THE CRANE CORNER

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A WORD FROM TOPSIDE

Sam Bevins

Last September, the Navy Crane Center issued Crane Safety Advisory (CSA) 155 addressing the proper use of chain hoists, including manual chain hoists (chainfalls) used in rigging configurations of crane lifts. Two instances were cited where hand chains became fouled with another object. In one case, the hand chain looped around a regulator valve on a compressed gas cylinder and lifted the cylinder. In the other case, the hand chain snagged an item fixed to the deck and parted as the crane was hoisted.

Since that time, six similar accidents have been reported where a component of a chainfall snagged or got caught on another object. In five of these events, it was the hand chain that snagged another object. In the other case, the riggers were paying particular attention to the excess hand chain and load chain, and it was the empty hook of the chainfall that snagged the load as it was about to be lifted.

Chainfalls are commonly used in rigging configurations, either as aids in balancing the load or to provide precise hoisting and lowering. Their hanging load chains and hand chains (and occasionally their empty hooks) present the risk of snagging objects as the crane is hoisted, rotated, or traveled. In more complex rigging configurations with multiple chainfalls being used, the risk of snagging is greater and riggers need to be especially alert to this possibility. In such situations, the rigger in charge should ensure the rigging team is briefed on the potential for snagging, and control of the chainfall's chain/hooks should be discussed. Sufficient personnel should be on hand to guide the movement of the chains. Crane movements should be at slow speed to enable the movement to be safely stopped before snagging occurs.

The potential for snagging exists during the lift and after the load is set down when the disconnected rigging gear is being removed. The need to remain alert does not stop when the load is set down.

Fortunately, all of the accidents recently reported resulted in only minor damage. The potential always exists for more serious consequences. With multiple potential points of snagging, this is a perfect example of the need for operational risk management and teamwork in lifting and handling operations.

Operational Risk Management
5-Step Process

- Identify Hazards
- Assess Hazards
- Make Risk Decisions
- Implement Controls
- Supervise (Watch for Changes)

Inside This Issue

HAVE YOU HEARD ABOUT?

This column in the March 2005 edition of *The Crane Corner* described a load insulating link with a fiberglass load path. The link protects the load and personnel from:

- Electric shock in case of accidental contact with power lines,
- Internal electrical faults, and
- Voltages induced in the crane structure or wire ropes from radio frequency (RF) transmitting antennas.

Figure 1

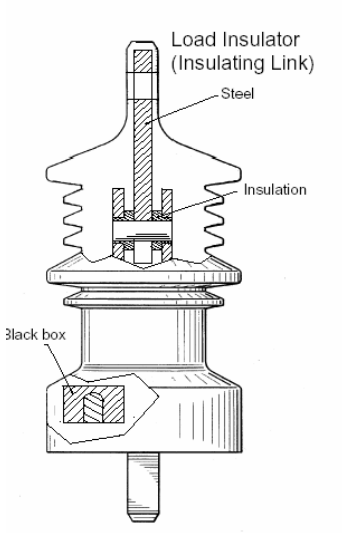

Figure 2

An alternate design of the link that serves the same purpose but has a steel load path and built-in diagnostics, is also available. Figure 1 shows the exterior view of the link, and figure 2 shows cross-sections of its key elements. The steel straps and pins are insulated from each other by dielectric flanged bushings and then encased in a dielectric molded housing. It includes a diagnostic "black box" monitoring system designed to:

- Daily self-test the integrity of the internal insulation and external (surface) conductivity,
- Emit an audible warning if the link is faulty or is due for its annual inspection and re-certification, and
- Record the date and time of high voltage contact and self-test failure.

The annual inspection and re-certification are performed at one of the manufacturer's U.S. facilities or on-site. It includes the replacement of the battery and downloading of stored data for the owner's information.

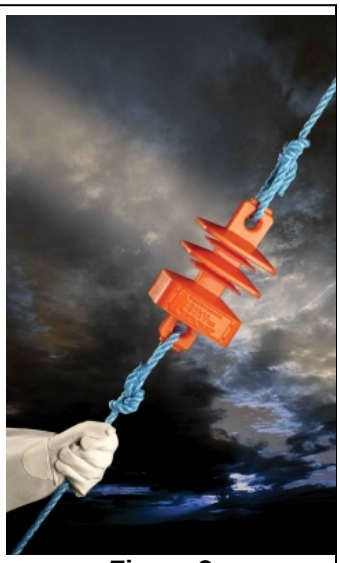

Figure 3

Rated Load	Mating Pin Diameter	Hole-to-Hole Distance	Weight
10 tons	1.5 inches	24 inches	105 pounds
25 tons	2.0 inches	28 inches	239 pounds
55 tons	3.0 inches	34 inches	470 pounds
100 tons	4.0 inches	45 inches	1286 pounds

The manufacturer offers four standard links from stock, all built to an International Standard:

The rated load is 20 percent of the ultimate load. The rated operating voltage is 25 kV rms, rated test voltage is 32 kV rms, and rated leakage current is less than 2 mA at 25 kV rms. The operating temperature range for the links is -40 to +140 degrees Fahrenheit, and they can be used in the rain. The standard links are designed for a frequency of 60 Hz, but links can be designed for protection against any specified frequency.

Other configurations - of any load rating and electrical characteristics - can be provided.

In load handling operations there is also the danger of lethal electric shock through damp or dirty tag lines. To eliminate this hazard, another version of the link is provided for that purpose. It is similar to the load insulating link but is smaller, weighs 3 pounds, and has no diagnostic "black box". This link is tied into the tag line as shown in figure 3. It is important to note that neither of these links, nor the fiberglass type described in the previous column, are lightning proof.

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-156: Grove Hydraulic Hoist Brake Deficiency. A test load slipped through the hoist brake assembly on a Grove model 30 hoist. An activity recently reported that after returning the hoist control to neutral (hoist brake should set), the test load continued to lower to the ground. Disassembly of the brake revealed that the brake piston was misaligned with the brake cylinder so that the brake was stuck in the released position. The piston O-rings had deteriorated due to wear and the brake cylinder had a piece broken just above the O-ring groove. The activity also found brake cylinders with cracks on two other hoists during a subsequent inspection and reported one additional cylinder with a broken piece from a previous inspection with the brake stuck in the set position.

Discussion with Grove revealed that this brake assembly design is similar on Grove model 15 and 30 hoists that may be in use on Grove cranes (excluding KMK and GMK) produced since the late 1970's until recently (2005). Newer Grove cranes utilize a Braden hoist and Braden brake design. Grove is aware of similar occurrences of the model 15 and 30 hoist brake cylinders cracking just above the O-ring groove. Grove stated that these occurrences were reported as a result of normal maintenance on the hoist and that there have not been any previous reports of loss of load control as a result of this condition. Grove attributes the brake cylinder cracking as most likely resulting from wear of the O-rings allowing the cylinder wall to contact the piston and thereby causing a crack in the thin walled material between the O-ring groove and the face of the brake cylinder. Grove service bulletin #00-014 recommends that the Grove hoist assemblies be opened and that internal components (including brakes) be examined for damage and/or wear every 10 years or 10,000 hours whichever comes first.

During the crane's next scheduled type "B" maintenance inspection, activities shall open and inspect brake assemblies on all Grove model 15 and 30 hoists for damaged and/or worn components.

For Grove cranes over 10 years or 10,000 hours old, during the next scheduled type "B" maintenance inspection, activities shall perform the hoist maintenance and inspection requirements as discussed in Grove service bulletin #00-014. Contact authorized Grove distributors for additional guidance as necessary.
Activities that find damaged and/or worn components shall notify Manitowoc Crane Care,
(888) 499-7278, and the Navy Crane Center.

CSA-157: Samsung Generator Circuit Breaker Failure. An activity reported a failure of the main generator circuit breaker on a Samsung portal crane. It was determined that a loose lug to bus connection on the load side of the circuit breaker caused overheating and arcing which eventually lead to failure.

The probable cause of this failure was poor workmanship during crane assembly. Additionally, subsequent annual inspections did not include removal of the circuit breaker terminal end covers. Removal of these covers is necessary to visually inspect the load and line side terminals to identify looseness or signs of overheating. Proper inspections of the load and line side terminals may have given indications of overheating and arcing before circuit breaker failure.

The circuit breaker OEM recommends visually inspecting wire connecting terminals and other type of bus bar connectors for looseness or signs of overheating. Overheating will show as discoloration, melting or blistering of conductor insulation, or as pitting or melting of conductor surfaces due to arcing.

Activities shall remove terminal end covers and visually inspect all lug to bus and wire to lug connections on the main generator circuit breaker on all Samsung portal cranes for evidence of loose connections or overheating unless they have already performed this inspection. If any signs of looseness or overheating are found, activities shall clean and replace terminations as necessary and torque all lug to bus and wire to lug connections in accordance with the circuit breaker's OEM maintenance manual.

During the next "B" maintenance inspection, activities shall torque check all lug to bus and wire to lug connection fasteners on the main generator circuit breaker on all Samsung portal cranes in accordance with the OEM maintenance manual. Notify the Navy Crane Center of any loose fasteners discovered during the "B" maintenance inspection.

EQUIPMENT DEFICIENCY MEMORANDA

CSA-158: Friction Bolts on Johnson Industries Shoe Brakes. Johnson Industries shoe brakes may have missing shoe friction bolts or shoe friction bolts installed without jam nuts. These bolts are tapped into the brake arm and press against the brake shoe. Without these, the brake shoes could pivot and drag on the brake drum while the brake is open, decreasing the brake shoe lining life and causing the brake to run hot. Various activities have reported similar problems on different cranes. It is unclear if the shoe friction bolts fell out during operation or were not initially installed.

Discussions with Johnson Industries determined that for any size brake drum each brake shoe is required to have two shoe friction bolts with jam nuts. At the request of one naval activity, updated drawings were supplied showing this arrangement. The activity ordered replacement shoe friction bolts and received a different type of bolt than originally installed. The original shoe friction bolts have a rod/spring assembly at the end of the bolt but the replacement shoe friction bolts have a non-threaded portion at the end of the bolt. Both the rod/spring assembly (original bolts) and the non-threaded end bolts (replacement bolts) are satisfactory (per Johnson Industries they are equivalent replacements).

At the next annual or "B" maintenance inspection, activities with Johnson Industries shoe brakes shall determine if two shoe friction bolts with jam nuts are installed on each brake shoe (four bolts per brake). If shoe friction bolts or jam nuts are found to be missing, contact Johnson Industries for replacement parts. Updated brake drawings may be obtained through Johnson Industries.

WEIGHT HANDLING EQUIPMENT AUDITS

SECNAVINST 11260.2A, *Navy Weight Handling Program for Shore Activities*, directs the Navy Crane Center to audit Navy shore activity weight handling equipment (WHE) programs annually or biennially, as appropriate, to ensure compliance with NAVFAC P-307, *Management of Weight Handling Equipment*. Audit procedures are contained in NAVCRANECENINST 11200.33, *Weight Handling Audits, Validations, and Third Party Certifications; Procedures for Conducting*.

Approximately 45 days prior to the scheduled date, activity WHE program managers will be contacted by the cognizant audit team leader to request pre-audit information and to establish the in and out-briefs with the commanding officer, certifying official and other key WHE program personnel as appropriate. The audit will include a detailed review of all WHE program elements including inspection, testing, certification, maintenance/ repair, operations, licensing, safety, accident reporting, engineering support, rigging, crane records/documentation, and training. Navy Crane Center personnel will conduct a condition inspection and activity crane team will load test a random sample of cranes. Certifying officials should be prepared to discuss

the following special interest items: your initiatives planned or taken to prevent crane accidents; effective WHE inventory utilization; applications where hook latches or mousing are not used and if those applications are approved; naval messages issued by Navy Crane Center and actions taken upon receipt of the messages; Navy Crane Center safety videos, receipt and utilization of the safety videos provided by Navy Crane Center. For activities utilizing contractor-operated cranes, contracting officer compliance with NAVFAC P-307, paragraph 1.7.2, and contractor reported crane accidents will be reviewed. In addition, certifying officials are requested to share any WHE program cost saving initiatives implemented by the activity, which could be exported to other naval activities, including improvements to efficiency and cost effectiveness realized through the reduction from active inventory of underutilized WHE.

Some activities where elements of the program are managed by another activity will be audited in two phases. The object of the initial phase will be to assess the effectiveness of the servicing activity in those program elements for which WHE services are provided (e.g., inspection, testing, certification, maintenance/repair, licensing, engineering support, crane records/documentation). The second phase will audit the activity's effectiveness in the remaining WHE program elements for which the activity retains primary responsibility (e.g., crane operations, rigging/rigging gear documentation, safety/accident reporting, and training).

It is very important to the successful and efficient completion of the audit process, that all key activity in-house/contract weight handling program personnel be available upon arrival and throughout the duration of the audit. Since the duration of the audit is five days or less, logistical and administrative support is imperative. This includes means of safe access to the cranes selected for inspection. A list of complete support requirements will be requested in the formal audit notification letter.

Activities will be requested to provide pre-audit information, in electronic format, as follows:

- Self-assessment questionnaire. It is noted that the self-assessment is available in the "download" section of our web site: http://portal.navfac.navy.mil/ncc. It is required that the self-assessment be completed and returned approximately 30 days prior to the audit. Audit results continue to indicate that not all completed self-assessments accurately reflect the activity's WHE program status. Certifying officials are required to review, and approve, the self-assessment.
- Detailed inventory of WHE.
- Crane data sheets.
- Activity points of contact.
- Responses to applicable crane safety advisories issued since the previous audit.
- Lifting and rigging applications where it is impractical to utilize a hook latch.

Addition information including the WHE organization chart, all WHE instructions, lockout/tagout procedures, internal audit reports, and activity training records, must be available for audit team use upon their arrival on site.

To assist activities in improving their WHE programs, a complete review of FY05 unsatisfactory crane results and other audit findings can be found in the audit report section of our website.

SHARE YOUR SUCCESS

We are always in need of articles from the field. Please share your sea stories with our editor, (610) 595-0905, fax (610) 595-0748, or e-mail m_lstr_ncc_ccorn@navy.mil.

FIRST QUARTER FY06 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 and 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 first quarter of FY06, 46 Navy weight handling equipment (WHE) accidents (41 crane accidents and 5 rigging gear accidents) and 4 contractor crane accidents were reported. Significant Navy accidents this quarter included three injuries, two dropped loads, three overloads, and two two-blockings.

INJURIES

Accident: A rigger-in-charge (RIC) was struck by a material pallet as he stepped into the rotation path of the load. After signaling the operator to swing an empty pallet back to the pier for the next load, the RIC stepped towards the ship's lifelines to check the next load to be lifted. In doing so, the RIC stepped into the path of the swinging pallet. The pallet struck the RIC in the upper left arm, knocking him over the lifelines and into the ship's flight deck safety net. While falling into the net, the RIC struck a support cable resulting in a laceration above his eyebrow.
Lessons Learned: Personnel working in the crane operating envelope must remain alert at all times during lifting and handling operations and stand sufficiently clear of lifted and swinging loads. The result of this accident could have been much worse.

Accident: A member of the crane team pinched his fingers while lowering the load onto a ship's deck. While landing a Conex box with its trailer attached a crane team member was attempting to align the trailer onto the ship's deck for tie down. Although there were taglines attached to the Conex box, he placed his hand into one of the pockets of the trailer. As the weight of the Conex box settled fully onto the trailer, the pocket became a pinch point.
Lessons Learned: Where possible, personnel must utilize proper methods for maneuvering loads, such as taglines, to minimize the placing of body parts in pinch points. Proper pre-lift planning must occur for all lifts to avoid the risk of injury and equipment damage.

Accident: A rigger injured his finger when the load dropped. While hoisting a steel plate from a welding table with a lifting magnet, the plate began to rotate. When the rigger grabbed the edge of the plate attempting to keep it from rotating, the plate dislodged from the magnet and fell back onto the table with his finger under the plate. A main cause of this accident was the improper use of the magnet. The plate lifted was not rigid enough to maintain a flat lifting surface, reducing magnet to plate contact area. Additionally, as mentioned above, taglines should have been used to maintain control of the load.
Lessons Learned: Management must ensure that personnel are properly trained in the selection and use of equipment. Where possible, personnel must utilize proper methods for maneuvering loads such as taglines.

DROPPED LOADS

Accident: A gun port shield was dropped when one of the eye bolts used for attaching the rigging gear failed. During the investigation it was found that the two eye bolts that were installed as part of the gun port shield lifting fixture were not original equipment and not the proper eye bolts for this lift. The technician who installed the fixture had provided the eye bolts after the original eye bolts were discovered missing. In

addition, the fixture was not designed to remove the shield at the specified gun barrel angle and the lifting procedure was not written in sufficient detail.
Lessons Learned: Lift procedures must clearly state all conditions and configurations for the lift. Additionally, personnel must perform as trained and not make field changes to equipment without proper cognizant engineering evaluation and authorization.

Accident: A cabinet was dropped when the rigging gear slipped off. The cabinet had been rigged using a synthetic sling in a choker configuration. However, the shipping material was not removed from the cabinet. The protective shipping material did not allow for the sling to properly choke and the weight of the cabinet caused it to slip through the rigging.
Lessons Learned: Riggers must ensure the load is firmly secure in the rigging. Two slings may have been a better solution for this item.

OVERLOADS

Accident: A half-ton air hoist was overloaded and damaged while lifting an electrical cabinet. A category 3 bridge crane installed over the forward logistics escape trunk (LET) used to load and unload material was to lift an electrical cabinet that weighed 1,000 pounds. Normally, a two-ton air hoist is hung on the crane to give additional length and speed for hoisting material through the LET. However, at some time during a previous shift, the two-ton hoist had been replaced by the half-ton hoist. After the rigging was attached, the operator lifted the cabinet with the half-ton hoist as far as it could without causing a two-blocking. The cabinet still had to be raised an additional three to four feet with the crane to clear a safety railing around the LET opening. As the cabinet was hoisted higher, the hoist came into contact with the crane's chain bucket and broke off the hoist air fitting. When the lift was secured and the accident investigation began, it was discovered that in addition to the collision, the half-ton hoist had been overloaded. Additionally, the operator had previously identified a risk of the hoist coming into contact with the crane's chain bucket, but because the site supervisor failed to make specific assignments during the pre-lift briefing, all crane team members were watching the cabinet for clearing the rail, and no one was watching for contact between the hoist and the crane.
Lessons Learned: Management must ensure that all members of the crane team perform as trained and are properly briefed. Crane team members must stay alert to all aspects of the lift.

Accident: A portal crane and 10-ton chainfall, incorporated in the rigging, were overloaded during the fit up of a ship's propeller. The lift was not identified nor briefed as a complex lift, and the lift instruction did not include a procedure for the installation/removal of the propeller in a vertical position while going to or coming from a prop stand using a single crane with a duplex hook. In addition the riggers deviated from the instruction for the rigging configuration and did not incorporate a load indicating device (LID) to warn of potential binding due to tight tolerances. The rigger-in-charge chose not to use the chainfall to take the slack out of the rigging, but instead signaled the operator to raise the main hoist. In doing so, the propeller was lifted up against the shaft, causing an overload to the crane and the chainfall.
Lessons Learned: Management must ensure lift instructions contain the proper procedures for the evolutions to be performed, and that riggers follow those instructions.

Accident: While attempting to remove a component (scroll) from a centrifuge in a wastewater treatment plant, an A-frame structure and trolley were damaged due to overloading. Although there is a five-ton bridge crane over the centrifuge, during original installation of the crane, placement of the centrifuge was miscalculated and the hook cannot be centered over the scroll. The riggers attempted to compensate by using the A-frame and trolley to lift one end of the scroll while the bridge crane lifted the other end. The riggers failed to identify the weight of the scroll causing an overload. Additionally, they failed to report the overload, damaged A-frame, and trolley as an accident.

Lessons Learned: Management must ensure that riggers perform as they were trained, and verify the weight of the load prior to the lifting evolution. Following an accident or suspected accident, NAVFAC P-307 requires activities to stop work and promptly initiate an investigation.

TWO-BLOCKINGS

Accident: A category 3 crane was two-blocked for the second time in a three-month period when operated by an unknown operator while the crane was tagged out of service. The crane had been tagged out of service for faulty limit switches. However, it was still energized both times while waiting for maintenance.
Lessons Learned: Again, it is emphasized that management must ensure that cranes that are unsafe to operate be made inoperable to unauthorized personnel (e.g., locked pendant station, de-energized power source).

Accident: A category 3 bridge crane was two-blocked while hoisting a load. While hoisting a dipping basket with its contents to be placed in a cleaning tank, hoisting stopped, as the crane was two-blocked. Investigation revealed that while hoisting, the operator was also bridging the load. The momentum of the load caused the wire rope to cross lay on the drum, shortening the hoisting distance, resulting in a two-blocking.
Lessons Learned: When performing multiple operations simultaneously, operators must be aware of all movements at all times. Although this type of operation may appear to save time, it is not always the fact. Unless it is necessary for the lifting evolution, operators should perform one function at a time.

SIGNIFICANT CONTRACTOR WHE ACCIDENTS

Accident: A category 4 crane was two-blocked and overloaded while hoisting a landscaping rock. While the operator was telescoping the boom out, he failed to lower the hook block/load causing the two-blocking. Although the crane was equipped with an anti-two-block device, it was not functioning. After lowering the hook block/load, the operator continued to telescope further out exceeding the manufacturer's load chart for the configured boom radius. The accident was witnessed by a Navy Crane Center auditor who notified the activity and work was stopped. During the investigation, it was also noted that the crane was not level during set up, it had a kinked hoist wire, the rigging gear was in poor condition, and the contractor had not completed and posted the documentation required by NAVFAC P-307. Additionally, the activity was not aware that work involving a crane was ongoing at that particular site and therefore did not provide compliance oversight.
Lessons Learned: There are a number of problems with this accident from poor contractor performance to lack of oversight. Management must ensure that procedures are in place and enforced for contractor cranes accessing and working on naval shore activities.

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.