THE CRANE CORNER

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A WORD FROM TOPSIDE

Sam Bevins

As I noted in the September 2003 edition of the Crane Corner, the Secretary of Defense issued a challenge to all DOD agencies to reduce the number of accidents by at least 50 percent in the next two years. Although Navy shore activity weight handling equipment (WHE) accidents have been on a downward trend since 1999, I believed last year, and I still believe, that the Navy shore community can further reduce WHE accidents (FY03 numbers) by 50 percent by the end of FY05.

If there is one area where we can make a significant dent in both the total number and the severity of WHE accidents, it is in mobile crane operations. In terms of raw numbers, 40 percent of all the WHE accidents reported to the Navy Crane Center occurred during mobile crane operations, most due to human error. Yet mobile cranes make up a mere 8 percent of the Navy's inventory of approximately 8,000 cranes and hoists.

From a severity standpoint, the majority of serious accidents reported to the Navy Crane Center involve mobile cranes, including contractor-owned mobile cranes operating on Navy property. In the past three months alone: a Navy-owned crane tipped over while being prepared for a routine oil change; a contractor-owned crane tipped over while being prepared for removal from the site; a contractor employee lost his hand while troubleshooting a problem on a contractor-owned category 4 crane; and a tree being removed by a contractor-owned crane fell on power lines and disrupted power on a Navy installation.

In three of these accidents, there was no load on the hook. In fact, about half of all mobile crane accidents reported to the Navy Crane Center occur without a load on the hook. Serious mobile crane accidents have occurred during crane assembly, during operator's pre-use checks; and, as noted above, during maintenance or when securing the crane for travel off site. More than for any other type of crane, the operation of mobile cranes, whether with a load attached or not, requires constant attention by the crane team. The operator must be intimately familiar with the operational characteristics of the particular crane he/she is operating. We have had numerous tipped cranes resulting from rotating an unloaded crane without having deployed the cranes' outriggers. Two-blockings have resulted from the operator paying attention to one hook and temporarily disregarding the position of the second hook. These small lapses in attention can have catastrophic consequences.

Inside This Issue

There are many tools to help ensure the safety of mobile crane operations, including proper training, a true crane team concept, risk assessment and mitigation, and sharing lessons learned from previous accidents and near misses. The Navy Crane Center produced two training videos on mobile cranes. The first provides guidance on how to properly load test a mobile crane. Our newest video addresses mobile crane safety. It addresses the common types of mobile crane accidents and the measures required to prevent them. All shore activities with mobile cranes were provided copies of this worthwhile video. Our auditors will be asking how this video is being used at your activity to help prevent mobile crane accidents.

For mobile cranes, there are no "routine" operations. Thorough knowledge of the crane's operational characteristics, basic operational risk management, and solid teamwork are necessary for each and every operation. While all of us continue to strive for our ultimate goal of Zero accidents, performing all mobile crane operations safely will have a high payback toward meeting the 50 percent accident reduction challenge, keeping our personnel safe, and performing our mission of supporting the Fleet.

HAVE YOU HEARD ABOUT?

A new photoluminescent material that resolves several deficiencies of the conventional zinc-sulfide (ZnS) based products traditionally used in the Navy such as short shelf-life, continual in-service degradation, and poor luminous performance - is offered as a long-lasting light source in the dark. It is intended for marking emergency egress routes, exit signs, wall and floor openings, hazards, and other items that need identification in the event of a power outage. The new material uses oxides of strontium-aluminate (SrAl) phosphors to generate an afterglow, and according to the manufacturer, it:

- Is 12 times brighter than ZnS based material for time intervals up to 60 minutes
- Lasts 8 times longer
- Has unlimited life (can be re-charged indefinitely - in excess of 30 years)
- Charges with low-level ambient light (after a 10-15 minute charge remains visible for over 8 hours after the lights go out)
- Requires no maintenance
- Requires no external power source
- Is durable and weather and fire-resistant.

The SrAl-based material is available in sheet form with various thicknesses, strips, moldings, adhesive tape, custom signage, powder coatings, paint, and slip-resistant handrail coverings. In the case of powder coating application, the parts must be shipped to a local powder-coater for proper application of the material.

This material has been used by NASA on the International Space Station and by DoD in the Pentagon to illuminate evacuation routes. UL has approved photoluminescent exit signs to replace electric signs. GSA recently used these signs to replace all electrically powered exit signs in the Old Executive Office Building. FAA has authorized photoluminescent material for use in marking egress routes on commercial aircraft.

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NAVFAC P-307 CHANGE 3

NAVFAC P-307 was revised to clarify misunderstood requirements with respect to wire rope slings used in basket hitches, to clarify load test and marking requirements for wire rope endless slings to ensure proper usage, to include new requirements from ASME B30.9 for chain slings, and to provide additional clarification to certain sling use criteria.

REPLACEMENT PARAGRAPHS

- Paragraph 14.7 Slings. Slings shall meet the selection, use, and maintenance criteria of ASME B30.9, with additions and changes as noted below. Loads on slings increase with increasing angles from vertical.

Slings shall not be used at angles of less than 30 degrees from horizontal, unless specifically authorized by an engineering work document. In addition, capacity reductions may be required for slings used in basket or choker hitches, or where the body of the sling is bent around a hook, shackle, or other rigging gear. Components in multiple leg sling assemblies shall be sized based on the worst-case distribution of loads. For example, slings, shackles, and attachment points in a four leg assembly for a four-point lift shall be sized based on either pair of diagonally opposing legs carrying the entire load, unless the assembly is equipped with devices that automatically adjust for equal distribution of the load such as engineered equalizer plates. Chain hoists may be used for equalizing loads only if used in conjunction with load indicating devices. This requirement for load indicators does not apply to chain hoists used for leveling the load in three-point or two-point lift configurations.

- Paragraph 14.7.1.3 Chain Sling Use Criteria. Chain slings shall be used in accordance with OEM recommendations. Chain slings are recommended for use in abrasive and high temperature environments that may damage other slings. Chain slings shall not be used where their use increases the risk of electrical shock or electrocution, or where damage to equipment may result. For use in temperatures below -40 or above 400 degrees Fahrenheit (F), follow OEM recommendations for rated load reduction. Where a chain sling is used in a choker hitch, the capacity shall be reduced to reflect the efficiency percentages shown in table 14-4.

- Paragraph 14.7.2.3 Wire Rope Sling Use Criteria. Wire rope slings shall not be used over a pin, shackle, hook, or ring of less than the nominal diameter of the wire rope. If the body of the sling is bent around an object that is greater than 40 times the diameter of the wire rope (e.g., basket hitch), then the total capacity of the sling is equal to two times the sling's single leg lift capacity. If the body of the sling is bent around a pin, hook, or other object that is 40 times the diameter of the sling or less, the total capacity shall be reduced to reflect the efficiency percentages shown in table 14-3. For loads with non-circular cross sections, "D" shall be derived from the minimum bend diameter of the wire rope around the corner of the load. No reduction is required for endless slings that are rated and used based on a D/d efficiency of 50 percent. Where a wire rope sling is used in a choker hitch, the capacity shall be reduced to reflect the efficiency percentages shown in table 14-4. Chafing protection shall be used where necessary to protect the load and the sling from damage. In addition, for slings bent around corners, corners shall be rounded (e.g., with pipe sections) to provide a minimum D/d efficiency of 50 percent. Except for braided slings, wire rope slings shall not be used in single leg vertical hitches, unless a method is used to prevent unlaying of the rope. Wire rope slings shall not be used where their use increases the risk of electrical shock or electrocution, damage to equipment may result, or exposure to temperatures below -40 or above 400 degrees F may occur. (For fiber core slings, the maximum temperature shall be 180 degrees F.)

- Paragraph 14.7.2.3.1 Additional Criteria for Wire Rope Endless Slings. To determine the vertical rated load of an endless sling, use the following equation:

$$\text{Rated load} = \frac{\text{NRS} \times \text{D/d efficiency} \times 2}{\text{DF}}$$

Where: NRS is the nominal rope strength listed in federal specification RR-W-410, the nominal rope strength provided by the wire rope OEM, or the actual breaking strength based on destructive testing of material samples.
D/d efficiency is taken from table 14-3.
DF is the design factor (5 or greater).

- Paragraph 14.7.2.3.1.1 Load Test. The sling shall be tested over a pin with a diameter equal to or greater than the wire rope diameter. The test load shall be 200 percent of the rated load determined from the above equation using the efficiency factor derived from the diameter of the test pin, with a maximum efficiency of 78 percent. For a test pin diameter between the values shown in table 14-3, the efficiency shall be determined from a curve plotted from the D:d values and efficiency percentages shown. The test load and test pin diameter shall be recorded. For slings procured from commercial vendors, the vendor's proof test shall be in accordance with these criteria.

- Paragraph 14.7.2.3.1.2 Marking and Usage. Endless slings shall have a marked rated load based on a D/d efficiency of 50 percent and may be used over various size pins at loads not exceeding the marked rated load or for a sling that will be used in a specific application over a single pin diameter, the marked rated load shall be the rated load based on a D/d efficiency for that pin diameter; in which case the sling shall be marked to indicate that pin diameter. The load test pin diameter shall be greater than or equal to the specific use pin diameter.

- Paragraph 14.7.2.3.1.2.a. If the test pin diameter is greater than the wire rope diameter, the sling may be used at a load higher than the marked rated load with written approval from the activity engineering organization. The allowable load shall be the load derived from the above equation for the intended pin diameter but shall not exceed 50 percent of the test load. Authorization shall be provided for each intended use at a load higher than the marked rated load.

TABLE CHANGES

- Table 14-3. Add a line for D/d ratio 5:1 and its corresponding efficiency percentage of 78. Revise the third sentence of the note as follows: Multi-part slings shall only be used where the D/d efficiency is at least 75 percent.

- Table 14-4. Delete first column (i.e., "Wire Rope") including percentages. Replace first column heading with "Chain." Add the following percentages corresponding to the five choke angle ranges: 80 percent, 70 percent, 60 percent, 50 percent, and 40 percent. Change heading for second column to "Wire Rope & Synthetic Rope."

Replacement pages for this change as well as for changes 1 and 2 are posted on our web site, http://ncc.navfac.navy.mil. Replacement pages for pages iii and iv contain the change record and synopsis for changes 1 through 3. NAVFAC P-307, incorporating all changes, is available from our web site, http://ncc.navfac.navy.mil, and Naval Logistics Library web site, http://www.nll.navsup.navy.mil.

For endless slings not currently load tested to the above criteria, appropriate load tests shall be performed at the next annual inspection of the sling. ■

MOBILE CRANE STABILITY

A Navy mobile crane recently lost stability and overturned during a routine maintenance evolution. Fortunately, there were no injuries but there was considerable damage to Navy property and extended loss of a vital lifting asset. With the boom at a high angle and with the outriggers retracted, the crane was rotated to facilitate the maintenance. The crane lost backward stability and tipped over on the counterweight.

In February of this year, a similar accident occurred with a contractor crane on Navy property. In that accident, the outriggers were also retracted but the boom was at a low angle. When this crane was rotated, the crane lost forward stability and the crane tipped over on its boom.

Mobile cranes are complex machines with many unique operating characteristics. Extended booms provide greater reach but decrease the margin of forward stability. Heavy counterweights provide greater lifting capacity but decrease the margin of backward stability. A large percentage of overturned crane accidents reported to the Navy Crane Center were the result of loss of stability resulting from the rotation of the crane, either intentionally or inadvertently, while the outriggers were retracted and with no load on the hook.

Crane operator supervisors must ensure they and their operators are thoroughly familiar with each mobile crane's operating characteristics. Operating characteristics vary from crane to crane and the list of precautions can be extensive. If an operator is assigned to a crane he/she has not operated recently, the supervisor should review the crane's operating requirements and precautions with the operator. Operators must instinctively know when to deploy the crane's outriggers. When traveling the crane, even short distances, the rotate lock must be engaged. If a problem arises, the supervisor should be contacted. Operator attentiveness is required even for minor movements of these cranes. Other personnel on the crane team, including riggers, inspectors, test directors, and maintenance personnel, should be alert to potential problems.

The Navy Crane Center's video on mobile crane safety is a useful tool in reminding crane team personnel of the numerous risks involved with mobile crane operations. It is available on the web at dodimagery.afis.osd.mil. Go to DAVIS/DITIS. PIN is 806721.

UNAUTHORIZED REPAIR OF CRANE RADIO CONTROLS

An accident occurred on a bridge crane that utilized a radio control system. The radio control's transmitter malfunctioned and caused the crane to move unexpectedly. Upon investigation, it was found that one of the circuit boards was modified without the original equipment manufacturer's (OEM) knowledge.

Radio control systems are typically used to control overhead and monorail cranes. The systems include a portable transmitter, crane mounted receiving and decoding equipment, power supply, and necessary circuitry to control the crane.

The equipment utilizes a microprocessor in both transmitter and receiver. When a control lever is moved or a pushbutton is pressed, the transmitter sends a unique encoded digital signal with error checking. The receiver on the crane checks the signal for errors. If the receiver detects an error or erroneous signal, the crane will not move. If the error checking is satisfactory, the crane will operate depending on which control lever is moved or pushbutton is pressed.

When the radio transmitter or receiver is not functioning properly, repair by following an OEM diagnostics guide located in the owner's manual or by sending it to a designated repair facility authorized by the OEM. Typically, the owner's manual diagnostic guide only allows replacement of circuit cards or fuses. Replacing discrete components on the circuit card is not allowed. The OEM is not responsible for repairs performed by the user activity or unauthorized repair facilities. Radio transmitters or receivers repaired by an unauthorized person or repair facility may result in unintended operation that may cause an accident.

Please notify the Navy Crane Center if an unauthorized person or repair facility repaired your radio equipment. Provide your name, your phone number, activity, manufacturer's name, model number, and description of repair. This information will be used to determine if the equipment should be sent to the OEM for inspection to determine if the equipment is safe to use.

CRANE CONTROL SYSTEM TROUBLESHOOTING DEVICES

Crane control systems have increased in complexity over the years as manufacturers compete to provide more sophisticated load control and better fail safe circuitry. Government contracts for crane procurements often compound system complexity to incorporate lessons learned, system redundancy, and enhancements required by customers. The final product can be a challenge to troubleshoot when problems occur resulting in loss of production time and decreased reliability. Repeat problems can become very costly.

Control systems that incorporate programmable logic controllers or ladder logic can be user friendly and invaluable as troubleshooting tools when a problem occurs. These control systems can provide sufficient details to narrow the cause of a problem down to a specific area of a circuit. However, sometimes even with these tools, it can be difficult to find the root cause of a problem. This is especially true when a problem causes the drive to immediately shut down or lose control circuit power. Any indication of the problem can be lost before troubleshooting efforts are begun.

Fortunately, tools are available to troubleshoot problems that cause a drive to immediately shut down or cause control circuit power to be removed. Tools to assist in troubleshooting these types of problems are available.

A Scope Type Meter. This meter is similar to an oscilloscope with two channels but has many added features. The meter can save data internally or can save data to a laptop computer for review at a later time. It can depict specific signal quality and parameters for AC or DC signals and waveforms. It can be set for peak to peak, RMS, Hz, Volts, amps, etc. Specific circuit troubleshooting applications include:

- Pinpointing faulty and non-firing SCR by reviewing the DC output waveform of a SCR drive.
- Graphing signal output quality from an encoder.
- Identifying levels of line noise and harmonics on a power system caused by SCR (thyristor) drives.
- Measuring network noise / signal stability on the Panelview network.

Sixteen Channel Field Recorder. This recorder can be used when more than two circuit points must be monitored simultaneously. This recorder can provide real time continuous monitoring of a circuit at up to 16 points and can be set to save data automatically when a system trip occurs. Specific circuit troubleshooting applications include:

- Identifying the cause of a luff hoist motor breaker trip to an intermittent shorted SCR.
- Capturing an intermittent loss of encoder signal output that had caused numerous drum brake trips on a 60-ton portal crane.
- Monitoring brake circuit operating parameters during various operating conditions.
- Identifying the cause of loss of control circuit power to be intermittent contact of a hoist upper weighted limit switch on the M140 enclosure bridge crane.

Other applications for these tools include balancing of travel motor currents and system monitoring during annual PMs that can point out marginal conditions that normal PM inspections might otherwise miss. If your activity is interested in using similar devices, be sure to understand your needs and applications before researching the systems available to best fit your requirements. ■

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-126: Spline Shafts on Shepard Niles 5-Ton Package Hoists.
CSA-127: Crack in Drum Pillow Block of Shaw-Box Bridge Crane.
CSA-128: Defective Handle on ABB Ltd. Disconnect Switches.
CSA-131: Square D Heavy Duty Safety Switch, Series F, 60 and 100 Amperes.

EQUIPMENT DEFICIENCY MEMORANDA

EDM-064: General Electric Heavy Duty (Mill Duty) Switch Assemblies, Master Switches, Limit Switches, and Rotary Limit Switches.
EDM-065: General Electric DC2000, 3TB Interface Circuit Board.
EDM-066: Loose Brake Hub on a Stearns 35X Series Armature Actuated Brake. ■

SECOND QUARTER FY04 ACCIDENT REPORT

The Navy Crane Center disseminates crane accident lessons learned to prevent repeat accidents and improve overall crane safety. NAVFAC P-307 requires commands to submit to the Navy Crane Center a final, complete accident report (including corrective/preventive actions) within 30 days of an accident involving Navy-owned weight handling equipment, regardless of severity or type. This reporting requirement includes rigging gear accidents, i.e., gear covered by section 14 of NAVFAC P-307 used by itself in a weight handling operation. In addition, contracting officers are required to forward to the Navy Crane Center and the host activity reports of all contractor caused accidents with Navy-owned cranes regardless of severity.

For the second quarter of FY04, 44 Navy and 3 contractor weight handling equipment accidents were reported. Serious Navy accidents this quarter included 2 injuries, 3 dropped loads, 2 overloads, and 2 two-blockings.

PERSONAL INJURY

Accident: While landing a pipe staging material rack onto a submarine, a worker sustained a broken finger. While the rack was being lowered, the worker was placing pieces of plywood under the legs of the rack to protect the submarine's hull. The worker took his eyes away from the leg where his hand was positioned and focused on another leg which was about to touch down. When the material rack was landed, the leg the worker was no longer watching came down on his finger.
Lessons Learned: Personnel working in the crane operating envelope must remain alert at all times during lifting and handling operations. Pre-lift preparations should include interactive discussions on risk assessments and the safe positioning of crane team members in the work area.

Accident: A crane team made up of personnel from two different commands was assigned to transfer two valves and a dolly from a pier to a ship. The first lift of one valve was completed successfully. While making the second lift, which consisted of the other valve and a dolly, the load was suspended approximately twelve inches above the ship's deck when it was decided that the dolly was not needed. The rigger-in-charge directed one rigger to lift the suspended dolly while another rigger untied the dolly lashing. While the rigger was untying the lashing for the dolly, the valve fell to the deck. It was later determined that the lashing for the valve was not properly attached to the shackle. The valve cut the shoe of one rigger and then rolled and struck the other rigger's leg. The team then correctly rigged the valve back to the shackle and completed the lift. The crane team failed to stop the operation upon having an accident, did not notify immediate supervision, failed to ensure the accident scene was secured and undisturbed, and failed to ensure the valve was inspected for damage prior to the valve being installed shipboard. Management was not aware of the accident until the following day when one of the injured riggers reported to the dispensary for treatment.
Lessons Learned: When crane teams include personnel from different commands, it is very important to conduct a thorough pre-lift brief to ensure that all personnel are aware of their responsibilities and will work together as a team. The rigger-in-charge has overall control of the lift, directs all team members during the lift, and ensures that the load is properly rigged. Following an accident or suspected accident, NAVFAC P-307 requires activities to stop work and promptly initiate an investigation. Management must ensure that all applicable personnel are trained on these requirements.

DROPPED LOADS

Accident: While a jet blast deflector panel was being lifted into position on a flight deck, two cooling modules became detached from the panel and fell to the deck. The modules were attached to the panels with fasteners and secured with nuts on the back. The two modules that fell had fasteners through them but no nuts to secure them. The on-site rigger supervisor placed the load in a safe position, secured the accident scene, and notified his supervisor. The second level supervisor arrived at the scene, surveyed the area, and told the crane team they could resume work. The crane operator knew this was not proper procedure and notified his supervisor who reported to the flight deck. After learning what had transpired, the crane operator supervisor notified senior management and was instructed to halt work. The crane accident prevention team was notified and started an investigation.

Lessons Learned: The rigger in charge must ensure the load to be lifted does not have any loose objects that may dislodge during the lifting operation. Also, when a suspected WHE accident occurs, work must stop, the load must be placed in a safe position, and the accident scene must be preserved to facilitate the required accident investigation.

Accident: While loading life raft containers aboard ship, a decision was made not to use tag lines to maneuver the containers into the holding racks. The thought was that ship's force personnel on board could reach the containers without tag lines. The containers were rigged using two nylon slings in a choker hitch, one on each side of the container. While attempting to pull the suspended container to the rack by the left side-lifting sling, ship's force personnel pulled the sling off the container, dropping the container to the pier.
Lessons Learned: The rigger-in-charge must ensure that sufficient tag lines are used to control and maneuver the load. Additionally, a strap must be attached horizontally between the two nylon slings to prevent one or both of the slings from sliding off the load.

Accident: While performing a no load test of a monorail crane, an inspector thought something was wrong with the tracking of the trolley but continued on with the load test. While moving the weights the full length of the track, one side of the trolley came off the monorail while going through a ninety-degree turn, causing the test weights to drop.
Lessons Learned: When deficiencies are noted that may affect load bearing or load controlling parts or operational safety devices, they must be corrected prior to operating the crane. Management must ensure that all applicable personnel are trained on these requirements.

OVERLOAD

Accident: A 2,000-pound capacity electric chain hoist was overloaded, damaging the upper hook, while conducting an annual load test. A dynamometer indicated that there had been an applied dynamic load of 4,000 pounds. The hoist was attached to a structure used to test jack assemblies and lift a beam that travels vertically on two guideposts. Investigation revealed that one of the sleeves that travels along the guide posts bound from lack of lubricant causing an uneven pull on the beam and the subsequent overload.
Lessons Learned: Personnel must ensure that equipment is properly maintained prior to operating. Additionally, crane team members must remain focused on the lift at all times and be alert for any abnormal condition, such as binding, that could affect the safety of the lift.

Accident: A 3/8-inch wire rope sling was overloaded when the operator of a pendant-controlled crane transferred a motor weighing 2,940 pounds from a pallet to a test stand slab. The sling was attached to the motor by passing the sling through two integral lifting padeyes with the eyes of the sling attached to the crane hook. This rigging configuration provided no chafing protection between the sling and edges of the padeyes. The D/d ratio and corresponding efficiency percentage reduced the capacity of the sling to 1,960 pounds. A proper rigging method would have been to attach appropriate capacity slings from the hook to the padeyes by shackles.
Lessons Learned: Management must ensure that all personnel are trained in and utilize proper rigging methods.

TWO-BLOCKING

Accident: A mobile crane was two-blocked during the troubleshooting of a hydraulic leak in the auxiliary hoist. After lowering the hook, a mechanic returned the hoist lever to the neutral position but the auxiliary hoist block started to rise. The mechanic shut the engine down to stop the hoist, but the two-blocking still occurred. It was determined that the hoist raised when the lever was returned to neutral because a hydraulic spool valve in the control system had been reassembled incorrectly during previous troubleshooting of the leak. The mechanic who reassembled the valve was not completely familiar with the characteristics of the hydraulic system on this crane and there was no in-process inspection performed.
Lessons Learned: Maintenance and operator supervisors must ensure that personnel use extreme caution when operating cranes that are out of service for repair. In addition, maintenance supervisors should assign trained

personnel familiar with the characteristics of the systems they are assigned to repair or troubleshoot. Paragraphs 2.3 and 2.3.2 of NAVFAC P-307 require load bearing and load controlling parts to be inspected after work is completed and in-process when inspection is not practical after completion of work. An in-process inspection during reassembly of the hydraulic spool valve could have prevented this accident.

Accident: A mobile crane main hoist was two-blocked during a load test. During the test evolution, the crane was required to have it's reeving changed for different capacity lifts. Each time this was done the crane was placed in the "rigging/travel" mode, which deactivates the limit switch. After reeving the crane from three to four parts of line, the operator was extending the boom to perform the next test and two-blocked the main hoist damaging the boom tip sheave. Besides inattention to the operation of the crane, the operator failed to change the "rigging/travel" mode to reactivate the limit switch. Additionally, the test director failed to ensure all standard operating procedures were followed during set up for individual tests.
Lessons Learned: Crane operators must remain alert and focused during all types of crane operations. Whenever mobile crane safety devices are bypassed for travel or reconfiguring the crane, the operator must ensure the safety devices are properly reset prior to commencing lifting operations. Additionally, test directors must ensure crane team members are in compliance with procedures during the different phases of testing. Requirements for bypassing safety devices are contained in section 10 of NAVFAC P-307.

CONTRACTOR SIGNIFICANT ACCIDENTS

Accident: During construction of a building, two steel pipe cross braces were rigged and hoisted to the building roof using a choked two leg 3/8-inch wire rope bridle. When the load reached the roof area, the crane operator could no longer see the load and was taking signals by radio from an ironworker supervisor positioned on the roof. The load was placed on the roof and then separated. One of the pipe braces was then rigged by the iron worker supervisor on the roof using only one leg of the bridle in a doubled choker configuration around the pipe. The crane operator then proceeded to hoist the load and swing the crane to position for lowering the pipe brace into place. While lowering the pipe brace, it bumped a structural member and began to dislodge from the sling. The operator was told to stop and hold the load. However, enough weight shifted that the load slid through the sling and fell to the ground.
Lessons Learned: Ensure all personnel are trained in proper rigging techniques prior to being allowed to rig a load. A better technique would have been to rig the pipe brace with both legs of the bridle assembly.

Accident: While a crane was being prepared for travel, the counterweight was removed and the outriggers were retracted. When it was time to stow the crane boom into the crane dolly, located at the rear of the crane, the operator then swung over the side of the crane causing the crane to tip over.
Lessons Learned: Crane operators must be aware of operational characteristics of the equipment they are operating. With the outriggers retracted, some cranes will tip merely from the weight of the boom or the counterweight in certain configurations. Personnel must ensure that they follow OEM instructions when preparing the crane for travel.

Weight handling program managers and safety officials are encouraged to consider the potential risk of accidents occurring at your activity similar to those highlighted above and apply the lessons learned to prevent similar accidents. OPNAVINST 3500.39, *Operational Risk Management*, prescribes methods for assessing hazardous operations, which should be used in the planning and preparation of all WHE lifts.

E-mail submission of reports of accidents, unplanned occurrences, and near misses is encouraged. The e-mail address is m_lstr_ncc_safe@navy.mil. The reports must include a complete and concise situation description, corrective and preventive actions, probable cause and contributing factors, and an assessment of damage. For equipment malfunction or failure, include specific description of the component and the resulting effect or problem caused by malfunction or failure.

P-307 QUESTIONS & INTERPRETATIONS

The questions and interpretations listed below are based on crane program issues that arose and Requests for Clarification, Deviation, or Revision, P-307, figure 1-1. They are also listed on our web page, http://ncc.navfac.navy.mil/. Click on P-307 and then on P-307 Questions and Interpretations. The issues are arranged by the applicable section or appendix to the P-307.

Question: Reduction of Rated Load. Clarify the meaning of paragraph 14.13.f second sentence "The rated load shall be reduced by 20 percent or the D/d efficiency factor, whichever is greater."
Answer: The sentence should be revised as, "The rated load shall be reduced by 20 percent or by the reduction due to D/d efficiency, whichever is the greater reduction." In other words, if the D/d efficiency is 75 percent, this represents a reduction in rated load of 25 percent. The rated load of the lashing would be reduced by 25 percent, since this is greater that 20 percent (which is the reduction factor for wire rope clips). If the D/d efficiency is 90 percent, then the reduction due to D/d efficiency is 10 percent. Thus, the rated load in this case would be reduced by 20 percent since this is greater than the reduction due to D/d efficiency.

Question: Post Hand Signals in Crane Cab. Request deviation from the NAVFAC P-307 requirement to post hand signals in the crane cab on all cranes. In lieu of posting standard hand signals in the cab, signals will be posted in view of the riggers.
Answer: The request to post standard hand signals in view of riggers in lieu of posting the hand signals in the operator's cab is denied. The operators need to be aware of all of the hand signals that riggers are using to signal the crane. Even though operators are trained periodically in the understanding and use of standard hand signals, posting them in the cab serves as a continual reference and positive reinforcement to help ensure that operators will be operating the crane safely and properly. The Navy Crane Center does endorse the posting of hand signals in view of the riggers in addition to the required posting of hand signals in the operator's cab.

Question: Testing Mechanical Load Brakes. Request clarification of the correct testing of mechanical load brakes. Specifically, we request deviation from the 125 percent requirement only in those specific instances where we have clear OEM guidance.
Answer: The request to deviate from the 125 percent testing of mechanical load brakes is denied. Mechanical load brakes are to be tested with a 125 percent test load as required by NAVFAC P-307, appendix E, paragraph 6.2.1.d or 7.2.1.c.

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