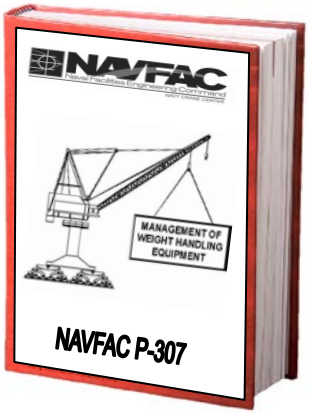
Navy Crane Center



NAVFAC P-307 Training

RIGGING GEAR INSPECTION

WEB BASED TRAINING STUDENT GUIDE

NCC-RGI-04

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TABLE OF CONTENTS

INTRODUCTION

Welcome

Welcome to Rigging Gear Inspection.
Rigging Gear Inspection is designed to acquaint personnel (riggers) with Navy requirements for inspecting and testing rigging gear and provide a knowledge base on which to build upon with on-the-job experience.
Topics covered include: rigging gear inspection, testing and marking requirements, and crane and rigging accidents.

Course Learning Objectives

Upon successful completion of this course you will be able to: identify rigging gear marking and record requirements, understand test and inspection requirements, and identify crane and rigging accidents and reporting requirements.

Getting the Most Out of the Course

To get the most out of this training:
Pay close attention to the narrations and information provided on each screen. There may be information in the narration that is not shown on the screen. And vice-a-versa, there may be information on the screen that is not contained in the narration.
Replay narrations and screen content as often as needed by clicking on the topic title or the tab title, as applicable.
Complete all knowledge checks and module quizzes to help re-enforce your understanding of the material covered.

Navigating Through This Course

As you navigate through this course, you will find several helpful tools and features that will facilitate your learning. This interactivity enables you to easily navigate and access various training aids and tools using the following buttons:

- The topic list, if present (on the left), displays the topics within the module. Topics can be selected by clicking on the title.
- The navigation buttons (top right) look like arrow heads and allow you to move forward to the next screen or backward to the previous screen by clicking on the arrowhead pointing to the right or left, respectively.
- The 'home' button (top right) returns you to the main module menu.
- The 'reference' button (top right) allows you to view various references, documents, or pictures provided to support your learning experience.
- The 'view narration' link (lower left on the content screen) allows you to view a text version of the audible narration.

Reference Area

Some courses require you to refer to other documents when completing the modules, exercises, quizzes and final exams. These documents are available in the reference area and can be copied to your computer or printed.
Load Test Director and General Crane Safety are two such courses and require you to have the load chart or certification packages handy. Note that the reference button is not available when taking the final exam.
Student Guides, a glossary of terms, and pictorial representations of equipment are also available from the reference area.

Knowledge Checks

These courses use various types of questions to help you retain the material presented. As you proceed through each topic, you will be asked questions in the form of knowledge checks.
The knowledge checks will help you prepare for the module quizzes and final exam. Question types include: Fill in the Blank, Drag and Drop, Multiple Choice - Single Answer, Multiple Choice - Multiple Answer, and True/False.

Exam Directions

When taking exams, keep the following in mind…
Some questions require multiple answers and have check boxes next to the choices. Single answer questions have circles next to the choices.
If you score less than 80% on a module quiz, review the necessary content, then return to retake the quiz.
You can go back and review any content prior to taking a quiz or final exam. You can review and change your answers any time before you select the ‘Score Exam’ button. A score of 80% or higher is required to pass.
The final exam score will be recorded in the Navy eLearning system and on your completion certificate.
If you fail a course, you can re-enroll and retake the course.

Feedback

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Upon completion of the training, or at any time during the training, please feel free to provide feedback to Navy Crane Center on how to improve or better deliver this presentation. Include suggestions such as: Current WHE accidents, near misses, trends (with narratives and pictures); Content changes, additions, deletions; Other topics; Clarifications, corrections; and Delivery methodologies.
Contact information is provided on the screen and in the student guide. You can come back to this screen at any time prior to passing the final exam. After passing the final exam, the course will roll up, your information will go to “My Transcripts”, and the course content will no longer be available. However, you may still refer to the student guide for contact information or you can go to the Navy Crane Center’s training web page and provide feedback via the links found there.

Ready to Begin

You are now ready to begin your training. Navigate back to the main module menu, select the next module, and begin your training. Good luck.

NOTES

RIGGING GEAR TEST, INSPECTION, AND MARKING REQUIREMENTS

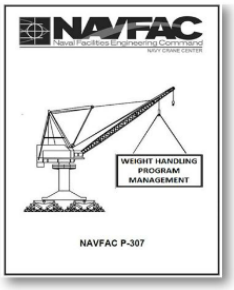
Welcome

Welcome to the Rigging Gear Test, Inspection, and Marking Requirements module.

Learning Objectives

Upon successful completion of this module you will be able to explain the primary goal of the test and inspection program, identify the section of NAVFAC P-307 that addresses rigging gear requirements, list the required equipment markings, identify what records must be kept, and identify the equipment covered in Section 14.

NAVFAC P-307 Section 14



Let's look at the section of NAVFAC P-307 that deals with rigging, Section 14.

Section 14 provides selection, maintenance, inspection, test, and use requirements for rigging gear and miscellaneous lifting equipment. These requirements help ensure the rigging gear you use is safe. When followed, these requirements help ensure optimum service life of the gear.

These requirements apply to covered equipment used, with or without cranes, in weight handling operations, and to covered equipment used with multi-purpose machines, material handling equipment or "MHE" (e.g., forklifts), and equipment covered by NAVFACP-300. These requirements also apply to contractor-owned rigging equipment used with Navy and BOS contractor-owned WHE, multi-purpose machines, MHE, and equipment covered by NAVFAC P-300 used in weight handling operations.

Except for BOS contracts, these requirements do not apply to contractor-owned equipment used with contractor-owned cranes, multi-purpose machines, MHE, backhoes, excavators, and front-end loaders.

Test and Inspection Program

NAVFAC P-307 requires each activity to establish a program that includes initial visual inspection and load test of equipment, marking, pre-use inspections before equipment is used, documented periodic inspections of equipment, and documented periodic load tests of certain equipment.

Except for hooks, rigging hardware and load indicating devices do not require load tests or documentation of inspections.

Why Test and Inspection?

Why do we need a test and inspection program? The primary goal is to prevent personnel injury!

The test and inspection program is designed to identify sub-standard, defective, damaged, or worn equipment, and remove unsafe equipment from service. Unsatisfactory equipment and gear shall be removed from service and disposed of or repaired. Equipment shall be stored before and after use in such a way and location so as to prevent damage and not be a hazard to employees. Occasionally, equipment and

gear is unsatisfactory as a result of a crane or rigging accident. The activity shall determine if damage was due to a crane or rigging accident and, if so, ensure that the accident is investigated and reported in accordance with NAVFAC P-307 section 12.

Covered Equipment

NAVFAC P-307 section 14 applies to the following equipment used in weight handling operations: rigging gear (slings, including chain, wire rope, metal mesh, synthetic rope, synthetic webbing, and synthetic roundslings; shackles; eye bolts; swivel hoist rings; links and rings; turnbuckles; insulated links; hooks; etc.); portable LIDs (dynamometers, load cells, crane scales, etc.); crane structures; and portable manual and powered hoists/winches.

Additional Covered Equipment

Also covered are below-the-hook lifting devices identified in ASME B30.20 (e.g., spreader beams, container spreaders, plate clamps, magnets, vacuum lifters); personnel platforms; portable gantry/A-frames, and portable floor cranes used for general lifting; and cranes and hoists procured with, integral to, and used solely in support of larger machine systems (milling machines, press brakes, etc.).

Equipment Not Covered

Equipment not covered includes: ordnance equipment, which falls under NAVSEA OP-5, original equipment manufacturer or OEM installed welded lift lugs, threaded holes and bolt-on pads, OEM provided rigging gear used for limited lifts such as off-loading, re-loading, initial storage, and shipment, and equipment in an approved test and inspection program (NAVAIR, NAVSEA, Strategic Systems Program, Army, or Air Force approved program).
Where OEM provided specialized rigging equipment is used, the activity shall ensure that the equipment is in good condition and that personnel using the equipment know how it is to be used.

Knowledge Check

1. Select all that apply. The reason test and inspection is required is to:
   A. Prevent personnel injury
   B. Identify sub-standard equipment
   C. Remove unsafe equipment

2. Select the best answer. Rigging gear identification markings applied by the activity usually indicate that the equipment is:
   A. New to the activity
   B. Not damaged
   C. In an inspection program
   D. Authorized for use

3. Select the best answer. Equipment test and inspection requirements in section 14 of NAVFAC P-307 do not apply to:
   A. Cranes and hoists integral to larger machines
   B. Personnel platforms
   C. OEM installed bolt-on pads
   D. Container spreaders

Equipment Markings

Markings on each piece of equipment are the most apparent way for you, the user, to know the requirements of NAVFAC P-307 have been met.
Equipment must be marked per the applicable ASME B30 volume (B30.9 for slings, B30.10 for hooks, B30.16 for portable hoists, B30.20 for below-the-hook lifting devices, B30.21 for lever hoists, and B30.26 for rigging hardware).
In addition to the identification and marking requirements of the applicable ASME volume, except as noted in NAVFAC P-307 paragraphs 14.8 and 14.11, each piece of equipment must be clearly marked, tagged or engraved with an indication of the re-inspection due date and a unique serial number that will allow it to be traced to its test and inspection documentation.
Below the hook lifting devices weighing more than 100 pounds shall be marked with the weight of the device.
Markings must be done in a manner that will not affect the strength of the component. Vibra-etch methods and low stress dot faced stamps are acceptable methods for marking equipment.
Contact the OEM for guidance on where and how to mark equipment.
Load tests, documented inspections, and special equipment markings (other than the manufacturer's markings required by B30.26) are not required for equipment covered by ASME B30.26 (shackles, adjustable hardware, compression hardware, links, rings, swivels, rigging blocks, and portable load indicating devices.)

Wire Rope Endless Slings

Endless slings shall have a marked rated load based on a D/d efficiency of 50 percent and may be used over various size pins at loads not exceeding the marked rated load.
Where endless wire rope slings are designed for a particular use, they shall be marked to indicate the pin diameter used to determine the rated load.

Chain Slings

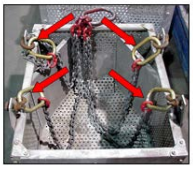
In accordance with 29 CFR 1915.112 and 29 CFR 1917.42, chain slings used in ship repair, shipbreaking, or cargo transfer require quarterly periodic inspections and must be marked to indicate the date of the next required inspection.

Lashing

Lashing must be marked to identify it to the spool or reel from which it came. The rated load must be marked on each piece as well as the re-inspection due date.

Multiple Part Equipment

For multiple part equipment that can be separated (e.g., load indicators with custom shackles), the subordinate part (the shackle) shall be identified to the primary part (load indicator). This is not intended for standard shackles or turnbuckles, equipment that is not field disassembled such as swivel hoist rings, or for equipment for which the activity engineering organization is allowed to designate fasteners by grade only, such as portable padeye/lifting lug fasteners and eyebolt nuts. If space limitations do not permit legible marking, a tag containing required markings shall be attached and engineering guidance shall be obtained.



Markings on Multi-leg Sling Assemblies

Multi-leg slings assemblies shall be marked with the rated load of each leg, the rated load of the entire assembly, and the sling angle upon which the rated load is based.

Braided Wire Rope Slings

NAVFAC P-307 requires that braided slings shall have the OEM's marking re-marked at 70% of the OEM's rated load unless destructive tests are conducted on sample slings. The documentation is reviewed by the Navy Crane Center.
So, there are many additional markings that may be required for different equipment. Not only do these markings have to be present, they must be legible.

Illegible / Missing Markings

Sometimes markings become hard to read due to wear or they may even be removed during a repair process. Replace markings that are hard to read or have been removed. Remember, all rigging equipment must be marked.

Required Records

Equipment markings should link the piece of equipment to its test and inspection records. NAVFAC P-307 requires documentation of tests and inspections. Records are the auditable proof that equipment has been tested and inspected and provide a basis for ongoing evaluation of the equipment. The latest test and inspection record will be retained on file at the activity. Computer generated files are acceptable if they identify the individual components and inspection results.

Records Information

NAVFAC P-307 requires that the records include identification of individual components, latest test and inspection results, and dates of inspections and tests. There are many ways to identify the equipment to the records.

MASTER HISTORY RECORD CARD	EQUIPMENT TYPE / DWG NO	EQUIPMENT ID
		CF 127D

SPS CAPACITY	MANUF. RECOMMENDED PERIODIC TEST VALUE	MAX. MATERIAL REMOVAL AUTHORIZED	PROOF TEST VALUE

RECORD OF INSPECTION / TESTING					MAINTENANCE REPAIR AND MODIIFICATION RECORD		
CYCLE	PURPOSE / DESCRIPTION	S	U	** C/740 VSR/DATE	CYCLE	DESCRIPTION	**C740/VS/DATE
Annual	Load Test Chainhoist	X		J.W. Inspector 1/27/20XX			

Matching Gear to Record

A unique identification number may be used to identify the equipment to its record.
The ID number can be as simple or complex as you need it to be.
A simple method might be to use a letter designator that represents a particular type of gear followed by a serialized number.
Mark the equipment ID number on the gear. Write the ID number on the record.
Now the gear has identifiable records!

Identifying Gear to its Record

This is an example of how the gear is marked at one Naval Shipyard. This is just one example of how an activity could choose to identify individual components to their records. This example reflects a fairly complex system that may be useful for activities who own multiple groups of equipment that need to be segregated. In this example, the unique identification number is used to identify three different things. The first number “98” identifies which shop, group, or code owns the equipment. Secondly, “P28” identifies the specific piece of gear with a serialized number. This particular number indicates that it was the 28th sling manufactured or certified on a specific day. The number 94-350 identifies the day it was manufactured or certified, 94 being the year 1994, 350 being the day of the year. No matter what method you use, there is important information that should be included in the gears records.

Knowledge Check

1. Select all that apply. Which of the following markings are required on lashing?
   A. The re-inspection due date
   B. Rated load
   C. Size
   D. Serial number

2. Select the best answer. Rigging gear test and inspection records must include:
   A. Identification of individual components
   B. Dates of tests and inspections
   C. Latest test inspection results
   D. All of the data listed above

3. Select the best answer. Matching ID marks on rigging gear are required for:
   A. End fittings on slings
   B. Components that can be separated
   C. Rope or chain sling bridle assemblies
   D. All rigging equipment
   E. Chain slings with permanent attachments

4. Select the best answer. Rigging gear test and inspection records are required to be kept on file:
   A. For 3 years
   B. For 6 months
   C. For 1 year
   D. Until replaced by a more current record

NOTES

RIGGING GEAR INSPECTION

Welcome
Welcome to the Rigging Gear Inspection module.

Learning Objectives
Upon successful completion of this module you will be able to list the required inspections, determine inspection frequency, describe inspection and rejection criteria, and identify repair requirements.

Inspection Types
There are two types of required inspections, pre-use and periodic.
The pre-use inspection is performed prior to use.
No documentation is required for pre-use inspections.
The periodic inspection is a comprehensive, documented inspection, performed on a schedule.
Note: Documentation is not required for inspections of rigging hardware covered by ASME B30.26 (shackles, adjustable hardware, compression hardware, links, rings, swivels, rigging blocks, and portable load indicating devices).
Post-use inspections are recommended to ensure no damage has occurred during the weight handling operation.

Pre-use Inspection
All equipment must be inspected prior to each use. The pre-use inspection ensures the equipment is not damaged or worn beyond allowable limits. The inspector must verify the rated load of the equipment and ensure the markings are legible. If the inspection due date has passed, the equipment must not be used. Remove any gear from service that fails inspection.

Periodic Inspection
Periodic inspections must be done by a qualified person.
If inspection reveals that the equipment has accumulated damage or is worn beyond the allowable limits it must be removed from service.
Records must be kept on file for all periodic inspections.
Note: Documentation is not required for inspections of rigging hardware covered by ASME B30.26 (shackles, adjustable hardware, compression hardware, links, rings, swivels, rigging blocks, and portable load indicating devices).
Inspection records provide a basis for evaluation, and provide the audit trail proving the equipment is in a test and inspection program.
The inspection frequency varies depending on the type of equipment. See table 14-1 of NAVFAC P-307.

Annual Inspection
Annual Inspections are required for beam clamps, below the hook lifting devices, blocks, slings, container spreaders, cranes integral to larger machine systems, equalizer beams and flounder plates, eye bolts, eye nuts, hoists/winches, hooks, insulated links, lashing, lifting beams, links and rings, magnetic lifters, personnel platforms, plate clamps, portable load indicating devices, portable padeyes/lugs,

shackles, swivels, swivel hoist rings, turnbuckles, vacuum lifters, and welded links and rings.

Biennial Inspection

Periodic inspections are required every 2 years for crane structures that do not have permanently mounted hoists, portable gantry/A-frames and portable floor cranes, and trolleys.

Inspection Every 3 months

In addition to the annual inspection noted previously, OSHA requires a periodic inspection every three months for chain slings used in ship repair and cargo transfer.

Damaged Rigging Gear

When damage to rigging gear is discovered during an inspection or when damaged rigging gear is returned to the gear room, and an accident is suspected, the gear shall be immediately removed from service and a comprehensive investigation initiated.
For a suspected accident, the activity shall follow the investigation and reporting requirements of NAVFAC P-307, section 12, promptly perform a comprehensive investigation, and prepare a Crane and Rigging Accident Report and forward a copy to the Navy Crane Center (Code 06) within 30 days of the accident.
Local Weight Handling Equipment accident reporting procedures shall also be followed.

Deficiencies

Deficiencies include failure or malfunction of equipment and major or unsafe discrepancies between design drawings and equipment configuration. This does not include normal wear on the equipment.
In those instances where a deficiency is detected that has applicability at other Navy activities, the Navy Crane Center shall be notified as soon as practical, but in no case later than five days of the discovery.
A summary report of the deficiency, including corrective actions taken or recommended, shall be forwarded to the Navy Crane Center within 21 days.

Knowledge Check

1. True or False. Documented records are required for periodic inspections of all rigging equipment.
   A. True
   B. False

2. Select the best answer. What are the two types of rigging gear inspections?
   A. Frequent and Annual
   B. Periodic and Random
   C. Annual and Biannual
   D. Periodic and Pre-Use

3. Select the best answer. Who is required to perform an inspection prior to using rigging gear, and what is this inspection called?
   A. Rigging gear room personnel, Prior to Use Inspection
   B. The User, Pre-Use Inspection
   C. The User, Periodic Inspection
   D. Gear Room Qualified Personnel, Pre-Use Inspection
   E. Gear Room Personnel, Pre-Operational Inspection

Sling Rejection Criteria - Knots

A knot in any part of a sling is cause for rejection.

Inspecting Chain Slings

Chain slings used for overhead lifting must be fabricated from chain that is grade 80 or 100.
Links are randomly marked by the manufacturer with 8, 80, or 800 for grade 80 chain, and 10, 100, or 1000 for grade 100 chain.

Chain Sling Inspection

Chain slings are generally very tough and durable and consequently they tend to get a lot of hard use. Carefully inspect each link and end attachment; including master links and coupling links. Nicks and cracks may be removed by grinding. Measure the link or component after grinding. Rejection is required if the defect cannot be removed or if any part of the link diameter is below the required minimum. Look for deformation such as twisted, bent, stretched links, or broken welds.

Chain Link Stretch

Chain links stretch when they are overloaded. Worn chain links will also cause the sling length to increase. Measure the length of each sling leg and look for increased chain length that may indicate overloading or link wear.

Chain Sling Rejection Criteria

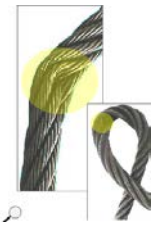
In addition to the removal criteria of ASME B30.9, the sling shall be removed from service if inspection reveals any of the following: an increase in length of a measured section due to stretch exceeding five percent and a link with a raised scarf or defective weld.

Coupling Link

Inspect coupling links carefully.
Make sure the keeper pin is not loose or protruding.

Wire Rope Sling Rejection Criteria

Inspect wire rope slings along the entire length of the sling including splices, end attachments, and fittings. Look for permanent distortion such as kinked, crushed, or birdcaged areas.



Wire Rope Sling Rejection Criteria

Look for core protrusion in-between the strands of the wire rope. Core protrusion is indicative of structural failure within the wire rope. The core should not be visible in straight runs. However, when a wire rope is bent, you will be able to see the core; this is not core protrusion. Fiber core wire rope slings may sometimes protrude between the strands in the end of an eye, opposite the bearing point; this too is not core protrusion.

Wire Rope Sling Rejection Criteria

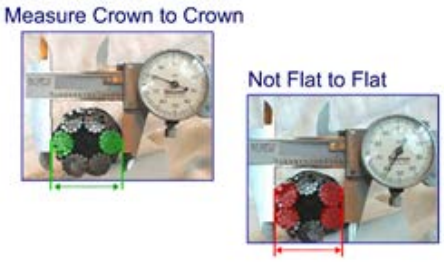
Look for signs of heat damage such as discoloration and other more obvious signs as shown here.

Wire Rope Sling Rejection Criteria

Look for severe corrosion or pitting of the wires or any condition that would cause loss of wire rope strength. Pay close attention to the outside area on each eye of the sling. This area wears more due to dragging the sling on concrete/paved surfaces.

Measuring Wire Rope

When measuring wire rope sling diameter with calipers, make sure you place the caliper on the crowns of the wire strands. Do not place the caliper across the flats or valleys of the strands.

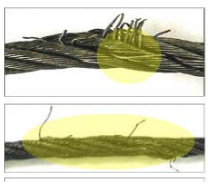


Broken Wires

Do not run your bare hand along the wire rope to detect broken wires! Bend the sling while watching for broken inside wires. Bending will open the area between the two ends and expose a broken wire making it easy to detect. Broken wire rejection criteria is based on a section of the wire determined by its “lay length”. Lay length is the linear distance along the wire rope in which a strand makes one complete turn around the rope's center.

Strand Laid Wire Rope Slings

Single part and strand laid wire rope slings must be removed from service if inspection reveals any of the following criteria: ten randomly distributed broken wires in one lay length, or five broken wires in one strand in one lay length.



Braided Wire Rope Slings Rejection Criteria

For braided wire rope slings with less than eight parts, reject slings with 20 randomly distributed broken wires in one rope braid length, or one completely broken strand.

For braided wire rope slings with eight parts or more, reject slings with 40 randomly distributed broken wires in one rope braid length or one completely broken strand.

Cable Laid Wire Rope Slings

Cable laid wire rope slings must be removed from service if inspection reveals, 20 randomly distributed broken wires in one rope lay length, or one completely broken strand.

Wire Rope End Fittings

When inspecting slings with end fittings, ensure the fitting is not cracked, deformed or loose. Make sure the wire rope in the fitting is not corroded. Inspect the end attachment for wear that exceeds 10% of the OEM's nominal socket dimension or 5% of the socket pin diameter. When inspecting slings with speltered sockets, the wire should not have any axial or lateral movement.

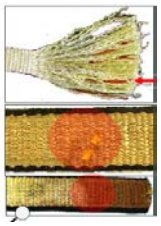
Metal Mesh Slings

Inspect the entire length of metal mesh slings including welds, end attachments, and fittings.

Remove the sling from service if inspection reveals any of the following: missing or illegible sling identification, a broken weld or a broken brazed joint along the sling edge, a broken wire in any part of the mesh, a reduction in wire diameter of 25% due to abrasion or 15% due to corrosion, a lack of flexibility due to distortion of the mesh, a cracked end fitting, visible distortion of either end fitting out of its plane, slings in which the spirals are locked or without free articulation, fittings that are pitted, corroded, cracked, bent, twisted, gouged, or broken, or other conditions, including visible damage, that cause doubt as to the continued use of the sling.

Remove From Service

Remove the sling from service if the eye openings in the end fitting are increased by more than 10%, or if there is a reduction of 15% of the original cross sectional area at any point around the hook opening of the end fitting.



Synthetic Sling Rejection Criteria

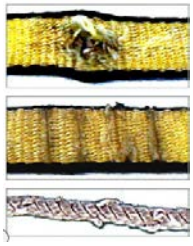
Remove the sling from service if the sling identification is missing or illegible.

Never use synthetic slings with exposed core warning yarns.

Do not rely on core warning yarns to indicate damage, as not all manufacturers use them and damage can reach rejection limits without exposing core yarns.

Synthetic Sling Rejection Criteria

Other damage that would require a synthetic sling to be removed from service includes heat or chemical damage, melting or charring of any part of the sling, punctures, cuts, or snags, indications of rotting, variations in size, crushed webbing, excessive abrasive wear, and embedded abrasive particles.

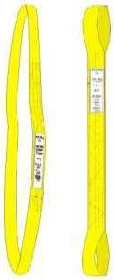


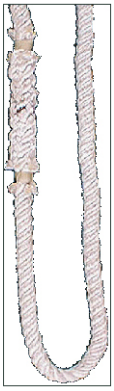
Synthetic Sling Rejection Criteria

Look for broken or damaged stitches or splices. The stitching holds the sling together. Check it carefully.

Synthetic Sling Rejection Criteria

Look for damage caused by prolonged exposure to sunlight, which can result in discoloration, fading or roughness. Look for cracked, distorted, broken, or excessively worn, pitted, or corroded end fittings. Also look for knots or indications the sling has been knotted. If you find evidence that a sling has been knotted, remove it from service.





Synthetic Rope Sling Removal Criteria

Remove the sling from service if any of the following conditions are present: Missing or illegible sling identification; cuts, gouges, areas of extensive or considerable fiber or filament breakage (fuzzing), and abraded areas on the rope; inspect inside the rope for fiber breakage, fused or melted fiber; damage that is estimated to have reduced the effective diameter of the rope by more than 10%; foreign matter that has permeated the rope and may attract and hold grit; kinks or distortion in the rope structure; melted, hard, or charred areas; poor condition of thimbles or end fittings; for hooks, removal criteria as stated in ASME B30.10; for rigging hardware, removal criteria as stated in ASME B30.26; and other conditions including visible damage that cause doubt as to the continued use of the sling.

In addition to the above, the sling shall be removed from service if inspection reveals any of the following: indications of rotting, backturns, variations in the size or roundness of the strands, or severance of one-third of the cover (outer) yarns.

Synthetic Round Sling Removal Criteria

Remove the sling from service if inspection reveals any of the following: melting, burn marks, charring, or other evidence of heat damage; snags, punctures, tears, or cuts that expose any part of the core yarns; broken or worn stitches in load bearing splices; excessive wear, abrasion, or embedded abrasive particles; internal knots, bumps, bulges, or irregularities that can be felt by massaging the sling manually along its length. Note: A knot in the yarn where the cover is joined may be a termination made by the OEM, which is acceptable.) Cracked, distorted, broken, or excessively worn, pitted, or corroded end fittings; and any other condition that causes doubt as to the strength of the sling are also signs for removing a sling from service.

Synthetic roundslings have two covers. If the outer cover is torn, cut, or damaged, the sling should be removed from service and sent to the OEM for inspection and repair. If the inside cover is also torn or damaged and exposing the core yarns, the sling must be removed from service.

Knowledge Check

1. Select the best answer. What is the minimum grade of chain required for chain slings?
   A. Grade 80
   B. Grade 100
   C. Grade 60
   D. Grade 70

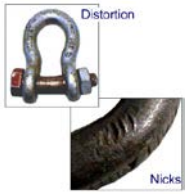
2. True or False. A knot in a synthetic sling is allowed as long as it does not cause permanent damage to the sling.
   A. True
   B. False

3. True or False. Chain slings used in cargo transfer should be inspected annually.
   A. True
   B. False

4. True or False. A metal mesh sling can remain in service if only one wire is broken in the mesh.
   A. True
   B. False

Types of Hardware Damage

When inspecting rigging hardware look for corrosion or severe pitting that would leave an orange peel effect when cleaned. Slight surface rust is okay. Inspect for wear, cracks, nicks, gouges, deformation, or distortion. Distortion may include elongation, peening, or heat damage.

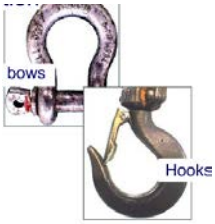


Areas to Inspect for Hardware Damage

Inspect the whole body of the hardware, but be particularly vigilant when inspecting the bearing surfaces for wear and distortion. Pay particular attention to the bearing surfaces since this is where the load is applied and will often show tell-tale signs of overload or abuse; just as the flattened area indicates on this picture.

10% Wear Reduction

Remove shackle bows and welded links, from service when wear exceeds 10% of the nominal diameter shown in federal specification RR-C-271. For shackle sizes not shown in federal specification RR-C-271, the OEM's listed nominal dimensions will be used. Remove hooks from service when wear exceeds 10% of OEM's nominal dimensions.

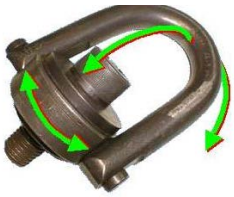


Areas to Inspect for Hardware Damage

Threaded shanks must be inspected carefully before use or load testing. When using gear with threaded shanks such as eyebolts, hoist rings, etc., inspect the shank carefully for bends, twists, or damaged threads.

Inspect Moving Parts

Some hardware has moving parts such as hoist rings and turnbuckles. Ensure that all moving parts move freely. Hoist ring bases should swivel 360° and the bail should pivot at least 180°.



Tackle Blocks

Tackle blocks shall be removed from service if inspection reveals distortion, cracks in the housing or sheaves, damaged sheaves, binding, abnormal sheave play, or any damage that may cause doubt as to the strength of the unit.

Below the Hook Lifting Devices

Below the hook lifting devices and container spreaders shall be inspected in accordance with ASME B30.20 and OEM recommendations. Always read and follow the information provided by the OEM.

Hoists, Cranes, A-frames, Gantries

Chain hoists and portable hoists shall be inspected in accordance with: ASME B30.16 and OEM recommendations. Lever operated hoists shall be inspected in accordance with ASME B30.21 and OEM recommendations. Other equipment shall be inspected in accordance with applicable ASME B30 criteria and/or OEM recommendations.

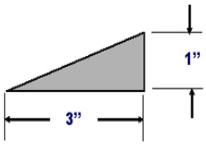
Portable Load Indicating Devices

Follow the inspection and removal criteria of ASME B30.26.
Attachment of these devices shall be in accordance with OEM recommendations.
Portable load indicating devices shall be calibrated in accordance with the activity's calibration program and the OEM's recommendations.
Initial and periodic load testing are not required.

Repairs and Alterations

When minor damage, such as nicks or cracks are found, it may be possible, and more economical, to remove the defect rather than replace the gear.
Repairs must be performed in accordance with OEM or engineering instructions.
Alterations must be approved by the activity engineering organization.
Re-inspection and load test of the repaired or altered equipment shall be performed prior to returning to service.
Repair documentation for load bearing, load controlling, or operational safety devices must be retained for 7 years, all other repairs 1 year.
Alteration documentation must be retained for the life of equipment.

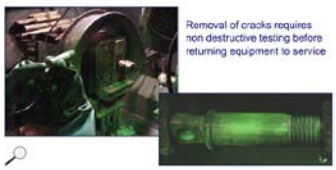
Authorized Hardware Repair



Grinding to remove defects is the only method authorized to repair rigging gear. Heat or welding is not permitted to correct defects. And no attempt shall be made to straighten bent or twisted rigging gear.
Grinding shall follow the contour of the piece blending with a maximum 1 to 3 taper. The component dimensions after grinding must be within the wear limits for the piece being repaired. If the after-grinding dimensions exceed the wear limits specified by the OEM or NAVFAC P-307, the component must be removed from service. Removal of defects as specified will not require a load test.

Non-Destructive Test

Removal of cracks must be verified by non-destructive testing before the hardware can be returned to service.



Knowledge Check

1. True or False. Rigging hardware that is bent can be repaired by straightening it back to its original shape.
   A. True
   B. False

2. True or False. Rigging hardware such as eyebolts, links, rings, and shackles are required to have a periodic inspection every 2 years.
   A. True
   B. False

3. Select the best answer. Distorted rigging hardware must be:.
   A. Evaluated for repairs
   B. Removed from service and destroyed
   C. Heat treated and returned to service
   D. Re-marked for a reduced capacity

4. Select the best answer. Documentation for alteration or repair of rigging equipment is required to be retained for:
   A. 2 years
   B. 1 year
   C. The life of the equipment
   D. Until replaced by another record

NOTES

RIGGING GEAR TEST REQUIREMENTS

Welcome
Welcome to Rigging Gear Test Requirements.

Learning Objectives
Upon successful completion of this module you will be able to describe the required tests, determine the test load percentages, and determine the testing frequency for rigging gear and miscellaneous equipment.

Load Test Overview
Load tests ensure that the equipment will operate safely within its rated load and design function.
Except as noted in NAVFAC P-307 paragraphs 14.8 and 14.11, each piece of applicable equipment shall be given an initial load test.
Equipment that does not require an initial load test includes: shackles, links, rings, swivels, eye bolts, eye nuts, turnbuckles, blocks, swivel hoist rings, and portable load indicating devices (LIDs).

Load Tests
For each test, the equipment shall withstand the load test for a minimum of two minutes (ten minutes for hoists or winches, cranes, and crane structures) with no permanent deformation.

Dynamic Tests
Equipment with moving parts requires an additional test.
Hoists, winches, trolleys, and other moving machinery must lift, or travel, the test load through at least one revolution of all moving parts.

Certificate of Load Test
A certificate of load (proof) test from the supplier of purchased equipment (stating the actual test load and test duration) will satisfy testing requirements, provided the proof loads and test duration meet or exceed the requirements of NAVFAC P-307 paragraph 14.4.1.

Determining Test Loads
To determine the correct test load, you will need to know the rated load of the equipment and the required test percentage.
Nominal test loads or test load percentages for rigging gear and related equipment can be found in Table 14-1 of NAVFAC P-307.
Be sure to check the test load percentage for the type of gear you are testing, because test load percentages vary for different types of gear.

Test Load Tolerance (+5% -0%)

The actual test load, or test load tolerance, is plus 5 minus 0 (+5/0) percent of the nominal test load.
The plus 5% provides a range to ensure the full test load is achieved without excessive overloading.
For cranes, crane structures, hoists, winches, portable floor cranes, portable gantry/A-frames, and trolleys, the test load shall be plus 0 minus 5 (+0/-5) percent of the nominal test load.

Determining Test Load Example

To determine the minimum test load for a plate clamp with a rated load of 2,000 lbs. we must first find the required test load percentage in Table 14-1 of NAVFAC P-307. We see that plate clamps are tested at 125%, plus 5%, minus 0%. Multiply 2,000 pounds by 1.25. This equals 2,500 lbs. The test load must not be less than 2,500 lbs.

Determining Test Load Example 2

Once the minimum test load is established we need to determine the load tolerance.
Multiply the 2,500 lbs. minimum test load by 1.05.
This equals 2,625 lbs, the maximum test load for this piece of equipment.
The maximum test load can also be determined by multiplying 2,500 lbs. by .05 (or 5%), which gives us 125 lbs. Then add 125 lbs. to 2,500 lbs. This provides the maximum test load of 2,625 lbs.

Reduction of Rated Load

For equipment where the OEM does not permit testing at the percentages shown in table 14-1, the rated load shall be reduced such that the OEM's allowed test load will serve as the load test value.

Rated Load Reduction

For example, if we need to load test a plate clamp that has a rated load of 2,000 pounds and the OEM does not allow overload testing, the OEM’s allowed test load will serve as the maximum load test value.
To find the reduced rated load, we would divide 2,000 pounds by 131.25 percent. This gives us 1,523 pounds.
The rated load should be rounded to 1,500 pounds, and the item must be marked to show the new rated load.

Conducting Load Tests

When conducting load tests, wear the appropriate personal protective equipment and secure the area to keep personnel out of harm's way in case the equipment fails.
Remember, you are exceeding the rated load of the gear. Be safe!

Rigging Gear

When testing wire rope and synthetic rope slings, ensure the slings are prevented from unlaying.

For slings and NAVFAC P-307 paragraph 14.8 equipment used in cargo transfer, a certificate of proof load test from the OEM is required. Proof load test percentages shall be obtained from the applicable ASME volume if not specified in table 14-1.

Where test weights are used to test rigging gear and other equipment covered by section 14, the requirements of NAVFAC P-307 paragraph 4.7.1.1 shall apply for the test weights.

Rigging Assemblies

A rigging assembly made up of component parts (i.e., slings, shackles, rings, etc.) that are reserved for that particular assembly may be tested as a complete assembly.

A rigging component tested as part of an assembly shall not be removed and used independently, unless it can be proven that the component was tested at the applicable percentage shown in table 14-1.

Load Testing with Machines

Load testing of rigging gear and miscellaneous equipment utilizing machines specifically designed for that purpose (e.g., pull test machine) is not considered a weight handling operation.

Deficiencies that occur during these evolutions shall be reported in accordance with NAVFAC P-307 paragraph 14.5.

Overloads that occur during these evolutions should be investigated and reported as unplanned occurrences in accordance with section 12.

Lashing

Lashing materials such as synthetic rope, wire rope, and webbing do not need to be individually tested if a sample has been tested and each piece is marked. A sample from each spool or reel must be tested and determined to have satisfactory breaking strength. OEM certification is acceptable. Each piece used for lashing must be inspected and marked.

Annual Load Test

A periodic load test must be conducted annually, or within 12 months prior to use on: cranes integral to larger machine systems, hoists and winches, magnetic lifters, personnel platforms, plate clamps, and vacuum lifters.

Biennial Load Test

Crane structures without permanently mounted hoists, as well as portable A-frames, portable gantries, portable floor cranes, and trolleys are required to be load tested every two years.

Controlled Storage Exception

The requirement for periodic load test within 12 months prior to use does not apply to manually operated portable hoists placed into an extended controlled storage condition.
The hoist must be inspected, repaired if necessary, and initially load tested. It may then be placed in controlled storage and given a tracking number.
A numbered locking security seal (metal or plastic) must be applied to the pull chain or operating lever to ensure the hoist cannot be operated.
When the hoist is needed for use, it must be visually inspected for apparent damage or significant deterioration and operated prior to being issued.
The re-inspection due date must then be marked on the hoist.
This new re-inspection due date cannot exceed one year from the date the hoist was put back into service.
The maximum storage period is 10 years.

Exception to Periodic Load Testing

Crane structures and portable gantry or A-frames with rated loads of 100 pounds or less, or that have a minimum design factor, based on the yield strength of the material, of 10 or greater do not require periodic load testing.
A periodic inspection is required every two years.

Knowledge Check

1. Select the best answer. For applicable rigging equipment (not including hoists, winches, cranes, and crane structures), a load test is held for a minimum of _____ minutes.
   A. 2
   B. 4
   C. 6
   D. 8

2. Select the best answer. For each load test of hoists, winches, cranes, and crane structures, the test load must be held for a minimum of _____ minutes?
   A. 5
   B. 20
   C. 10
   D. 2

3. Select the best answer. Hoists, winches, trolleys, and other moving machinery must lift, or travel, the test load through at least ____ revolution(s) of all moving parts.
   A. 1
   B. 3
   C. 2
   D. 4

4. Select the best answer. What must be done if the OEM does not permit testing in excess of the rated load?
   A. The equipment's rated load must be reduced
   B. Use the rated load marked on the equipment
   C. OEM must re-mark the equipment

5. Select the best answer. Individual components tested as a lifting assembly must:
   A. Show individual load ratings
   B. Be lock-wired to prevent disassembly
   C. Not be used independently
   D. Be tested first independently

6. True or False. The actual test load, or test load tolerance, is plus 0 minus 5 (+0/-5) percent of the nominal test load for rigging gear (not including cranes, crane structures, hoists, winches, portable floor cranes, and portable gantry/A-frames).
   A. True
   B. False

7. Select the best answer. How often do cranes integral to larger machine systems, hoists, winches, magnetic lifters, personnel platforms, plate clamps, and vacuum lifters require a periodic load test?
   A. Every 2 years
   B. Every year
   C. Quarterly
   D. Every three years

NOTES

CRANE AND RIGGING ACCIDENTS

Welcome
Welcome to Crane and Rigging Accidents.

Learning Objectives
Upon successful completion of this module you will be able to identify the elements in the crane and rigging operating envelopes, define a crane accident, define a rigging accident, near miss, and unplanned occurrence, identify the primary causes of accidents, and explain the procedures to follow when an accident occurs.

Accident Categories
There are two general categories of accidents: crane accidents and rigging accidents. Crane accidents are those that occur during operation of a category 1, 2, 3, or 4 crane. Rigging accidents are those that occur when gear and equipment identified in section 14 is used by itself in a weight handling operation, i.e., without category 1 through 4 cranes, or when covered gear is used with multi-purpose machines, MHE (e.g., forklifts), and equipment covered by NAVFAC P-300 in a weight handling operation. In addition, accidents that occur during the operation of entertainment hoists shall be classified as rigging accidents.

Significant Accidents
A significant accident is an accident that typically has a greater potential to result in serious injury or substantial property damage.
The following accident types are considered significant accidents: injuries (regardless of severity), overloads, dropped loads, two-blocks, crane derailments, or contact with overhead electrical power lines.
Other types of accidents that result in OPNAV Class A, B, C, or D reporting thresholds for material property damage are also considered significant accidents.

Crane Operating Envelope

In order to define a crane accident, you must first understand the crane operating envelope.
The operating envelope consists of any of the following elements: the crane (except a crane being operated in transit as defined in NAVFAC P-307 appendix A), the operator, the riggers, signal persons, and crane walker, other personnel involved in the operation, the rigging gear between the hook and the load, the load, the crane's supporting structure (ground, rail, etc.), and the lift procedure.

Rigging Operating Envelope
The operating envelope around any rigging or other section 14 equipment operation includes the rigging gear or miscellaneous equipment identified in section 14, the user of the gear or equipment (including operators of multi-purpose machines, MHE, and construction equipment), other personnel involved in the operation, the load, the gear or equipment's supporting structure (padeyes, ship's structure, building structure, etc.), the load's rigging path, and the rigging or lift procedure.

Knowledge Check

1. Select all that apply. The crane operating envelope includes the crane, the operator, the riggers, the crane walkers, and …
   A. The load
   B. Any supporting structures
   C. The area where the load will be landed
   D. Rigging gear between the hook and the load

2. Select all that apply. The rigging operating envelope contains the rigging gear and miscellaneous equipment covered by P-307 section 14, the load itself and …
   A. Other personnel involved in the operation
   B. The crane removal procedure
   C. The load rigging path
   D. The rigging procedure
   E. The user of the gear or equipment
   F. The gear or equipment's supporting structure

Near Miss

A near miss is an unplanned event during a weight handling operation that did not result in a definable accident but easily had the potential to do so. Only a break in the chain of events prevented an accident. Simply put, a near miss is an accident that almost took place. The difference between a near miss and an accident (serious or otherwise) is often a fraction of an inch or a split second of time. A near miss report is used to learn from situations where an accident "almost" happened so that the real event can be averted.

Unplanned Occurrence

An "unplanned occurrence" describes an event that does not meet the definition of a crane or rigging accident but results in injury or damage to a crane, crane component, or related equipment due to an event not directly related to a weight handling operation. Examples include, but are not limited to, injury or damage caused by weather, damage to a parked or stationary crane caused by another moving object (e.g. vehicle, forklift), and flooding or fire damage.

Reporting

Near Misses and unplanned occurrences that do not fall under the crane and rigging accident definitions shall be reported using figure 12-2 (available on the Navy Crane Center website).
These reports shall be submitted in accordance with NAVFAC P-307 section 12 within 30 days of the event.

Crane Accident

A crane accident occurs when any of the elements in the crane operating envelope fails to perform correctly during a crane operation including operation during maintenance or testing, resulting in any of the following: personnel injury or death, material or equipment damage, dropped load (including any part of the load or rigging gear and any item lifted with the load or rigging gear), derailment, two-blocking, overload (including load tests when the nominal test load is exceeded), or collision (avoidable contact between the load, crane, and/or other objects).

Rigging Accidents

A rigging accident occurs when any of the elements in the operating envelope fails to perform correctly during a rigging operation resulting in any of the following: personnel injury or death, material or equipment damage that requires the damaged item to be repaired because it can no longer perform its intended function, dropped load (including any part of the load or rigging gear and any item lifted with the load or rigging gear), two-blocking of cranes and powered hoists identified in section 14, or overload (including load tests when the test load tolerance is exceeded).
Note: A dropped load, two-blocking, and overload are considered accidents even though no material damage or injury occurs.

Damaged Rigging Gear

When damage to rigging gear is discovered during an inspection or when damaged rigging gear is returned to the gear room, and an accident is suspected, the gear shall be immediately removed from service and a comprehensive investigation initiated.
For a suspected accident, the activity shall follow the investigation and reporting requirements of NAVFAC P-307, section 12, promptly perform a comprehensive investigation, and prepare a Crane and Rigging Accident Report and forward a copy to the Navy Crane Center (Code 06) within 30 days of the accident.
Local Weight Handling Equipment accident reporting procedures shall also be followed.

Accident Examples

Some common examples of accidents are: dropped loads, injuries from a shifting load, failure of rigging gear resulting in a dropped load, overloads, and improperly secured loads falling from pallets.

Accident Exception

A component failure (e.g., motor burnout, gear tooth failure, bearing failure) shall be considered an accident only if damage to the load or another component occurs as a result of the failure.

Accident Causes

In most cases, crane accidents result from personnel error and can be avoided.
Most crane accidents are caused by: inattention to the task, poor judgment, bad communication, team members having too much confidence in their abilities, or operating the crane too fast.

Operator Responsibilities

The operator can play a significant role in eliminating human error and accidents.
Drugs and alcohol can affect a person's capability to think, reason, or react in normal situations and can certainly lead to serious accidents.
Operators must always consult their physicians regarding effects of prescription drugs before operating equipment, and recognize that medications often affect people differently.
An operator is responsible for evaluating his or her physical and emotional fitness.

Accident Actions

Upon having an accident or having seen evidence of damage, the crane team, riggers, equipment users, etc., shall stop all operations and notify immediate supervisor(s).
If there is impending danger to the equipment or personnel, place the crane and/or load in a safe position prior to notifying supervision.
Ensure the accident scene is secured and undisturbed so as to facilitate the investigation.
The supervisor shall review the situation and take any further emergency action.
The supervisor shall notify management personnel as well as the activity safety office.

Crane Accident Actions

If a crane accident occurs, personnel must take the following actions:
Stop operations as soon as possible, however don’t stop at the expense of safety.
In some circumstances, for example, if a crane is involved in a collision as a load is being lowered, the operator should first land the load, then, follow the accident response procedure.
Don’t try to correct the problem unless life or limb is in danger.
Call, or have someone call 911 if an injury occurs.
Secure the crane.
Secure power as required.
If danger exists to the crane or personnel, place the crane and load in a safe position.
Notify supervision as soon as safely possible.
Ensure that the accident scene is preserved to aid the investigation.

Notification and Reporting

For accidents involving a fatality, inpatient hospitalization, overturned crane, collapsed boom, or any other major damage to the crane, load, or adjacent property, notify the Navy Crane Center by e-mail as soon as practical, but not later than eight hours following the accident. Notification for all other accidents shall be made as soon as practical but no later than three working days after the accident.

For each suspected accident, activities shall promptly perform an investigation, prepare a crane and rigging accident report using figure 12-1 (available on the Navy Crane Center web site), and forward a copy to the Navy Crane Center (Code 06) within 30 days of the accident.

Contractor Reporting Procedures

The contractor shall: notify the contracting officer as soon as practical, but not later than four hours, after any WHE accident, secure the accident site and protect evidence until released by the contracting officer, and conduct an investigation to establish the root cause(s) of any WHE accident, near miss, or unplanned occurrence.

Crane operations shall not proceed until the cause is determined and corrective actions have been implemented to the satisfaction of the contracting officer.

The contractor shall provide the contracting officer a report for an accident or near miss within 30 days using the appropriate form provided in NAVFAC P-307 section 12 consisting of a summary of circumstances, an explanation of causes, photographs (if available), and corrective actions taken.

Contracting Officer Reporting Procedures

The contracting officer shall notify the host activity of any WHE accident upon notification by the contractor. Additionally, the contracting officer shall notify the Navy Crane Center, by e-mail (nfsh_ncc_accident@navy.mil), of an accident involving a fatality, in-patient hospitalization, overturned crane, collapsed boom, or any other major damage to the crane or adjacent property as soon as possible, preferably within 8 hours of notification by the contractor. For all other accidents, notify the Navy Crane Center as soon as practical but no later than three working days after the accident.

The contracting officer shall provide the Navy Crane Center and host activity a copy of every accident and near miss report, regardless of severity, upon receipt from the contractor.

The contracting officer or designated weight handling representative shall sign all crane and rigging accident and near miss reports to indicate that they are satisfied that the contractor's investigation and corrective action are sufficient.

Knowledge Check

1. Select the best answer. During maintenance the rigging gear between the crane hook and the load fails and results in equipment damage. This is reported as a:
   A. Operator error
   B. Rigging gear deficiency
   C. Crane accident
   D. Rigger error

2. Select the best answer. During crane operations the load shifts. The operator reacts quickly and saves the load but causes the crane to derail. This is reported as a:
   A. Load configuration error
   B. Operator error
   C. Crane walker's error
   D. Crane accident

3. Select the best answer. When rigging gear covered by P-307 Section 14 fails while suspended from a structure and drops the load it is a:
   A. Crane accident
   B. Rigging accident
   C. Rigging error
   D. Load configuration error

4. Select the best answer. If component failure occurs, such as motor burnout, and does not result in damage, the component failure is considered:
   A. A crane accident
   B. A rigging accident
   C. A non-accident
   D. Crane maintenance's responsibility

5. Select the best answer. To whom or to what are the majority of crane accidents attributed?
   A. Weather conditions
   B. Crane operators
   C. Riggers or signalmen
   D. Personnel error
   E. Equipment failure

6. Select all that apply. Over-confidence and poor judgment among team members can contribute to crane and rigging accidents. Select additional factors that can contribute to accidents:
   A. Inattention to the task
   B. Engineering lift specifications
   C. Operating the crane too fast
   D. The crane operating envelope

7. Select the best answer. If you have an accident with a crane or you find damage and suspect an accident has happened, your first step is to:
   A. Stop operations as soon as safely possible
   B. Call emergency services if anyone is injured
   C. Secure the crane and power as required
   D. Notify your supervisor immediately

NOTES

RIGGING GEAR INSPECTION COURSE EVALUATION SHEET

Student Name: _____ Command: _____

Course Title: _____ Date: _____

Instructor: _____

Directions: To assist in evaluating the effectiveness of this course, we would like your reaction to this class. Do not rate questions you consider not applicable.

Please rate the following items:	Excellent	Very Good	Good	Fair	Poor
Content of the course met your needs and expectations.					
Content was well organized.					
Materials/handouts were useful.					
Exercises/skill practices were helpful.					
Training aids (slides, videos, etc) were used effectively.					
Instructor presented the material in a manner, which was easy to understand.					
Instructor was knowledgeable and comfortable with the material.					
Instructor handled questions effectively.					
Instructor covered all topics completely.					
Probability that you will use ideas from the course in your work.					
Your opinion of the course.					
Your overall opinion of the training facilities.					

What were the key strengths of the training? How could the training be improved? Other comments?

_____

_____

_____

_____

List other training topics in which you are interested: _____

_____

_____

Note: If you would like a staff member to follow up and discuss this training, please provide your phone number_____