (Degrees)	Side Frames Extended (Pounds)	From Boom Pt. to Ground (Feet)
22	80.7	105,050	115
25	79.1	86,580	114
30	76.5	66,410	113
35	73.8	53,720	112
40	71.0	44,760	110
50	65.4	33,160	106
60	59.5	26,130	101
70	53.2	21,220	94
80	46.4	17,650	86
			75
			60
			35

On the Terex HC 110 quick calculations show that the maximum load moment is at minimum radius for all boom lengths shown above. The load moment radius for this crane will be dependant on providing adequate clearance around the crawler tracks. From the crane specifications the radius to the corner of the crawler track is approximately 14 feet. Depending on the size of the load a radius of 25 ft may be required to safely clear the crawlers and account for loss of deflection over the front and rear of the crane. If 20 feet is adequate then for some boom lengths the max capacity test and the load moment test may be able to be combined.

KEY

(symbol)	Counterweight
SC	Sideframe Counterweight

ACQUISITION NEWS

The Navy Crane Center accepted an overhauled 120/7.5 ton ordnance handling portal crane on November 19, 2011. The overhaul scope consisted of replacement of the 1970's vintage DC drives, thyristor (SCR) boxes, motor field power supplies and control panels with modern DC drives and controls. The new controls included a fault readout display external to the control panel and an external port that allows for a laptop computer to be plugged in providing access to the drives without having to open energized panels. The project also included reconfiguration of the existing foot operated pneumatic brake system to serve as an emergency brake, and the addition of encoders to the existing DC hoist motors to provide constant feedback for the newly installed control system. Finally, all equipment in the operator's cab, including operator's chair, controllers, and warning devices, was replaced and relocated to provide a safer and more ergonomic layout for the operators. All work was done on site and took approximately two months to complete; total contract duration was 14 months.

120/7.5-Ton Ordnance Handling Portal Crane

CRANE POWER DISCONNECTS

Several instances have been reported where a circuit breaker utilized for securing power to the crane had failed. Investigation determined the failure was the direct result of repeated cycling (daily) that exceeded the rated duty cycle of the breaker.

The National Electric Code (NEC) 2011 allows the use of a motor-circuit switch, circuit breaker, or molded-case switch to serve as the disconnecting means for the runway conductors and for cranes/monorail hoists. While circuit breakers can be legitimately and safely used as switches, the frequency and duration of such use is generally limited. Typically, circuit breakers are manually operated only for service/maintenance and repair type activities. They are not intended for long-term repetitive manual switching.

Where circuit breakers are utilized as a means to secure power on a repetitive basis and may be approaching rated duty cycle life, activities should determine if the circuit breaker requires replacement and consider upgrading with an alternate electrical component/circuitry (e.g. disconnect switch or mainline contactor with stop-start circuitry designed to remove power from the drive motors, brakes, and control circuit) as a better means for securing crane power.

FAILURE OF A TEST WEIGHT INTEGRAL LIFTING ATTACHMENT

The purpose of this article is to inform activities of the potential hazard associated with embedded lifting attachments used with test weights. Embedded lifting attachments are attachments that were put into position before the lead or concrete was poured into the test weight mold. An activity reported where an eyebolt embedded in a test weight failed while preparing for a chain hoist load test. Externally, the eyebolt appeared to be satisfactory but the corrosion was beneath the surface of the test weight and under the shoulder of the eyebolt. The shank of the eye bolt had corroded down to approximately one-quarter inch diameter from its original diameter of one inch. The design flaw with this type of lifting attachment is the inability to visually inspect the shank of the lifting attachment. Corrosion can be occurring beneath the surface of the test weight in this case - beneath the shoulder of the eyebolt, weakening the structural integrity of the lifting attachment.

Activities that utilize test weights with embedded lifting attachments should consider implementing actions to reduce the risk of a failure. Using a lift skid (pallet) or other attachment means when moving test weights, implementing periodic non-destructive testing of the lifting attachments that will identify subsurface deficiencies, and/or implementing a periodic load test program for the lifting attachment that will provide some assurance of the overall integrity of the attachment are just a few actions to consider for risk reduction.

Activities should never become complacent in terms of operational risk management and providing the necessary tools and procedures workers can use to take personal control of operational risk. This will decrease the likelihood of an accident, making a safer work environment.

SUMMARY OF WHE ACCIDENTS, FOURTH QUARTER FY11

Overall, the Navy shore establishment had another safe year with weight handling operations. Millions of lifts were made with Navy cranes in support of fleet readiness with only three accidents meeting the OPNAV reporting threshold and all were Class C mishaps; a very positive reflection of the low severity of accidents reported. It is noteworthy that there has not been a Class A mishap with a Navy crane in more than 10 years. Our contractor partners also had an improved weight handling safety record in FY11. For the fourth quarter of FY11, 59 Navy WHE accidents (41 crane and 18 rigging), and 11 near miss occurrences (8 crane and 3 rigging) were reported. A total of eight contractor crane accidents were also reported. Of the 59 Navy WHE accidents, 16 were considered significant (overload, dropped load, two block, or injury). Lessons which can be shared from the significant accidents are discussed herein.

Overloads: There were seven crane or rigging gear overloads during the quarter. Six of the overloads involved the overloading of rigging gear. In one event, riggers did not consider the effects of sling angle stress. In another event, riggers substituted undersized slings for the approved slings. In another occurrence, personnel used a lift fixture with a rated capacity of 1,500 pounds to lift equipment that weighed in excess of 2,300 pounds. Another rigging gear overload occurred during pre-tensioning of rigging gear with a bridge crane when a sling rated at 300 lbs was overloaded to1100 lbs. Due to potential binding conditions, a load indicating device (LID) was incorporated into the rigging gear; however, a chainfall was not used for finite control to ensure the sling would not be overloaded.

Lessons Learned: The weight of the load must be known/determined. Rigging personnel must ensure that the rigging gear being used has adequate capacity for the work to be performed in the configuration in which it is being used. The effects of sling angle stress must be considered whenever slings are used at angles from vertical. Where the weight of the load is in question, or when forces may increase due to load binding, a LID with readout readily visible to the signal person or rigger-in-charge (RIC) shall be used. An appropriate stopping point shall be established to minimize the risk of overload. When binding conditions exist, chainfalls or other finite hoisting control means (e.g., microdrives) shall be used to avoid sudden overload of the crane or rigging gear.

Dropped Load Accidents: Five dropped load accidents occurred during rigging and crane operations. While operating a forklift with a load attached to a lift attachment on the tines of the forklift, the operator suddenly stopped, causing the load to swing forward. The inertia pulled the lifting attachment off the forklift tines and the attachment and load dropped to the floor. In another accident a load was being lifted from a horizontal position to a vertical position when the load fell approximately three feet to the deck. The operator improperly installed the specifically designed rigging component.

Lessons Learned: Personnel must follow safe rigging practices. Prior to using a multi-purpose machine or material handling equipment (forklift) as a crane for lifting suspended loads, the operator must ensure that the original equipment manufacturer (OEM) has authorized the use of the specific lifting attachment being placed on the forks of the equipment for the intended purpose. The lifting attachment and the load should be secured to prevent movement. If the structural capacity is questionable, or assistance is needed to determine appropriate rigging attachment points, the activity engineering department should be contacted for assistance.

Injuries: Four personnel injuries occurred during crane and rigging operations this quarter. While lifting a metal stairwell using a multi-purpose machine with a sling attached to the fork blades, a worker was injured when the stairwell sprung off its foundation and struck the worker's mid-section. In another accident, while pushing on a load chain to free a chain hoist hook from the edge of a deck, the hook became dislodged and the load chain became tight and pinched the rigger's thumb between the load chain and the deck.

Lessons Learned: Personnel must remain alert and should not place themselves in a position where they may be contacted by the load or trapped between the load and other objects. Prior to and during tensioning of rigging gear, personnel must ensure hands and other body parts are not located between the rigging gear, the load, and other objects. Potential pinch points and hazards should be discussed with all personnel involved with the operation prior to work. When moving a load in tight or restrictive clearance areas, additional personnel should be assigned to monitor the load and rigging during movement.

Four of the eight contractor crane accidents were considered significant (three dropped loads and one overload). While using two cranes to lift a steel truss section, one side of the truss was binding on a bolt plate and during lowering of the crane boom, the load slipped from the bolt plate and swung forward, shock loading the crane. The load fell and pulled the crane over, striking the boom of a man lift that was positioned below. Two personnel working in the basket of the man lift were jolted and one of the employees and the crane operator were taken to a hospital due to injuries.

Lessons Learned: Critical lift plans must be reviewed to ensure the rigging plan, including the lift geometry, lift points, rigging equipment, and rigging procedures are adequate and appropriate for the lift. As discussed previously, where overloading of the crane or rigging is possible due to potential binding conditions, a portable LID with a readout readily visible to the signal person or rigger shall be used, an appropriate stop point shall be established, and the LID shall be monitored to ensure the stop point is not exceeded. Multi-purpose machines or aerial lift equipment should not be positioned or operated under the crane or load where possible. Luckily, no fatality occurred as a result of the accident discussed above, but the potential was there. We must ensure crane and rigging operations are conducted properly and safely.

Weight handling program managers and safety officials should review the above lessons learned with personnel performing weight handling functions and consider the potential risk of accidents occurring at your activity. Contracting officers should share this information with representatives who oversee contractor weight handling operations. This is also a good time to reinforce the principles of operational risk management. Our goal remains zero weight handling accidents. ■

CRANE ACCIDENT PREVENTION, SAFETY CHALLENGE FOR FY12

Although fiscal year (FY) 2011 saw an increase in the total number of crane accidents and an increase in the number of accidents that we classify as significant, (overloads, dropped loads, two-blockings, and personal injuries), the navy shore activities still had an excellent year in terms of accident severity, with only three of the accidents reaching the reporting threshold of OPNAV Instruction 5102.1, and all three were class c accidents.

With our "wide aperture" definitions for crane and rigging accidents, i.e., virtually any unplanned event regardless of degree of injury or whether damage occurred, our philosophy of reporting, analyzing, and learning from the small events has proven effective in keeping the number of truly serious accidents at a very low level. We are now seeing incremental progress in raising the sensitivity on the part of activity personnel to report lower level events (near misses and other unplanned events) in addition to those events that meet our comprehensive accident definition. This healthy strategy will significantly and continuously improve the safety of weight handling operations over the long term.

This is not to say we should be satisfied with our record. There is still significant room for improvement. FY11 saw an unsatisfactory increase in overload accidents, with most of them being rigging gear overloads. A number of rigging gear overloads occurred due to poor rigging practices, indicating in many cases a lack of understanding of rigging fundamentals. Additional training, re-training, and increased surveillance of crane rigging may be required.

Our goal is to evolve a culture wherein people instinctively focus on the value of gaining lessons learned from the reporting of all unusual events in a weight handling operation to prevent more serious events from occurring. Such a culture achieves a continuous improvement in safety over the long term. I challenge each activity to embrace this approach.

Human error is the cause of most accidents. It is imperative that weight handling managers be proactive in reinforcing safety expectations with all hands involved in weight handling operations; through appropriate safety stand downs and increased surveillances of operations. Every potential accident prevented not only improves the safety of personnel but also significantly improves operational efficiency by avoiding the inherent schedule disruption and cost associated with accident recovery actions.

With the winter months upon us, I ask weight handling managers and supervisors to place a special focus on safe crane and rigging operations. In many regions environmental working conditions will continue to worsen and bring ice, sleet and snow conditions. Frigid temperatures and icy conditions pose significant challenges to your crane teams as they support weight handling demands. Operations in cold weather reduce personnel dexterity and induce additional physical challenges which can lead to accidents. Cranes, barge decks, ground level rails and rail switches can become hazardous for slips, strains, and falls. Exterior working surfaces, platforms, walkways, and ladders are especially prone to icing conditions and appropriate precautions should be put into place to minimize this risk. Cranes and rigging gear are also affected by the cold weather. Crane sheaves and hoist blocks can become iced up or frozen which can result in mis-spooling conditions and cause damage to critical cranes and components. Ice build-up on mobile crane booms can also create hazardous conditions.

Where such hazardous conditions occur, managers and supervisors should consider conducting increased surveillance of weight handling operations. Look for signs of complacency or inattention. Make sure that the environment is conducive to safe weight handling operations. Make sure that your crane teams have sufficiently planned the task at hand and all involved personnel understand their responsibilities in support of the task. Proactive leadership throughout the command is a powerful tool in ensuring safe weight handling operations. Effective planning, teamwork, communication, situational awareness, and Operational Risk Management (ORM) are all good tools for reducing the risk of an accident. Good job planning and communication go hand in hand.

Each weight handling accident diminishes support to the fleet. A safe and reliable Navy weight handling program is an essential enabler for fleet readiness. I encourage commanding officers to intensify your efforts to raise the level of safety awareness in your activity's weight handling operations and continue to strive for the goal of zero weight handling accidents.

Navy Shore Weight Handling Safety Brief!

Title: Load Moment Test Configuration for Mobile Crane Testing

Target Audience: All personnel associated with mobile crane load testing.

CAUTIONS

- ✓ Lift load only high enough to perform required test
- ✓ Always lift test load well within maximum radius, then boom down to pre-measured radius stopping at least once to check brakes
- ✓ Perform all movements slowly
- ✓ REMAIN ALERT AT ALL TIMES

NEGATIVE TREND ALERT

- ➢ Several recent incidents have identified weaknesses during mobile crane load testing for cranes with telescopic booms, especially in determining the correct boom length and radius to be used during the Load Moment Test.
- ❑ Per NAVFAC P-307, Appendix E, paragraph 5.4.2.2:

  "Load Moment = Capacity X Radius"

1. Determine the shortest required boom length which must be a minimum of 50% of the maximum boom length using crane's load chart or working range diagram (not including power pin flys or jibs), AND where all boom sections are partially extended.
2. To identify the correct radius, multiply each radius by its rated load until the resulting load moment value decreases. Use the radius that results in the LARGEST load moment AND that also ensures the resulting test load clears ALL crane components during crane rotation.

➢ NOTE: Cranes equipped with multiple boom modes must have multiple load charts checked to ensure maximum load moment is selected.

3. If the preliminary test load determined in step 2 will NOT safely clear the crane, select a longer radius until clearance is obtained.
4. Using the load chart, multiply the capacity at the radius determined in step 2 or step 3 (as applicable) by 1.05 to obtain the minimum test load for the load moment test.

CONTACT NAVCRANECEN IN-SERVICE ENGINEERING FOR QUESTIONS AND/OR ASSISTANCE NEEDED WITH MOBILE CRANE LOAD TESTING

8 December 2011

SAFETY

Navy Crane Center 11-S-7

SHARE YOUR SUCCESS

We are always in need of articles from the field. Please share your sea stories with our editor nfsh_ncc_crane_corner@navy.mil.

WEIGHT HANDLING PROGRAM SAFETY VIDEOS

Accident Prevention, seven crane accident prevention lessons learned videos are available to assist activities in raising the level of safety awareness among their personnel involved in weight handling operations. The target audience for these videos is crane operations and rigging personnel and their supervisors. These videos provide a very useful mechanism for emphasizing the impact that the human element can have on safe weight handling operations.

Weight Handling Program for Commanding Officers provides an executive summary of the salient program requirements and critical command responsibilities associated with shore activity weight handling programs. The video covers NAVFAC P-307 requirements and activity responsibilities.

Mobile Crane Safety covers seven topics: laying a foundation for safety, teamwork, crane setup, understanding crane capacities, rigging considerations, safe operating procedures, and traveling and securing mobile cranes.

"Take Two" Briefing Video provides an overview on how to conduct effective pre-job briefings that ensures interactive involvement of the crane team in addressing responsibilities, procedures, precautions and operational risk management associated with a planned crane operation.

"Safe Rigging and Operation of Category 3 Cranes" provides an overview of safe operating principles and rigging practices associated with category 3 crane operations. New and experienced operators may view this video to augment their training, improve their techniques, and to refresh themselves on the practices and principles for safely lifting equipment and materials with category 3 cranes. Topics include: accident statistics, definitions and reporting procedures, pre-use inspections, load weight, center of gravity, selection and inspection of rigging gear, sling angle stress, chafing, D/d ratio, capacities and configurations, elements of safe operations, hand signals, and operational risk management (ORM). This video is also available in a stand alone, topic driven, DVD format upon request.

Note: ***"Load Testing Mobile Cranes at Naval Shore Activities"*** is currently being updated to address the new load test procedures in the December 2009 edition of NAVFAC P-307.

All of the videos can be viewed on the Navy Crane Center website: https://portal.navfac.navy.mil/ncc.

HOW ARE WE DOING?

We want your feedback on the Crane Corner.
Is it Informative?
Is it readily accessible?
Which types of articles do you prefer seeing?
What can we do to better meet your expectations?

Please email your comments and suggestions to ***nfsh_ncc_crane_corner@navy.mil***