THE CRANE CORNER

Navy Crane Center Technical Bulletin

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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 last May challenged his military departments to reduce accidents by 50 percent in two years. In line with this, I asked all Navy shore activities to embrace this challenge and reduce crane accidents by 50 percent by the end of FY05, using FY03 data as a baseline.

I am pleased to report that the numbers so far for FY04 are very promising. The data for October through February show a 22 percent reduction in accidents over the same period last year. The monthly totals for October and January were record lows for those months since we started keeping data for all Navy shore activities in our baseline year of FY99. I congratulate you on your efforts and encourage you to continue your initiatives to drive the accidents down to our ultimate goal of Zero.

The Secretary of the Navy provided three points of guidance. "First, assume there may be a smarter way to do business and empower your best minds to develop it." Naval shipyards have banded together to develop "best practices" for lifting and handling evolutions that are common to them. There are literally hundreds of ship repair related lift requirements that are common to all four shipyards but which are sometimes done four different ways. The shipyards are now sharing and comparing their methods and coming up with the safest and most efficient practices. Other activities with common lift requirements are following suit.

"Second, ensure solid resources for safety." Safety initiatives require the dollars to back them. This must be recognized by activity commanders and claimants. One activity's best practices may involve equipment that other activities with the same mission may not possess. Improved safety and effectiveness may require some investment in the right equipment.

"Third, align support and infrastructure for safety." A culture of safety must start with leadership's commitment to safety. And leadership's commitment must be continuous down to the first line of supervision. This commitment will be picked up by the operators, riggers, mechanics, inspectors, and test directors at the deck plate. Both safety stand downs to short-circuit negative trends and positive recognition of safe practices are effective tools to reinforce the culture of safety.

As we approach the spring and summer months, the challenge will be maintaining a sharp focus of safe lifting and handling on the job in the face of summer vacations and related distractions that may generate a more relaxed, inattentive atmosphere. Thinking ahead, being proactive, and taking the necessary actions to prevent complacency will be essential to continue the accident reduction trends.

I am convinced the Navy has the safest weight handling program in the business. And I am equally convinced all of us recognize we can, and must, do better. Safe and effective weight handling is an essential enabler for Fleet Readiness.

Inside This Issue

HAVE YOU HEARD ABOUT?

Automatic bearing lubricators are designed for a wide variety of bearing applications; such as pumps, conveyors, compressors, chain drives, fans, and especially machinery running around the clock as part of a continual process. They deliver consistent, dependable lubrication to bearings, eliminating the need for manual re-lubrication and reducing bearing maintenance costs.

The lubricators are available in a range of sizes. A sectional view of a lubricator is shown in Figure 1. The flow rate is set with an Allen wrench and can be varied to meet lubrication requirements. Each lubricator contains a small cell that produces hydrogen gas, which builds to the pressure needed to dispense the lubricant on a continual, incremental basis until it is empty. The cartridge neck provides an airtight seal at the lubrication point to prevent contamination by dirt or other matter, and a transparent container lets you visually inspect lubricant levels.

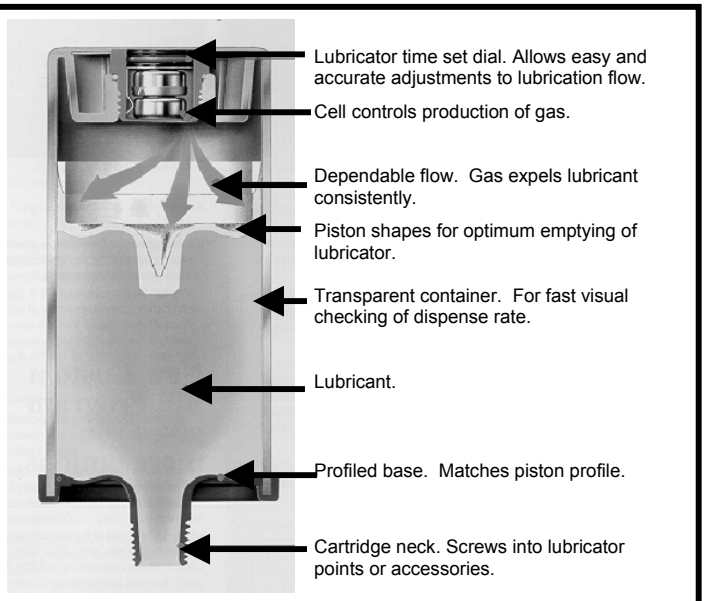

FIGURE 1 - Sectional View of Lubricator

The lubricators can be used with cartridge bearings, pillow block bearings, and custom fabricated bearing housings. Lubricators can be mounted in any position (vertical or horizontal). They are typically installed at the grease port on the pillow block. If installation at the grease port is not feasible, the lubricator can be remotely mounted and connected to the grease port with a hose. A grease escape valve or exit hole is recommended to allow fresh grease into the bearing while purging grease from the housing. Bearing housings and hoses or tubes (if applicable) must be pre-filled with the same lubricant before fitting the lubricator.

Lubricators should be used in conjunction with the equipment manufacturer's re-lubrication instructions for your equipment. If re-lubrication instructions are unavailable, or if the lubrication amount is suspect, a computer program is available that will provide the dial setting and re-lubrication interval based on the bearing type, bearing dimensions, operating speed, load, operational hours per day, bearing operating temperature, and ambient temperature.

With over a third of all of premature bearing failures caused by poor or inadequate lubrication, automatic bearing lubricators are a practical and cost-effective means of avoiding expensive downtime.

USING CRANES TO HOIST PERSONNEL

The use of a crane or derrick to hoist employees on a personnel platform is prohibited, except when the erection, use, and dismantling of conventional means of reaching the worksite, such as a personnel hoist, ladder, stairway, aerial lift, elevating work platform, or scaffold, would be more hazardous or is not possible because of structural design or worksite conditions. Lifting of personnel with cranes shall comply with the requirements of NAVFAC P-307, section 10.

NCC VIDEOS

Accident Prevention

Seven crane accident prevention lessons learned videos 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. Request these videos by e-mailing m_lstr_ncc_ccorn@navy.mil.

Weight Handling Program for Commanding Officers

"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).

Mobile Crane Load Test

"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).

Mobile Crane Safety

"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).

FIRST QUARTER FY04 ACCIDENT REPORT

The Navy Crane Center (NCC) 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 (NCC) 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 NCC and the host activity reports of all contractor caused accidents with Navy owned cranes regardless of severity.

For the first quarter of FY04, 42 Navy and 5 contractor weight handling equipment accidents were reported. Serious Navy accidents this quarter included 1 injury, 2 dropped loads, 5 overloads, and 5 two-blockings.

INJURY

Accident: A crane team member was struck on the head by a shore power cable. A crane team was moving shore power cable from one pile to another using a cable-handling reel suspended from a category 4 crane. The cable in the source pile was not neatly coiled and some layers of cable were overlapping and binding. A team member turned his back to the operation and walked toward the second pile of cable just as the cable in the first pile was binding and building up tension. When the binding cable pulled free the cable swung and struck the team member on the head. The other members of the crane team later stated that the cable-handling reel had stopped turning just before the accident occurred.

Lessons Learned: Remember, all 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. Crane operations should be halted when abnormal conditions, such as the cable-handling reel not turning, are identified. Conduct operational risk assessments before all 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.

DROPPED LOADS

Accident: A shore power cable, being lifted by a portal crane, slipped from a four-inch nylon web sling and fell to the ground. Investigation revealed that the stiffness of the sling and relatively light load for the capacity of the sling prevented the choker hitch from properly tightening around the power cable.

Lessons Learned: It is very important for the rigger to select the rigging gear best suited for lifting the intended load and to choose the optimal pick points and securing method. For this single cable lift, a one-inch nylon web sling used in a standard choker hitch configuration would have been a better method of securing the load. The rigger-in-charge has overall control of the lift and the responsibility of ensuring that the load is properly rigged. Remember, the entire crane team is responsible for recognizing potential problems while working together to ensure safe crane operations.

Accident: A 40-foot long piping assembly, being loaded for shipping, slid off of a trailer and hit the pier. A crane team was using a portal crane to lower the piping assembly from a vertical to a horizontal position on a trailer for shipping. The piping was lifted from the water and set vertically on the trailer. Then the crane traveled and lowered the hook simultaneously to position the piping horizontally. As this piping was being lowered, the bottom end slipped off of the trailer and hit the pier. Procedural instructions for the complex lift stated to first lower the piping from vertical to horizontal on the ground, then rig and lift the piping onto shipping chocks on the trailer. The rigger-in-charge made the decision to load the piping in one lift instead of two. Although the procedural instructions required this function to be accomplished in two lifts, this type of lift had been performed six times in the past year as a one-lift evolution without incident. It was later found that the piping assembly was slimy after being submerged in water and had been modified from the time it was placed in the water affecting its length, weight and center of gravity.

Lessons Learned: The pre-job brief should include an interactive discussion concerning lift requirements contained in the procedural instruction. Any deviation from these requirements must be approved using the appropriate chain of command. Crane team members must be observant at all times for any conditions that could possibly affect the safety of the lift such as slimy/slippery areas or possible modifications to the equipment. Requirements for making complex lifts are provided in section 10 of NAVFAC P-307.

OVERLOADS

Accident: A 2,000-pound capacity jib crane was overloaded because the shop rigger and a rigging supervisor failed to verify the weight of the load. The rigger and rigging supervisor believed that the load (snorkel tube) being lifted weighed approximately 1,300 pounds when in fact it weighed 3,200 pounds. The snorkel tube being lifted was different than the previous ones handled by the shop.

Lessons Learned: Weights of loads should be known and not assumed based on past experience. Criteria for pre-lift preparation are provided in section 10 of NAVFAC P-307. In addition, riggers must be aware that although loads may look similar to previous items handled, they may in fact be different with different weights.

Accident: Four eyebolts were overloaded when they were used as attachment points for lifting an electrical cabinet. A lifting sketch provided to the crane team required the use of four safety hoist rings as attachment points. However, after installing the safety hoist rings, the team noted that the hoist rings did not fit flush with the mating washers and did not rotate freely. The team stopped work and requested engineering resolution. The resolution was to use eyebolts in lieu of the safety hoist rings. During a review of the completed work document, it was discovered that the engineering resolution did not down rate the eyebolt capacities for the angles at which they were loaded.

Lessons Learned: When using eyebolts as attachment points, consideration must be given to angular loading, which reduces the capacity of the eyebolt. Criteria for capacity reductions for loading at angles from the axis of the eyebolt are provided in table 14-5 of NAVFAC P-307. In addition, when providing technical information for lifting and handling evolutions, it is important to verify that the information is accurate, complete and follows established procedures.

Accident: Four 3/8-inch wire rope slings were overloaded while lifting a staging platform because D/d ratio and corresponding sling efficiency percentages were not considered when planning the lift. The slings were connected together two at a time using shackles. Then they were passed through the top of the staging around two-inch diameter pipes and connected in a basket hitch configuration to four 5/8-inch slings suspended from a crane hook. The sling efficiency factor for the D/d ratio was not considered when the slings passed around the two-inch pipe at the top of the platform. In this configuration, the efficiency percentage calculation reduced the capacity of the slings creating the overload condition.
Lessons Learned: Whenever wire rope slings bend around an object the D/d ratio and efficiency percentage, which affects sling capacity, must be considered. For non-circular objects being lifted, the large D (numerator) is derived from the minimum bend diameter of the wire rope around the corner of the object.

Accident: One of two legs of a four-leg chain sling assembly was overloaded when the two legs were used to make a single point lift of a 5,000-pound test weight. The capacity of each leg of the assembly was 4,500 pounds. The rigger-in-charge incorrectly thought that the two sling legs provided a combined vertical capacity of 9,000 pounds in this configuration.
Lessons Learned: Never assume that two slings or two sling legs of a multiple leg sling assembly are exactly the same length. For a single point lift, assume that only one sling/leg will carry the entire load and size the sling/leg accordingly.

Accident: A bridge crane and the rigging gear attached to the crane were overloaded while performing a dual crane lift to remove a ship's rudderstock from a lathe. The overload resulted in damage to the slings, master links, load indicating device, rudderstock and lathe. The first crane's rigging gear was pre-tensioned to 5,000 pounds. Then the second crane's rigging gear was pre-tensioned to 7,000 pounds as indicated on the attached load indicating devices. Next, the rigger-in-charge signaled the operator of the second crane to slowly hoist. The operator felt uneasy about the amount of tension being applied, but continued to hoist, until the lathe broke, freeing one end of the rudderstock. An investigation revealed that a load of approximately 250,000 pounds had been applied to the crane and rigging. The crane's rated capacity was 150,000 pounds. During the investigation, a number of factors were attributed to this accident. The operator was not completely familiar with the operating characteristics of the crane and continued to hoist even though having concerns about the tension in the rigging gear. The rigger-in-charge continued to signal to hoist after the slack was taken out of the rigging gear while the lathe centers were still engaged. One of the load indicating devices was not properly calibrated. The electrical overload protection on the crane was set at 250 percent, which if set properly could have minimized the actual overload.
Lessons Learned: Operator supervisors must ensure the operator is fully familiar with a crane's operating characteristics prior to assigning operation of that crane. Complex lifts increase the potential for problems due to the uniqueness of the lift and or conditions. Therefore the pre-job brief should be interactive and must ensure that all crane team personnel understand their responsibilities (e.g., monitoring the load indicators) and required procedures for the lift. It is imperative that all crane team members understand their individual jobs and work together to ensure the lift is completed safely.

TWO-BLOCKINGS

Accident: A monorail crane was two-blocked while the operator was attempting to verify proper operation of the hoist upper limit switch. Investigation revealed that the limit switch was stuck in the closed position and failed to stop the operation of the hoist.
Lessons Learned: Operators must ensure proper operation of limit switches during the pre-use check, performed prior to the first use of the crane each shift. Caution must be observed during the checking of limit switches; always operate at slow speeds. Remember, limit switches and other safety devices are not a substitute for full attention by the operator.

Accident: A monorail crane was found in a two-blocked condition during a pre-use check. The responsible operator and actual details of the accident are not known, however, it was discovered that the hoist upper limit switch was not adjusted properly.
Lessons Learned: In addition to the lessons learned above, remember that the definition of an accident and requirements for what to do if an accident occurs are provided in section 12 of NAVFAC P-307.

Accident: A mobile crane whip hoist was two-blocked when the operator attempted to raise the boom but inadvertently moved the joystick controller in the wrong direction activating the whip hoist instead of the boom. The operator also failed to keep in mind that the hoist limit switch had been by-passed for traveling the crane. Members of the crane team yelled to stop hoisting, but the hook raised past the limit switch counterweight and contacted the boom tip sheave.
Lessons Learned: Crane operators must remain alert and focused at all times during all types of operations. Whenever mobile crane safety devices are by-passed for traveling or reconfiguring the crane, the operator must ensure the safety devices are properly reset prior to commencing lifting operations. Requirements for bypassing safety devices are provided in section 10 of NAVFAC P-307.

Accident: The auxiliary hoist on a hydraulic mobile crane was two-blocked as the operator was lowering the boom into the boom rest with the hoist limit switch by-passed. The operator did not maintain adequate distance between the auxiliary hoist block and the boom tip sheave.
Lessons Learned: This type of accident is far too common but can be avoided with increased attention to the positions of the hook and boom and good communication within the crane team. Operators must maintain adequate distance between the boom and hoist blocks at all times and operate at slow speeds when limit switches are by-passed.

Accident: A category 4 crane was two-blocked but the event was not recognized as an accident. Evidence that the accident occurred was discovered during an NCC audit.
Lessons Learned: Following an accident or suspected accident, NAVFAC P-307 requires activities to promptly perform a comprehensive investigation and to prepare a crane and rigging gear accident report. The completed report shall be sent to NCC within 30 days of the accident. Management must ensure that all applicable personnel are trained on these requirements.

SIGNIFICANT CONTRACTOR WHE ACCIDENTS

Accident: A mobile crane operator was lowering the boom in preparation to stow the boom extension but failed to sufficiently lower the auxiliary hook block and two-blocked the crane.

Accident: While testing a mobile crane, it was found that the cable keepers on the boom tip had been damaged. Probable cause was that the crane had been two-blocked. The time and place of two-blocking was unknown.

Accident: A mobile crane was being used to remove a loaded wooden pallet, when the lifting beam became disengaged from the rigging gear. This caused the load to slide off the pallet and fall approximately 40 feet to the elevator deck.
Lessons Learned: The rigger must make sure that all lifting attachments are properly attached and the load is secured to the pallet.

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. Note, the new 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: Allow the Maintenance Inspection as the "Before" Condition Inspection for All Category 3 Cranes. Request revising NAVFAC P-307 to allow using the maintenance inspection as the "before" condition inspection for all category 3 cranes. Change 2 to NAVFAC P-307 allows the biennial load test program for all category 3 cranes. Unlike other category 3 cranes included in the biennial load test program, category 3 bridge/overhead traveling, wall, gantry, cantilever, and semi-gantry cranes are excluded from using the maintenance inspection as the "before" condition inspection. Allowing the remaining category 3 cranes to use the maintenance inspection as the "before" condition inspection will standardize and streamline (especially in cases where a load test is not required for certification) the category 3 crane program. Request deletion of the references to the type of category 3 cranes in paragraph 3.6 of NAVFAC P-307 that are given exceptions to the separate maintenance and condition inspections and the allowance to use the maintenance inspection as the "before" portion of the condition inspection.

Answer: Concur. This change will be made in the next revision to NAVFAC P-307.

Question: Portable Gantry Load Test and Periodic Inspection Frequency. Request clarification of frequency of periodic load test and periodic inspection for portable gantries with permanently mounted hoists. NAVFAC P-307 paragraphs refer to table 14-1 for establishing frequency of periodic load test and periodic inspection for the listed equipment. Table 14-1 establishes for portable gantries a frequency of two years for periodic load test and inspection. Table 14-1 also establishes an annual frequency for periodic load tests and inspections of hoists.

Due to the difference in inspection and load test frequency for the two common assemblies that comprise a portable gantry the question becomes when are inspections and load tests required for portable gantries? If the hoist is permanently attached to the gantry framework, does the two-year frequency for periodic inspection and load test apply? The hoist in this situation becomes an integral part of the portable gantry and will only be utilized in that situation. The capacity of the portable gantry will be determined by the lesser of the hoist capacity or the gantry framework capacity.

Request establishment of a two-year periodic inspection and load test schedule for portable gantries with permanently mounted hoists.

Answer: A portable A-frame with a permanently mounted hoist may be tested as a single unit on a biennial basis. ■

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-124: Loose Brake Link Pivot Bolt on P&H Type SBE Brakes.
CSA-125: Plastic Cam Failure on Hubbell 4216 Cam Operated Master Switch Controllers.

EQUIPMENT DEFICIENCY MEMORANDA
EDM-062: Main Hook Block Sheave Seals and Pressure Relief Vents.
EDM-063: Clogging of Fuel Tank Filter Screens.

2004 NAVY WEIGHT HANDLING EQUIPMENT CONFERENCE

The 2004 weight handling equipment conference has been postponed until the spring of 2005 due to insufficient attendance. Information on dates and location of the 2005 conference will be provided early summer 2004. Your interest in safe and effective lifting and handling support to the Fleet is greatly appreciated.

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.

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