THE CRANE CORNER

Navy Crane Center Technical Bulletin

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Editor: m_lstr_ncc_ccorn@navy.mil

A WORD FROM TOPSIDE

Sam Bevins

In the September 2004 issue of the Crane Corner, I noted that the Navy shore activities had a golden opportunity to significantly reduce our shore activity crane accident numbers by exercising the same vigilance when operating an unloaded crane as when operating a crane lifting a load. A year later, the results indicate that many of the Navy shore activities have not taken full advantage of this opportunity.

For fiscal year 2005 to date, 61 crane accidents (39 percent of all the crane accidents reported) occurred with no load on the hook. Three common types of accidents noted last year were all too common this year. They were: collisions (including collisions between the crane and an object in the crane's travel path, and collisions between a hook block and another object); two-block accidents; and wire rope damage.

Collisions accounted for 27 of the 61 accidents. And more than half of these were collisions where a hook block struck another object. Many of the accidents occurred on mobile cranes when the hook block struck the boom. Operators must be attentive to the positions of the hook blocks, particularly when traveling or rotating the crane and especially with cranes with more than one hook block. Hook blocks should be stowed to minimum wire rope extension for travel. Travel and rotate speeds should not be excessive.

We continue to get reports of two-blockings on mobile cranes where the anti-two-block device was bypassed, either for stowing the crane or for maintenance. Frequently, the operator will need assistance from other crane team members to ensure the hook block does not approach the boom too closely.

We received reports of birdcaged and crushed wire rope resulting from operating the hoist too fast, sudden stops, and possible side loadings. With empty hooks, operators occasionally operate multiple functions simultaneously to expedite the work. However, such actions can divert the operator's attention. Recently, inattention to a swinging whip hook block on a portal crane resulted in the wire rope jumping the sheave, causing considerable damage.

Many of these accidents resulted in minor damage, but this was not always the case. A mobile crane tipped on its boom when the weight of the empty hook block on the extended boom caused the crane to become unstable. The portal crane accident noted above put the whip hoist out of service for a considerable period of time. Two-blockings can be deadly. Many of the minor accidents are subtle warnings of what could have happened. Let's heed those warnings.

Every crane operation, whether making a lift or operating unloaded, requires the same degree of attentiveness and teamwork. Paying greater attention while operating unloaded cranes will have added positive results when actual lifting takes place. Every accident diminishes support to the fleet. I ask that everyone in the Navy shore weight handling community intensify their focus on safe

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crane operations, with a strong emphasis on ensuring the same level of attention when operating cranes without a load as when conducting lifting operations. Overall, the Navy shore weight handling community has a good lifting and handling safety record. I am convinced all of us recognize we can, and must, do better.

A safe and reliable Navy weight handling program is essential for fleet readiness.

HAVE YOU HEARD ABOUT?

Figure 1

A remotely operated device allows release of the load from a safe distance. The device is comprised of a hydraulic lock and a battery powered control unit. It is operated by a battery powered radio remote control with a range of 300 feet on a frequency of 458.800 to 459.175 MHz. The device is suspended from the crane (hoist) hook and is designed to engage/release a ring (master link) of a sling assembly. The device is shown in figure 1 and the operator's remote control in figure 2.

The hydraulic lock includes features that prevent inadvertent/unintentional release of the load. To release the hydraulic lock - the ring must be unloaded (load set down), the safety button depressed, and then the release button depressed - all in that sequence. A manual bypass for release is provided as a back-up in case of remote release malfunction. The device is rated at 6,900 pounds, with a design factor of 4.0.

Figure 3

Figure 2

There are two other versions of this device offered - both rated at 4,400 pounds. One (shown in figure 3) is designed to engage a link of a chain sling, but otherwise its operation is identical to the ring type. The other device is intended for underwater operation. It does not include the remote controls, but releases the load (either ring or chain) by setting it down.

These devices are certified according to the Austrian Government Rating Agency and are marketed in North America.

SHARE YOUR SUCCESS

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

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-149: Loose Hoist Motor Field Pole Securing Bolts on Samsung Portal Cranes. An activity reported a noisy main hoist motor when operating at slow speeds on a Samsung portal crane. Further investigation by the activity found the GE MD810 motor had loose field pole securing bolts. Some of these bolts were less than hand tight. Upon tightening of the bolts the noise went away. Additional checks by the activity revealed loose field pole securing bolts on additional Samsung portal crane hoist motors.

The motor OEM recommends checking bolt torques upon arrival of the motors, after 24 hours of service, after 3 months of service, and then after every 6 months or as experience dictates. These OEM recommendations were not being performed on any of the Samsung portal crane hoist motors.

At or before each crane's next "A" maintenance period, activities shall torque check all Samsung crane hoist motor field pole securing bolts. Bolts shall be torqued to 120-150 lb-ft (unlubricated) in accordance with the OEM maintenance manual.

At the subsequent "B" maintenance period, activities shall recheck torque and report the findings to the Navy Crane Center.

CSA-150: Securing of Hook Openings in Weight Handling Operations. A serious accident recently occurred on a lifting operation when an eye hook (without a latch or other securing means) attached to a sling slipped off the load as the sling became slack, causing loss of control of the load.

Hooks used on all lifting and handling operations (i.e., hooks on cranes, hoists, slings, chainfalls, etc.) shall have self-closing latches or the throat opening shall be secured (e.g., with wire or rope) to prevent the attached item from coming free of the hook under a slack condition. This requirement shall also be invoked on all contractor lifting and handling operations at Navy shore activities. Exceptions (i.e., where securing the hook throat opening is impractical) shall be approved by the Navy Crane Center.

CSA-151: Failure of a Welded Alloy Steel Load Chain Link on a One-Ton Budgit Hoist. A welded alloy steel load chain link on a one-ton Budgit chainfall failed. Preliminary investigation shows that the chain link lacked adequate fusion in the weld. The load chain has the manufacturer's chain embossing mark "HDY" stamped on one side of the straight leg of the link and the manufacturer's chain embossing mark "*" (star) is stamped on the opposite side of the link. The chain embossing marks can be found on approximately every thirteenth link. The nominal diameter of the chain is 9/32 inches and is utilized on 1/2-ton and 1-ton Budgit chainfalls, and on 1-ton, 1-1/2 ton, and 2-ton Tugit lever hoists.

Immediately inspect 1/2-ton and 1-ton Budgit chainfalls and 1-ton, 1-1/2 ton, and 2-ton Tugit lever hoists for load chain with both chain embossing marks "HDY" and "*" (star). Load chains found with these markings are to be removed from service until further notice. Additionally, supply stock of replacement load chain shall be inspected for similar markings and removed from service until further notice. Activities shall retain any load chain found with the above identified markings and notify the Navy Crane Center. We will provide further information via a revision to this CSA.

CSA-152: Electrical Shock Hazard On Hubbell Type 4216 Master Switches. The purpose of this CSA is to eliminate a shock hazard on Hubbell 4216 master control switches that have a pushbutton in the handle. This CSA supersedes and cancels EDM-082. In 1993, an activity reported a wire connected to the pushbutton became loose and contacted the ungrounded brass retainer for the pushbutton. This established an electrical shock hazard to the operator. CSA 93-008 was issued in response to the deficiency and required Navy activities to disassemble each Hubbell type 4216 master switch which had a pushbutton in the handle and inspect pushbutton wiring to ensure that wiring connectors are properly tightened. In addition to CSA 93-008 requirements, the activity also manufactured a pushbutton retainer using stock nylon rod to replace the original brass retainer. This proved a satisfactory replacement preventing the potential for a shock hazard.

Recently, the activity reported a second electrical shock hazard on an identical master control switch where a wire connected to the pushbutton completed an electrical path through the internal spring to the ungrounded brass retainer. The wiring had been replaced a few days before due to deterioration and this circuit condition was introduced during reassembly due to the internal pushbutton spring being installed in a cocked position. The brass retainer was not replaced with a nylon retainer by the activity in 1993 because the crane was located at a different facility at that time. The activity has taken action to verify proper assembly, tighten wire connections, and replace the brass retainer with a nylon retainer. Hubbell now produces a nylon retainer as a replacement for the brass retainer.

For all Hubbell 4216 master control switches presently equipped with brass retainers, at the next annual or "B" PM (or when the switches are disassembled for maintenance or inspection if prior to the PM), replace the brass retainer with a nylon retainer (Hubbell part #48475-000). Activities are reminded that extra precautions should be taken when working on and reassembling these switches. These precautions include verifying connection tightness and ensuring proper pushbutton spring orientation.

CSA-153: Proper Use of Synthetic Slings. A number of recent accidents have occurred from the improper protection of synthetic slings from sharp corners or edges:

- During the lift of a mobile crane, the synthetic round slings were severed at the corners of the outrigger beams. Rubber padding was used for protection at the edges of the outrigger beams but the padding was inadequate.
- During the lift of an aerial work platform, one of the synthetic round slings was severed at the corner of the outrigger beam. Chafing protection had been provided, but the sling slipped off the chafing protection.
- During the attempt to rotate a 10-ton steel box, synthetic round slings were damaged when the corner of the steel box cut through the chafing protection and the outer cover on the round slings.
- After a contractor crane had overturned, a synthetic round sling was choked around the boom. As the crane was being uprighted, the round sling parted sending the boom back into the water. There was no protection for the round sling at the corners of the boom.
- A valve and plate were being lifted with a crane when the synthetic sling, which was threaded through bolt holes on opposite sides of the equipment, parted causing the load to drop.
- A pump and motor were dropped during a rigging operation when the synthetic sling parted at a sharp corner.

Synthetic slings can be easily cut at sharp corners or edges. NAVFAC P-307, section 14, requires chafing protection for synthetic slings where there is a possibility of the sling being cut or otherwise damaged by the load. In the accidents noted above, the protection was either not provided or was inadequate. Chafing material must be of sufficient thickness and strength to prevent sling damage. Synthetic rope slings and alternate yarn synthetic round slings require a specific radius of curvature around sharp cornered objects. Refer to NAVFAC P-307 (e.g., for alternate yarn round slings see paragraph 14.7.4.3.4.d(2). This requirement also applies to the minimum radius of curvature at corners of objects being lifted). With high stresses on the slings, soft chafing material may not maintain the minimum required radius or provide the required protection. Harder materials, such as split piping sections or special rounded shoes, are recommended. Sling manufacturers also provide wear protection products that protect slings from sharp corners or edges. Also, ensure the rigging configuration

is stable and slings cannot slide off the chafing protection. In addition, ensure synthetic slings are not excessively bunched in the bowl of the hook or in shackles. This can cause uneven loading on the synthetic fibers and failure of the sling. Finally, synthetic slings must be properly cared for and stored. Navy crane center auditors find more synthetic slings in poor condition than any of the other types of slings.

With their light-weight and ease of handling, riggers frequently favor synthetic slings. Their use can help avoid back strains, pinched fingers, and other minor injuries. However, these slings are not as durable and forgiving as other types of slings and their use requires extra care and planning. Activities shall consider the potential risk of accidents occurring similar to those noted above and apply lessons learned to prevent similar accidents. Additionally, activities are encouraged to contact sling manufacturers for synthetic sling wear protection products that may be available to suit specific applications.

CSA-154: Yale Engineering Series EW and Series CE Limit Switch Failure. The primary upper limit switch on a Yale 1.5-ton hoist did not properly stop the hoist during an operator's daily check and allowed the hoist to contact the secondary upper limit.

The limit switch is a Yale engineering traveling nut geared limit switch, series EW. This limit switch uses an l shaped bar that prevents the traveling nuts from spinning on the shaft by lodging into grooves on the traveling nut and instead forces the nuts to travel along the shaft to engage the contacts. This L shaped bar is held in place by the inspection cover. The EW series limit switch is used on a number of Yale hoist models and is similar to the series CE limit switch that may have the same problem. The CE series limit switch uses octagonal traveling nuts and a flat bar to prevent rotation. Both of these series limit switches can be found on Yale category 2 and category 3 hoists. The limit switch controls both an upper and lower limit setting.

Further investigation revealed that the cover plate was not tightly secured which allowed the L shaped bar to disengage from the traveling nuts. With the traveling nuts spinning on the shaft rather than traveling along it, the contacts were not engaged and the limit switch did not stop the motion of the hoist.

For all Yale hoists that utilize series EW and CE type traveling nut limit switches, within 30 days ensure the inspection cover is tightly secured and the limit switch operates correctly.

Any time the inspection cover is removed on Yale hoists with model EW or CE limit switches, instructions shall be included to ensure the inspection cover is tightly secured.

Operators shall be reminded of the importance of ensuring the limit switch operates correctly during their pre-use operational check as required by NAVFAC P-307 paragraph 9.1.2.1.4.h and paragraph 9.2.

CSA-155: Improper Use Of Chain Hoists. Several activities reported incidents of equipment damage due to improper use of chain hoists:

- A 1/2-ton chain hoist was being used to lower a part into a dip tank when the load and chain fell into the tank. The load chain was not being properly lubricated and rags were being used inside the chain container to prevent contaminants on the chain from entering the dip tank. This led to improper piling of the load chain in the chain container resulting in a cross-linked load chain jamming into the hoist housing ultimately breaking the load chain.
- A shaft seal housing was dropped when a 3-ton chain hoist failed. The load chain had become twisted as a result of the lower load hook block flipping through the 2-part chain falls while not in use. This condition did not allow the proper engagement of the load chain in the load sprocket allowing the load chain to slip over the sprocket.
- While positioning a section of shielding, the load chain on a one-ton lever hoist continued to pay out after the rigger stopped operation of the lever. The load chain became twisted and cross-linked when entering the load sprocket causing the chain to jam into and ultimately break the hoist frame.

- While investigating a trouble call on a 3-ton chain hoist, the mechanic noticed that the load chain was jammed between the load sprocket and hoist housing preventing the hook from being lowered. It was determined that the most probable cause of the chain jamming was from a twisted load chain.
- At the conclusion of a lift using a 3-ton chain hoist, the hook was returned to its upper limit for storage. The chain did not pile correctly due to the size and stiffness of the chain, resulting in the chain falling out of the chain container and contacting the ground.
- While transferring a load from ship to pier side, the hand chain on a chainfall dragged across a compressed gas cylinder bottle rack and caught a regulator valve on a bottle. When the chain released from the valve the bottle fell back to the rack. The hand chain had been left hanging and was not properly secured.
- While attempting to lift a load using a category 3 crane and a chainfall, the hand chain on the chainfall was caught in the t-locks on a test deck causing the hand chain to part. The hand chain had been left hanging and was not properly secured.
- In preparation for removing a load from a ship, the operator was directed to hoist. The riggers had notified the operator that the expected weight of the load was 11,000 lbs. While hoisting, the empty hook of a chainfall caught on a structural member, causing a weight to be registered on the crane load cell. The operator was not aware that the load had not been rigged. When the hook spread, the sudden release of the hook from the structural member caused the wire rope to wrap around the boom.

As evident by the incidents noted above, it is imperative that operators, riggers, and maintenance personnel pay particularly close attention to the condition of chain hoists at pre-use inspections, during use, and at maintenance inspections. Slack load chain that is not freely suspended from the hoist, such as during transport or with the use of chain containers, is more susceptible to twisting and cross-linking. After transporting chain hoists, load chain should be freely suspended and carefully checked to ensure that the load block has not flipped through the chain falls and twisted the chain. During use, special precautions are required to ensure that slack load chain does not become twisted or cross-linked. Make sure the load chain is not twisted as it travels into the hoist. Hand chains and empty hooks should be properly secured, stowed, and monitored to ensure that they do not become fouled on other components. During maintenance inspections, load chain should be lubricated as recommended by the OEM and chain containers should be sized and installed as directed by the OEM. Chain containers should be periodically checked for presence of foreign material and proper piling of the load chain. The load chain needs to be carefully inspected and load chain stretch and wear measurements taken to ensure the chain is within acceptable limits. This ensures proper operation over load sprockets and chain sheaves.

Activities shall consider the potential risk of incidents occurring similar to those noted above and apply lessons learned to prevent similar incidents. Activities are reminded that NAVFAC P-307, section 9.2, section 14.11, and appendix D provide preuse, operation, and maintenance requirements for chain hoists.

EQUIPMENT DEFICIENCY MEMORANDA

EDM-081: Faulty Heater Elements in Motor Overload Contactors. An activity reported faulty heater elements on a motor overload contactor after two previous "single phasing" occurrences on the motor. Single phasing occurs when a three-phase motor loses one of its phases from the power distribution system. Single phasing can be caused by an overload condition that causes one fuse to blow, faulty contacts in a switching element or a failure that removes power from one of the three phases. When single phasing occurs, the other two phases of the motor will carry increased current, which can then cause excessive heating on motor windings. To prevent this condition, motor overload contactors are usually provided to protect the motor from the excessive heating conditions caused by single phasing. The motor overload contactors consist of heater elements that actuate at a predetermined temperature causing the contacts to open.

The motor overload contactor OEM stated that heater elements should be inspected upon actuation of motor overload contactors or any single phasing condition. The heater elements in question showed signs of excessive heating and discoloration. Further investigation found these elements were causing premature nuisance overload trips. Upon element replacement, nuisance trips ceased.

Activities should inspect heater elements upon actuation of motor overload contactors or any single phasing condition. Activities should look for discoloration or any signs of excessive heating on the heater elements during inspections. Any questionable heater element on motor overload contactors should be replaced before returning a crane to service.

EDM-083: Error in PH Operation, Maintenance, and Parts Manual for Army-Type Trolley Hoists. An activity recently reported that the load chain on a PH model 1312-3 manual hoist (geared trolley 3-ton capacity) did not match the OEM gauge dimension. Subsequent investigation by the OEM found that the part number and gauge length for load chain on PH model 1311 (plain trolley) and PH model 1312 (geared trolley) Army-type trolley hoists with capacities of 1.5 tons through 10 tons were specified incorrectly in the PH operation, maintenance, and parts manual (Bulletin HP-16-2).

The PH operation, maintenance, and parts manual (Bulletin HP-16-2), table 2-5, incorrectly specified a gauge length of 15.656 inches over 13 links (measured outside to outside of links) with a gauge length limit of 16.047 inches. The part number specified for the load chain in table 3-1 was 1020Z5699. PH has corrected this error in a revised PH operations, maintenance, and parts manual (Bulletin HP-16-3). The corrected gauge length specified in table 2-5 is 15.015 inches over 13 links (measured inside to inside of links) with a gauge length limit of 15.406 inches. The corrected part number for the load chain in table 3-1 is 1020Z8599.

Activities with PH model 1311 (plain trolley) and PH model 1312 (geared trolley) Army-type trolley hoists with capacities of 1.5 tons through 10 tons should obtain the current PH operation, maintenance, and parts manual for army type trolley hoists (Bulletin HP-16-3) and correct local inspection specification and records and specification data sheets as necessary. Activities are reminded that NAVFAC P-307, appendix D, requires that chain length measurements be recorded as part of the annual maintenance inspection. Additionally, NAVFAC P-307 requires that questionable conditions to load bearing and load controlling parts and operational safety devices be referred immediately to the activity's engineering organization and, if necessary, to the certifying official for resolution.

EDM-084: Grove Mobile Crane Models GMK 4075-4090 and TMS 900E Spud Lock Assembly Deficiencies. Two activities reported finding broken spud lock connecting rods on Grove GMK 4075/4090 and TMS 900E mobile cranes. The spud lock secures the crane cab/boom in the forward and rear positions. The spud lock assembly consists of an operating lever connected to a locking pin via a connecting rod that is inside a spacer sleeve. The lever is located inside the operator cab and controls the vertical movement of the locking pin. The locking pin is drilled for the connecting rod to pass through and counter bored on the bottom to protect the rod. The upper end of the connecting rod threads into the operating lever and the lower end is secured to the locking pin with a self-locking nut. Over time the connecting rod can loosen in the lever and protrude past the face of the locking pin. This causes the end of the connecting rod to strike the deck structure. One activity inspected two cranes and found both connecting rods loose. In one of the cranes, the connecting rod was also broken. Another activity reported that they inspected one crane and found the connecting rod threads broken off and the flat washer installed in the wrong location.

Activities with Grove GMK 4075/4090 and TMS 900E mobile cranes should inspect connecting rods for tightness at the lever and for thread damage at the locking pin. Ensure that the rod does not protrude past the face of the pin and that a flat washer is not installed in the counter bore. The counter bore depth will only accommodate an M10 self-locking nut and one exposed thread. A standard 2 mm thick DIN 125 (M10) flat washer should be located between the top of the locking pin and spacer sleeve. Thread-locking compound should be applied to the threads if the connecting rod is loose. Perform an operational check to ensure the connecting rod does not protrude past the face of the locking pin when in the lowered position. Contact the OEM (888) 499-7278 for further direction if this condition cannot be met. Activities should include the above inspection attributes to the maintenance inspection specification and record as appropriate.

EDM-085: Grove Load Moment Indicator (LMI) System Not Programmed with All Boom Tip Configurations. The purpose of this EDM is to inform activities of Grove PAT LMI systems that were not programmed for an auxiliary boom nose sheave (rooster sheave). Several activities have reported where the grove pat LMI system was not accounting for the increase in radius when using the auxiliary boom nose sheave (i.e., the radius displayed on the LMI is for the main boom nose sheaves). One activity reported this condition on a Grove RT-870 and one activity reported a similar condition on a Grove TMS-870. This condition was found during radius accuracy checks when the auxiliary/whip hoist was reeved over the auxiliary boom nose sheave. Discussion with Grove has revealed that the PAT LMI system is not programmed for the auxiliary boom nose sheave on all grove mobile crane equipment, excluding the GMK models, unless specifically requested. PAT LMI's pre-dating 2002 require a new E-PROMM chip, reprogramming and calibration to account for the auxiliary boom nose sheave. PAT LMI's post 2002 only require reprogramming and calibration.

Mobile crane OEM's offer a range of optional ancillary equipment to accommodate various lifting configurations that may not have been accounted for in the original LMI configuration. Navy Crane Center recommends that activities review all mobile crane LMI configurations to ensure that they are programmed appropriately. Questionable conditions should be referred to the activity engineering organization or the OEM for resolution. For Grove cranes with an auxiliary boom nose sheave that has not been programmed with the LMI, Navy Crane Center recommends that the additional increase in radius be accounted for in the appropriate load chart, or contact grove to pursue reprogramming and calibration of the LMI. Activities are reminded that NAVFAC P-307, paragraph 1.2, requires that features and components not specifically addressed by NAVFAC P-307 shall be inspected and tested (where testing is practical, as determined by the activity engineering organization and approved by the certifying official) for proper condition and operation.

THIRD QUARTER FY05 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, 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 accidents including contractor caused accidents with Navy-owned cranes.

For the third quarter of FY05, 57 Navy weight handling equipment (WHE) accidents (54 crane accidents and 3 rigging accidents) plus 3 contractor crane accidents were reported. Significant Navy accidents this quarter included 3 injuries, 4 dropped loads, 3 overloads, and 2 two-blockings.

INJURIES

Accident: A laborer received a broken finger when a nose cap assembly was lowered onto his finger. The laborer had his fingers under the load when another person on the lift team gave the crane operator the signal to lower the load. The laborer was a new employee and had not been trained to align the nose cap by rotating the assembly while holding the outside of the nose cap.
Lessons Learned: Personnel working in the crane operating envelope must remain alert at all times during lifting and handling operations. Management must ensure that all personnel have the proper training prior to assigning of work.

Accident: Two riggers received an electrical shock when the load they were lowering cut through a temporary service line. While lowering a steam chest cover through a hatch, the cover came in contact with a temporary electrical service line cutting through the insulation causing the rigging gear and chest cover to be electrified.

Prior to lowering the cover, the rigger-in-charge identified temporary service lines as potential interferences and pushed them to the forward side of the hatch, but did not secure or cover them nor was there any chafing gear on the outside of the cover. Additionally, the team that was inside the hull did not position themselves to observe all clearances.
Lessons Learned: Risk management was less than adequate in this operation. A hazard was identified, but proper risk decisions were not made. The temporary service line could have been removed or de-energized for the lift. Additional protection could have been applied to prevent cutting the power line insulation. Personnel in hull could have been observing for potential contact. The result was an accident that could have had disastrous consequences.

Accident: An operator and a technician received a shock while positioning a load. The operator and technician were holding onto a wire rope sling while maneuvering the load into place. While doing this, the operator touched an un-insulated portion of the pendant strain relief cable of the category 3 crane. It was at this time that they both received a shock. They stopped work, tagged out the crane, and submitted a work order, but did not report it as an accident. This crane was newly installed and is under investigation by the activity and the contractor.
Lessons Learned: Management must ensure that all personnel are trained in the requirements of NAVFAC P-307 for the proper reporting of an accident. Additionally, management must continue to work with the contractor to determine the cause of the shock and correct the deficiency.

DROPPED LOADS

Accident: An electrical cabinet fell while being landed on a pallet. The electrical cabinet had been rigged using a synthetic sling in a choker configuration with 1/4-inch manila rope used as frapping, which is a method used to prevent the primary rigging gear (e.g., lashing, basket hitches, choker hitches) from moving or shifting during a lifting evolution. While landing the cabinet, the cabinet was leaned in a direction that was perpendicular to the direction of the choke, which deviates from normal rigging procedures. As the cabinet was laid over onto the pallet, the choke loosened, placing the weight of the cabinet onto the 1/4-inch manila rope, which parted causing the cabinet to slip from the synthetic sling and fall.
Lessons Learned: Management must ensure that riggers perform as trained following established rigging procedures.

Accident: A forklift battery was dropped while being loaded onto a trailer. The batteries are lifted by utilizing a two-leg chain sling with hooks that are inserted into padeyes located on two opposite sides of the battery. During the lift, one of the hooks slipped out of the padeye causing the weight of the battery to increase on the remaining hook, which then caused the padeye to fail and the battery to drop.
Lessons Learned: Per CSA-150, Securing of Hook Openings in Weight Handling Operations, hooks used on all lifting and handling operations (i.e., hooks on cranes, hoists, slings, chainfalls, etc.) shall have self-closing latches or the throat opening shall be secured (e.g., with wire or rope). Exceptions (i.e., where securing the hook throat opening is impractical) shall be approved by the Navy Crane Center. Where securing the hook is not feasible, the crane team must be alert to the possibility of the hook coming free of the load due to slackening of the load line. In all cases, the proper hook shall be utilized and the hook must fit securely into lifting attachments.

Accident: A rotor was dropped while being lifted out of its housing. A synthetic web sling was choked around the end of the shaft with no means of positive attachment. As the rotor was being placed on a work table, it slipped from the sling and dropped onto the table. Personnel had successfully used this means of rigging in the past. Additionally, the sling was out of date.
Lessons Learned: Riggers must ensure sling hitches used are appropriate for the item lifted. In this case, a choke hitch on a smooth shaft was not appropriate. Management is designing a lifting fixture for future lifts of these rotors.

Accident: A part was dropped when a chain link on a category 3 crane broke. The crane was lowering a part into a dip tank as part of a blueing process when the operator heard a clicking noise and then a popping sound. The operator stopped lowering the load to investigate the noise, but when he did not notice anything wrong continued to operate the crane. At that time, a chain link broke dropping the part. Investigation revealed that the chain had misfed into the chain guide, possibly from twisting. As the misfeed became more severe, the chain wedged against the guide and the hoist continued pulling until the chain link broke. Additionally, the operator had not received category 3 crane operator training as required by NAVFAC P-307.
Lessons Learned: Management must ensure that only trained personnel are allowed to operate weight handling equipment. Operators must stop all operations when a malfunction occurs and notify their supervisor.

OVERLOADS

Accident: A category 3 crane was overloaded while attempting to remove a planetary gear from a damaged gear box. The planetary gear was stuck in the gear box so the technician decided to use the crane to pull it out. When he began lifting the planetary gear, the gear box and the stand it was bolted to began lifting and sheared off one of the bolts that secured the stand to the deck. The technician reported the damaged stand to the appropriate personnel, but did not report the possible overloading of the crane. During inspection of the stand, it was realized that a crane accident had happened and was reported.
Lessons Learned: This crane should not have been used to remove the stuck gear. Without a load indicating device, the load on the crane was unknowable and unmanageable. With the significant force being applied, sudden release of the gear could have resulted in injury to the operator. Management must ensure that personnel are trained in the correct use of a crane. When operators do not perform as trained, they must be held accountable.

Accident: A mobile crane was overloaded during its annual load test when the load swung out of radius. The test being performed required a test load of 75,000 pounds at 25-foot radius with 110-foot of boom extended. A stop block was placed at the 25-foot radius mark to keep the weights from swinging out of radius. The load was picked at a 23-foot radius and due to boom deflection the load moved into the stop block. Without direction from the test director, the rigger-in-charge signaled the operator to rotate the crane to clear the load from the stop block. Additionally, the test director, who has overall responsibility for correct and safe performance of a load test, did not stop the rigger-in-charge when he directed the operator to rotate the crane. When the crane rotated, the load cleared the stop block and swung further out to a radius of 26-feet.
Lessons Learned: When the test load contacted the stop block, the test should have been stopped and the crane configuration and load re-evaluated. Additionally, management must ensure that personnel perform as trained.

Accident: Two wireless crane scales were overloaded while lifting a berthing ramp. The ramp was estimated to weigh 88,000 pounds. Since this was just an estimate, a decision was made to incorporate two wireless crane scales into the rigging. The scales, which had an indicated rating of 20,000 x 5 pounds, were thought to have a rating of 100,000 pounds each. In fact, they were rated for 20,000 pounds with a 5-pound readout accuracy. When the ramp was lifted, the crane's load moment indicator (LMI) showed a weight of 86,000 pounds, however, the scales indicated an overload. An on-site supervisor incorrectly confirmed the scales' capacity to be 100,000 pounds and concluded that the scales' remote indicator was not being properly used. The supervisor directed the lift to continue. The investigation revealed that records corresponding to the scales were incorrectly marked for 100,000 pounds capacity, personnel had not received scale training, there were procedural errors in operation and rigging, and personnel without sufficient experience developed the complex lift plan.
Lessons Learned: Management must ensure that only properly trained and experienced personnel develop and execute complex lifts. Crane teams must be fully familiar with the equipment they are using. When a load indicating device is required for a lift, a crane team member must closely monitor it to avoid overloading any equipment in the load path. Additionally, when a problem occurs during a lift, the problem needs to be fully evaluated, with engineering assistance if necessary, prior to continuing the lift.

TWO-BLOCKINGS

Accident: A mobile crane auxiliary hoist was two-blocked while the boom was being lowered. This mobile crane was not equipped with an anti two-block device and the activity had procedures in place as required by NAVFAC P-307 (e.g., prohibiting hoisting when hook block is within 10 feet of contacting the boom, providing a rigger to watch the hook block when the hook approaches the boom, prohibiting any simultaneous crane movement while hoisting, etc.). Both the operator and signalman failed to follow the established procedures.
Lessons Learned: Operations of weight handling equipment of this nature require special procedures and attention by members of the crane team. Management must ensure that when personnel fail to comply with established procedures they are held accountable.

Accident: A mobile crane whip hoist was two-blocked when the operator by-passed the load moment indicator (LMI). While preparing to make a lift, the operator noticed the out of service warning light on the LMI display screen. Assuming that the anti two-block limit switch was stuck, the operator raised the boom to try to free the limit switch weight. When this did not work, the operator shut down the LMI and re-programmed the computer. This did not free the limit switch weight. The operator then decided to by-pass the LMI to raise the whip line hook. Although the operator did not have a clear view due to the main hoist block, the operator kept hoisting, resulting in the two-blocking of the crane. After the accident, the operator did not secure the scene or notify his supervisor, but instead retracted and lowered the boom to inspect the damage. All crane movements were performed without receiving any signals from the rigger-in-charge. None of the crane team members attempted to stop the operator or notify their supervisor.
Lessons Learned: Operators shall not perform crane movements without receiving signals from the rigger-in-charge. The rigger-in-charge must be alert to any and all actions taken by members of the crane team. When an operational malfunction occurs, the operator should not try to fix it. The supervisor should be notified and obtain an inspection and an engineering evaluation as necessary. Additionally, NAVFAC P-307 requires that activities develop procedures for controlling the bypassing of safety devices. When crane team members fail to perform as trained and don't follow established procedures, they must be held accountable.

SIGNIFICANT RIGGING GEAR ACCIDENTS

Accident: Two personnel were injured when the end bell of a generator dropped, striking them in the legs. Riggers used certified 5/8-inch power braid (nylon) rope to form an overhead attachment point for rigging the end bell onto a generator in a machinery space. The attachment point was created by tying a clove hitch through the hole of a lifting beam in the overhead. The clove hitch was backed up by two half hitches and the upper hook of the chain hoist was placed directly into the clove hitch. As the end bell was raised, the riggers began to manually move it into place. When the clove hitch pulled out, the end bell dropped.
Lessons Learned: Management must ensure that riggers are specifically trained in the use of knots and the proper selection of rigging gear. In this case, a shackle should have been used as an attachment point instead of nylon rope.

Accident: Rigging gear was overloaded while attempting to remove a periscope hull fitting. A piece of single-ply nylon webbing was lashed between two different points of the ship's structure above the hull fitting. A 3/4-inch shackle was installed in the nylon and a 1-ton chain hoist was hung from the shackle. Two 1/2-inch safety hoist rings (SHRs) of different manufacture and bail heights were installed into the hull fitting for lifting attachment points. Installation of the SHRs required 28-foot-pounds of torque, but were installed with an Allen wrench instead of a torque wrench. Additionally, the depth of the bolt holes did not allow for proper seating of the SHRs. A piece of single-ply nylon was lashed between the bails of the SHRs and placed over the lower hook of the chain hoist. The riggers did not utilize a load indicating device (LID) in the rigging configuration because they did not consider this a binding situation. The riggers hoisted up on the chain hoist, but no movement was observed. At this point they tried to manually free the hull fitting so it would rise. When it did not, the riggers decided to change the rigging configuration by installing triple-ply lashing overhead, replacing the hoist with a 3-ton hoist, and connecting the bails of the SHRs directly to the hoist lower hook. Tension was again placed on the hull fitting and it lifted slightly but cocked. Rigging personnel then installed an LID,

applied tension, and again tried manually moving the fitting. When the fitting did not free up, the decision was made to maintain a strain on the load for a period of time. After about five minutes, one of the SHRs sheared off. The job was stopped and the unbroken SHR was removed for inspection, disturbing the accident site.
Lessons Learned: When lifting operations do not work as planned, the operations must be stopped and evaluated. Supervisory and engineering assistance should be requested as necessary. Also, when an accident occurs, all work must stop and the site preserved for investigation.

SIGNIFICANT CONTRACTOR CRANE ACCIDENTS

Accident: A pre-cast panel fell over when the operator left the controls of a crane. A 37,000-pound pre-cast panel was being off loaded from a trailer with a crawler crane. The panel was off loaded from the trailer and the crane crawled backwards from the trailer. The panel was lowered and rested with one corner of the panel on the ground. A few minutes later, while still suspended from the hook, the load fell hitting the crane's outriggers and landing on the ground. After resting one corner of the panel on the ground, the operator had left the controls of the crane.
Lessons Learned: Although part of the load was resting on the ground, it was not stable and was still suspended from the hook. Operators shall not leave the controls of the crane until the load is in a safe and stable condition and is no longer supported by the crane.

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

WEIGHT HANDLING TRAINING ONLINE

The Navy Crane Center now has three training courses available through Navy e-Learning, https://wwwa.nko.navy.mil/portal/splash/index.jsp. After accessing the web site, register if you have not already done so and log on to Navy Knowledge Online (NKO). This takes you to the NKO Home Page.

ACCESS COURSE

- Click on "Navy E-Learning" in the “Learning” column.
- Click on "Browse Categories" under "CONTENT" in the left hand column.
- Click on "US Department of the Navy (DON)."
- Click on "Navy Crane Training."
- Choose the course you wish to take.
- Click on "Enroll Now."
- Click on "Launch" next to the course title of the course you wish to take.

TAKE COURSE

- Click on the first icon "Welcome Module."
- Close each module when finished.
- When you close a module, the "Course Viewer" will grade your quiz.
- Select the next module.

COMPLETE COURSE

- Finish all the modules and the final exam with a score of at least 70 percent.

PRINT CERTIFICATE

- Click on "Navy E-Learning" in the “Learning” column of the KNO home page.
- Click on "My Transcripts" tab.
- Click on "Certificate" next to the completed course.
- Click on "Print Certificate," verify the proper printer settings, and click on "Print."

COURSES IN NKO

Category 3 (Non Cab) Crane Safety (NCC-C3CS-1.0)

This course is intended for Navy military and civilian personnel and service contractor personnel (BOS and other contractors) who are required to operate category 3 (non-cab operated) cranes. Completion of this course is a prerequisite to qualification. Course topics include: category 3 cranes types, pre-use inspections, basic safety rules and procedures for safe operation, communication, specific lifting situations, basic rigging gear inspection and use, determining load weights, calculating capacities, and crane accident response.

General Crane Safety Refresher Course (NCC-GCSR-1)

This course is required for renewal of Navy category 1 and 4 crane operators' licenses. It is designed to provide increased safety awareness for full-time and part-time crane operators. It also meets the requirements of the category 2 refresher course and may be taken as an alternate course for category 2 crane license renewal.

It highlights the main points from the initial General Crane Safety course. The primary emphasis is on preventing crane accidents by reviewing recent accident examples and lessons learned and explaining the operator's responsibility to know the equipment and safety requirements for each specific make and model of crane.

Category 2 Cranes Refresher Training (NCC-C2CRT-1.0)

This course is required for renewal of Navy category 2 and cab-operated category 3 crane operators' licenses. It is designed to help the operator review requirements for the safe operation of these cranes. Emphasis is placed on the individual responsibility to know the equipment and safety requirements for each specific make and model of crane. 

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: Aircraft carrier equipment such as tow tractors, ordinance handling carts, and specialized plate structures are handled using Crosby A-328, eye grab hooks or similar. These hooks are not intended to be "closed" or otherwise have their throat opening secured when in use. In addition, the aircraft carrier equipment in question has specific handling slots and/or attachment points wherein the entire hook's throat opening is taken up by the equipment making any kind of throat securing device impossible. CSA-150 requires that hooks used on all lifting and handling operations (i.e., hooks on cranes, hoists, slings, chainfalls, etc.) shall have self closing latches or the throat opening shall be secured (e.g., with wire or rope) to prevent the attached item from coming free of the hook under a slack condition. It is impossible to secure hooks attached to a plate or similar structure where the entire hook throat area is obstructed.

It is recognized that if the lifting gear were to become slack, the hook(s) could become disengaged from the attachment point(s); however, the design and in field practice of some equipment does not allow for the securing of the hook throat. It is the responsibility of the rigging personnel performing the job to understand and guard themselves against inherent risks associated with some types of work.

Request authorization and/or concurrence to use hooks without latches or other securing means for lifting specific aircraft carrier equipment (white gear) wherein design lift points prevent the securing of the hook throat as described above.

Answer: Concur with the request to use open hooks for lifts of specific aircraft carrier equipment where the open hooks entire throat area is obstructed by the equipment and the hook cannot be manually "moused" as directed by CSA-150. Personnel performing these lifts shall be given specific additional notice of the inherent risks associated with these types of lifts.

Question: Request a deviation from the requirements of CSA-150 in support of specific lift processes used in the metal preparation facility.

There are three specific types of lifts in the metal preparation facility and one in the forge shop that preclude the use of latches and other means of securing the throat of the hook. These types of lifts are described below:

Deck Grate Handling. In the blast area, there are steel deck grates that occasionally must be removed to expose auger mechanisms and other grit handling equipment. A forklift with a lifting attachment is used to support a double leg chain sling with one-ton hooks. To lift the grates, the hooks are passed between the vertical plates of the grate and hooked around a round bar that connects the plates. The distance between the vertical plates in the grate is not wide enough to allow a hook with a latch to fit between the grates.

"S" Hooks. The "S" hooks are somewhat symmetrical on each end and have been cut from steel plate. Typical use of these hooks is to lift an item by crane and transfer to the load onto an "S" hook hanging from a rack. Items that are hung from these hooks would be for drying and baking of parts to assist in Plastisol application. This type of hook is not used as a lifting hook, however it does support a load that has been transferred to the "S" hook by a crane, so it is considered weight handling.

Dip Tank Lifts. Some work over chemical dip tanks involves the use of hooks without latches or other hook throat securing means. The load may be supported by a two-leg chain sling, joined by a master link. A hook with a large eye and no latch is hung on the crane hook. The master link would be placed into the hook without a latch. When the load is positioned in the dip tank, a bar or pipe, which spans the top edge of the tank, is

inserted through the master link. The load is lowered until it is resting on the bottom of the tank, with the rigging gear slacked, and the master link suspended above the tank by the bar. As the crane hook is lowered, the unsecured hook will clear the master link with minimal assistance from personnel working over the tank. Disengaging the hook from the master link would, at most, require one hand to free the components. Due to the nature of the chemicals involved, minimizing the work required over the tanks is desirable.

Oven Hook. In the forge shop, a hook with an eye is placed on the crane hook. This hook does not have a latch or means of securing the throat. To use this hook, eight-foot long tongs are used to guide the hook into and out of the bail of a heated basket or other item. The temperatures associated with the forge shop ovens makes approaching the hook extremely dangerous for personnel.

It is recognized that if the lifting gear were to become slack, the hook(s) could become disengaged from the attachment point(s); however, the design and in field practice of some equipment does not allow for the securing of the hook throat. It is the responsibility of the rigging personnel performing the job to understand and guard themselves against inherent risks associated with some types of work.

Request approval and/or concurrence to use hooks without latches or other securing means for lifting various items in the metal preparation facility and forge shop wherein securing the hook throat is either dangerous to personnel who perform the work or are impractical as described above.

Answer: Approved.

Question: NAVFAC P-307 is being revised. At this time, there is consensus for a change to the complex lift rules for submerged lifts. Request permission to work to the proposed NAVFAC P-307, paragraph 10.4.1.e.

Answer: Approval to work to the proposed NAVFAC P-307, paragraph 10.4.1.e is granted.

10.4.1.e. Lifts of submerged or partially submerged objects. The following lifts are not considered complex:

Removal of valves, rotors, pipes, etc., from dip tanks for cleaning or coating purposes. Lifting boats of known weight from the water if the boats are of open design with bilge compartments accessible for visual inspection; the boats have label plates indicating weights; and the boats have pre-determined lifting points established by the OEM or the activity engineering organization.

Additionally, submerged or partially submerged objects that meet the following criteria may be lifted as non-complex lifts: the object is verified to not contain fluid in pockets and/or voids that are unaccounted for in the weight of the object; the object is verified or known to not be stuck by suction or adhesion by corrosion, marine growth, excessive surface tension, mud, etc.; and the object is verified to be clear of obstructions such as other objects in the water, underwater cables, etc.

Weight Handling Program Films

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. Send requests to m_lstr_ncc_ccorn@navy.mil for these videos.

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. The video is available at http://dodimagery.afis.osd.mil/ (DAVIS/DITIS) (PIN 806467) in VHS, CD-ROM, and DVD.

Load Testing Mobile Cranes at Naval Shore Activities provides load test personnel guidance on properly testing mobile cranes per NAVFAC P-307. The video is available at http://dodimagery.afis.osd.mil/ (DAVIS/DITIS) (PIN 806634) in VHS, CD-ROM, and DVD.

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. The video is available at http://dodimagery.afis.osd.mil/ (DAVIS/DITIS) (PIN 806721) in VHS, CD-ROM, and DVD.

NAVY CRANE CENTER

OFFICE HOURS: MON-FRI 0630-1730

PHONE: DSN 443-0505
COMMERCIAL (610) 595-0505

FAX: CONTRACTS/PROJECT MGMT 0747
DIRECTOR 0748
ENGINEERING 0749
FIELD SUPPORT 0812