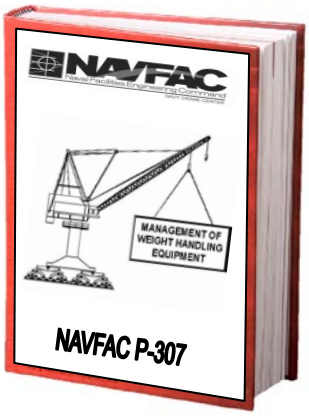
Navy Crane Center



NAVFAC P-307 Training

CATEGORY 2 CRANE SAFETY REFRESHER

WEB BASED TRAINING STUDENT GUIDE

NCC-C2CSR-03

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INTRODUCTION

Welcome

Welcome to Category 2 and Cab-Operated Category 3 Crane Safety Refresher. Category 2 and Cab-Operated Category 3 Crane Safety Refresher is designed to refresh crane operators with Navy requirements for the safe operation of Category 2 and Cab-Operated Category 3 cranes.
Topics covered include: Crane Components, Operator's Daily Checklist (ODCL), Lift Types, Crane Communications, Crane Team Concept, Rigging Considerations, Safe Operations, and Crane and Rigging Gear Accidents.

Course Learning Objectives

Upon successful completion of this course, you will be able to perform an Operator's Daily Checklist, understand the crane team concept, and identify crane components, lift types, proper crane communication methods, proper selection and use of rigging gear, safe crane operations, and crane and rigging gear accidents.

NOTES

CRANE COMPONENTS

Welcome

Welcome to Crane Components.

Learning Objectives

Upon successful completion of this module you will be able to define and identify critical crane components, load bearing parts, load controlling parts, and operational safety devices.

Category 1 and 4 Crane Power Types

Category 1 and 4 cranes generally use electric or hydraulic power that is supplied by a diesel engine.
A collector ring system conveys electrical current from the revolving portion of the crane to the lower crane structure.

Category 2 and 3 Crane Power Supply

Current to Category 2 and 3 cranes is carried from the building or shore power to the bridge and trolley by an insulated electrification conductor system, festoon system, or cable track system.

Category 1 and 4 Crane Components

The principal parts of most Category 1 and 4 cranes are: the boom, machinery house, roller path or rotate bearing, supporting structure, and travel system.

Category 2 and 3 Crane Components

The principal parts of overhead traveling cranes are: bridge girders, end trucks, trolley with hoisting mechanism, and operator's cab or pendant control.

Critical Crane Components

Careful repair and maintenance are essential to safe crane operations.
To ensure repairs are not compromised by sub-standard parts, critical crane components are clearly identified.
NAVFAC P-307, Appendix F provides examples of load bearing parts, load controlling parts, and operational safety devices.

Load-Bearing Parts

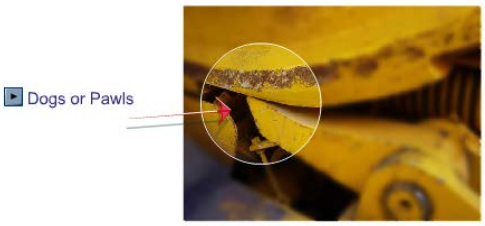
Load-bearing parts support the load.
Failure of a load-bearing part can cause dropping, uncontrolled shifting or uncontrolled movement of the load.
There are many different load bearing parts; this picture shows three examples.

Examples

Examples of load-bearing parts are wire rope, sheaves, hooks, hook blocks, and hoist drum pawls.
The next example screen shows a boom dog, used to prevent unwanted rotation of a boom or hoist drum.

Wire rope,
Hooks, & Blocks

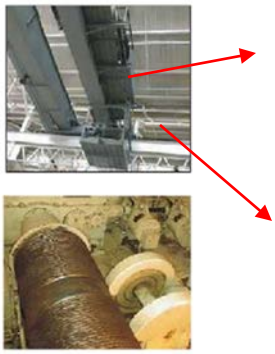
Sheaves



prevent unwanted drum rotation

Carrier Frame Structures

The carrier frame provides a working base for the upper works of the crane.
The tires, wheels, and axles support the carrier frame for transporting and for lifting loads on rubber.
Outriggers, stabilizers, and locking devices provide support for on-outrigger operations.
Failure of any one of these components or systems can cause the load to drop or cause uncontrolled movement of the load. These are critical components that must be carefully checked before operations or testing.



On Bridge Cranes

Two examples of load-bearing parts found on bridge cranes include the bridge girders that carry the weight of the trolley including hoisting machinery and the load; and the wire rope drum and hoisting machinery that lifts and supports the load.
Appendix F of NAVFAC P-307 provides additional examples of load-bearing parts.

Load Controlling Parts

Load-controlling parts are crane components that position, restrain, or control movement of the load.
Malfunction of these parts can cause dropping, uncontrolled shifting, or movement of the load.
Shown are two examples of load controlling parts.

Foot-controlled Brakes

Travel-Gear Assemblies

Rotate-Gear Assemblies

Examples 1

Examples of load-controlling components are foot-controlled brakes used as secondary brakes for hoist speed control, travel gear assemblies, rotate gear assemblies, and rotate locks.
Appendix F of NAVFAC P-307 provides additional examples of load-controlling parts.

Examples 2

Some additional examples are crane-mounted diesel engines and generators, electrical-power-distribution systems, and electrical crane-control circuits related to rotate and travel including brakes and clutches.

Knowledge Check

1. Select the best answer. What types of power does a Category 1 or 4 crane generally use and what is its source?

   A. Pneumatic and electric power supplied by a backup generator
   B. Electric or hydraulic power supplied by a diesel engine
   C. Hydraulic and water power supplied by a compressor
   D. Pneumatic and hydraulic power supplied by a compressor

2. Select the best answer. Load - _____ parts are those that restrain, position, or control the movement of the load.

   A. Operation
   B. Bearing
   C. Controlling
   D. Handling
   E. Lifting

3. Select the best answer. A hook is what type of component?

   A. Load-Controlling Part
   B. General Safety Device
   C. Operational Safety Device
   D. Load-Bearing Part

4. Select the best answer. Hydraulic foot brakes are what type or group of components?
   A. General Safety Device
   B. Load-Controlling Parts
   C. Operational Safety Device
   D. Load-Bearing Parts

5. Select the best answer. Load - _____ parts are those that support the load.

   A. Lifting
   B. Operational
   C. Bearing
   D. Handling
   E. Controlling

6. Select the best answer. How is electrical current conveyed from the revolving portion of the crane to the lower crane structure?

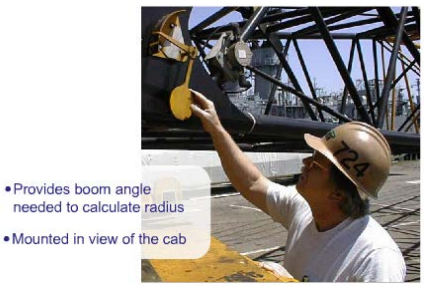
   A. Through the main circuit board
   B. Through the collector ring system
   C. Through transistors
   D. Through the electrical panels

Safety Devices

Safety devices are divided into two groups, general safety devices and operational safety devices.
Operational safety devices affect the safe lifting and handling ability of the equipment.
Operational safety devices are critical crane components.
General safety devices provide protection for personnel and equipment on or in the crane operating path.

Load Indicators

Load-moment indicators are operational aids providing the crane operator necessary information to stay within the capacity of the crane.
Load-moment indicators that provide shutdown capabilities are operational safety devices. They may provide the operator with load weight, boom angle, and boom length.
As the operator approaches critical limits, load moment devices may sound an audible alarm, illuminate warning lights, or lock out functions that could possibly allow the operator to overload the crane.
If a load moment device has lockout capability, it must be treated as an operational safety device.



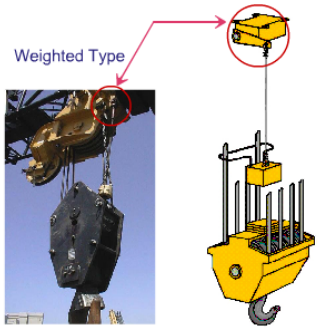
Angle Indicators

Mechanical boom angle indicators are operational safety devices.
These devices provide the operator with the boom angle needed to calculate the radius of the crane.

Mechanical boom angle indicators are usually mounted on the boom where they can easily be read from the cab.

Limit Switches

Limit switches are operational safety devices that prevent damage to the crane if a loss of control occurs. Most cranes are equipped with limit switches.
The purpose of a hoist limit switch is to prevent over-travel of the hook block and the possibility of two-blocking.
Two-blocking occurs when the hook block comes in contact with the upper sheave block during hoisting of the hook (or lowering the boom). Two-blocking is dangerous because it could result in damage to the crane, parting of the hoist lines, and dropping the load.
These images are examples of weighted-type hoist upper-limit switches.
A spring-loaded switch opens the circuit when the hook block raises the weight. Interruption of power to the hoist function stops the upward movement of the hoist block to prevent two-blocking.



Over-speed Devices

Over-speed, pressure, and temperature devices on crane-mounted engines are **operational safety devices**
When the engine provides the power to move loads, the devices provide shutdown ability to protect the engine from damage.
Appendix F of the P-307 provides a comprehensive list of operational safety devices.

General Safety Devices

General safety devices are those devices that protect or alert the operator or personnel working in the vicinity of the crane.
Some general safety devices used to warn personnel working on or around the crane are horns, bells, whistles, travel alarms, travel warning lights, and bumpers.


Horns, Bells, Whistles


Travel Alarms


Travel Warning Lights


Bumpers

Knowledge Check

1. Select the best answer. Safety devices that provide protection for personnel and equipment are considered _____ safety devices.

   A. General
   B. Load bearing
   C. Universal
   D. Operational

2. Select the best answer. Safety devices that affect the safe load lifting and handling capabilities of equipment are considered _____ safety devices.

   A. Operational
   B. General
   C. Universal
   D. Load bearing

3. Select the best answer. Which of the following does not affect the safe operation of the crane?

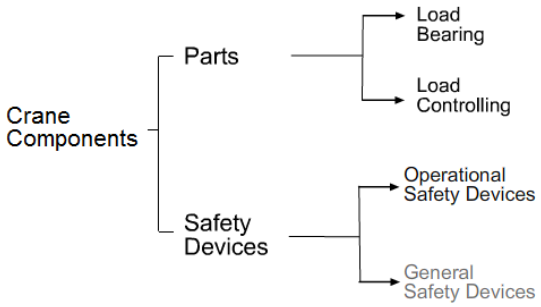
   A. Operational Safety Devices
   B. General Safety Devices
   C. Load-Bearing Parts
   D. Load-Controlling Parts

4. Select the best answer. A travel alarm is what type or group of components?

   A. General Safety Device
   B. Load-Bearing Part
   C. Operational Safety Devices
   D. Load-Controlling Part

Summary and Review

NAVFAC P-307, section 1 defines load bearing parts, load controlling parts, and operational safety devices, which, as a group, are commonly referred to as "critical" components."
Careful repair and maintenance is essential to safe crane operations.
Your awareness and maintenance of critical parts ensures repairs and maintenance are not compromised by sub-standard parts.



NOTES

OPERATOR'S DAILY CHECKLIST (ODCL)

Welcome
Welcome to Operator's Daily Checklist.

Learning Objectives
Upon successful completion of this module you will be able to state the purpose of pre-operational checks, explain the frequency of pre-operational checks, and properly complete an Operator's Daily Checklist.

Introduction
An Operators Daily Checklist or ODCL is a safety checklist.
The ODCL aids the operator in doing a complete check and provides a record of inspections.

Purpose
The daily inspection conducted by the operator is a general check by sight, sound, and touch.

It helps the operator identify conditions that may render the crane unsafe to operate and enhances crane reliability.

ODCL Frequency
A complete check of the crane is performed by the operator prior to the first use of the crane each day using a Crane Operator's Daily Checklist, referred to as the ODCL.
The operator signs the ODCL at the completion of this initial check.
Subsequent operators review, perform operational checks, except boom limit switches and sign the initial ODCL prior to operating the crane.
If a load is suspended from the hook for a period that spans more than one operator, the operator who completes the lift shall perform appropriate checks immediately upon completion of the lift unless he/she will not operate the equipment again.
For operations not involving a lift, such as moving the crane to a new location, the operator needs to check only the functions to be used.
When a crane is used in construction, a complete pre-use check must be performed by each operator.
A documented pre-use check is not required for non-cab operated Category 3 cranes; however, for bridge, wall, and gantry cranes, a documented pre-use check shall be performed at least once each calendar month the crane is in use.

ODCL Sections
A proper pre-operational check is performed in four sections: the Walk Around Check, the Machinery House Check, the Operator Cab Check, and the Operational Check.
The operator may perform the check from the various groupings in parallel.

Knowledge Check

1. Select the best answer. A complete check of the crane is performed by the operator prior to:

   A. The first use of the crane each day
   B. Complex lifts only
   C. Moving the crane to a new location
   D. Securing the crane each day

2. Select the best answer. The ODCL is used to identify:

   A. Who is licensed to operate the crane
   B. Conditions that may render the crane unsafe
   C. Necessary and missing paperwork
   D. Members of the current crane team

3. Select all that apply. What are the four sections of a properly performed pre-operational check?

   A. Stability check
   B. Walk around check
   C. Operator's cab check
   D. Machinery House check
   E. Operational check
   F. Electrical function check

4. Select the best answer. What method of inspection is used in the operator's daily check of the crane?

   A. Review of OEM manual
   B. Observing the crane in operation
   C. Sight, sound and touch
   D. CCI inspection

Warning Tags

Before energizing the crane, look for warning tags. You may find warning tags posted with the certification card or information, attached on the pendant controller or other types of crane controls, or on the power source of the crane.

The red danger tag prohibits operation of equipment when its operation could jeopardize the safety of personnel or endanger equipment. If you discover one, never energize the crane with a danger tag attached! Energizing equipment with a danger tag attached may result in personnel injury or equipment damage.

The yellow caution tag generally gives some type of warning, precaution, or special instructions to the operator of the crane. Most caution tags inform of hazardous conditions such as rail stops, swing interference,

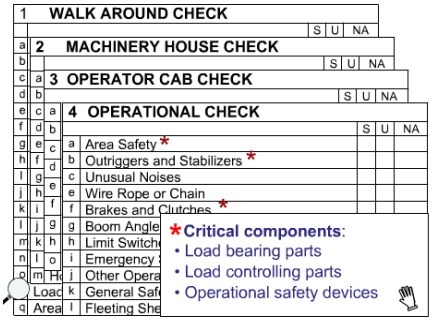
crane clearance problems, etc. Always read and follow the written instructions on the tag before operating the crane. If you do not understand the instructions, ask your supervisor for clarification.
A Lockout Tag is installed to inform you that the energy has been locked out, and is used to protect the person or persons who hung the tag while they are working on the affected system or component. It is intended for one shift use and is usually accompanied by a physical locking device to prevent operation.
Another tag you may find is an “Out of Service” tag. An Out of Service tag is normally installed to perform maintenance, testing, or inspection. When you find this tag, do not use or operate the crane.
Remember, only authorized personnel may install or remove warning tags.

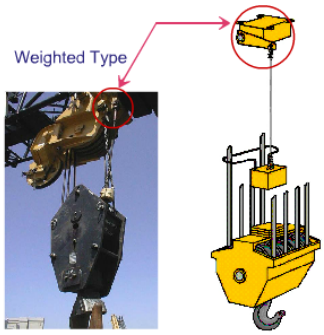
Who Can Remove These Tags?

Only authorized personnel may install or remove warning tags. Who are the authorized personnel? The person who applied the tag and sometimes his or her supervisor.

Critical Components

The ODCL identifies components that are critical to the safe operation of the crane.
Critical components are load-bearing parts, load-controlling parts, and operational safety devices.
They are identified by an asterisk (*) next to the item.
Any deficiency to a critical component or safety hazard must be reported to your supervisor immediately, and the crane shall not be operated until resolved.



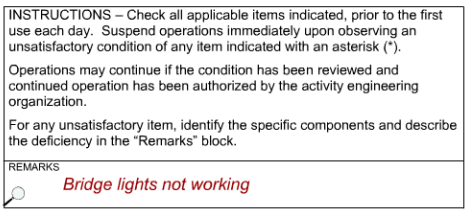


Limit Switches

Limit switches are operational safety devices that prevent damage to the crane if a loss of control occurs. Most cranes are equipped with limit switches.
The purpose of a hoist limit switch is to prevent overtravel of the hook block and the possibility of two-blocking.
Two-blocking occurs when the hook block comes in contact with the upper sheave block during hoisting of the hook (or lowering the boom). Two-blocking is dangerous because it could result in damage to the crane, parting of the hoist lines, and dropping the load.
These images are examples of weighted-type hoist upper-limit switches.
A spring-loaded switch opens the circuit when the hook block raises the weight.
Interruption of power to the hoist function stops the upward movement of the hoist block to prevent two-blocking.

Unsatisfactory Conditions

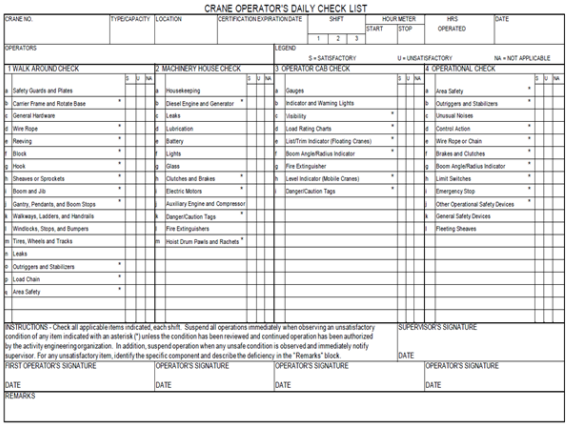
You must give a detailed description of unsatisfactory conditions in the remarks block of the ODCL form.
If you discover a load bearing part, load controlling part or operational safety device that is unsatisfactory, you must stop, secure the crane and notify your supervisor. The



supervisor shall immediately report the crane deficiency to the crane inspection organization. The item shall be marked by the operator as unsatisfactory on the ODCL and the deficiency shall be described in the remarks block.
Minor deficiencies must be marked as unsatisfactory on the ODCL and the operator shall describe the deficiency in the remarks block.
The supervisor shall provide the ODCL to the organization responsible for corrective action.

Recording ODCL Results

Results of the inspection must be noted on the ODCL.
Each item shall be marked “S” for satisfactory, “U” for unsatisfactory or “N/A” for not applicable.
The operator signs the ODCL after performing the pre-operational check.
The ODCL shall be turned in to the supervisor after the last use of the crane each day.



CRANE OPERATOR'S DAILY CHECK LIST

CRANE NO.	TYPE/CAPACITY	LOCATION	CERTIFICATION EXPIRATION DATE	SHIFT 1 2 3	HOUR METER START	HOUR METER STOP	HRS OPERATED	DATE

OPERATORS

LEGEND: S = SATISFACTORY; U = UNSATISFACTORY; NA = NOT APPLICABLE

1 WALK AROUND CHECK	S	U	NA	2 MACHINERY HOUSE CHECK	S	U	NA	3 OPERATOR CAB CHECK	S	U	NA	4 OPERATIONAL CHECK	S	U	NA
a Safety Guards and Plates				a Housekeeping				a Gauges				a Area Safety *			
b Carrier Frame and Rotate Base *				b Diesel Engine and Generator *				b Indicator and Warning Lights				b Outriggers and Stabilizers *			
c General Hardware				c Leaks				c Visibility *				c Unusual Noises			
d Wire Rope *				d Lubrication				d Load Rating Charts *				d Control Action *			
e Reeving *				e Battery				e List/Trim Indicator (Floating Cranes) *				e Wire Rope or Chain *			
f Block *				f Lights				f Boom Angle/Radius Indicator *				f Brakes and Clutches *			
g Hook *				g Glass				g Fire Extinguisher *				g Boom Angle/Radius Indicator *			
h Sheaves or Sprockets *				h Clutches and Brakes *				h Level Indicator (Mobile Cranes) *				h Limit Switches *			
i Boom and Jib *				i Electric Motors *				i Danger/Caution Tags *				i Emergency Stop *			
j Gantry, Pendants, and Boom Stops *				j Auxiliary Engine and Compressor								j Other Operational Safety Devices *			
k Walkways, Ladders, and Handrails				k Danger/Caution Tags *								k General Safety Devices			
l Windlocks, Stops, and Bumpers				l Fire Extinguishers								l Fleeting Sheaves			
m Tires, Wheels and Tracks				m Hoist Drum Pawls and Rachets *											
n Leaks															
o Outriggers and Stabilizers *															
p Load Chain *															
q Area Safety *															

INSTRUCTIONS - Check all applicable items indicated, each shift. Suspend all operations immediately when observing an unsatisfactory condition of any item indicated with an asterisk (*) unless the condition has been reviewed and continued operation has been authorized by the activity engineering organization. In addition, suspend operation when any unsafe condition is observed and immediately notify supervisor. For any unsatisfactory item, identify the specific component and describe the deficiency in the "Remarks" block.

SUPERVISOR'S SIGNATURE / DATE

FIRST OPERATOR'S SIGNATURE / DATE	OPERATOR'S SIGNATURE / DATE	OPERATOR'S SIGNATURE / DATE	OPERATOR'S SIGNATURE / DATE

REMARKS

- Mark each item:
  - S = Sat
  - U = Unsat
  - NA = not applicable
- Sign card
- Turn in daily

Knowledge Check

1. Select the best answer. On the ODCL, critical components are identified by _____.

   A. Letter color: red for critical – yellow for cautionary
   B. Bold letters
   C. Ampersand (&)
   D. Asterisks (*)

2. Select the best answer. Critical components must be carefully examined during the ODCL. Which of the following are considered critical components?

   A. Emergency Stop button
   B. Windlocks, Stops and Bumpers
   C. Batteries

3. Select the best answer. If you discover a load bearing part, load controlling part or operational safety device that is unsatisfactory, you should:

   A. Stop, secure the crane and notify your supervisor
   B. Report the situation to crane maintenance
   C. Report the situation to crane inspection
   D. Resolve the situation before continuing

4. Select the best answer. Whether a critical component or not – any unsatisfactory conditions must be:

   A. Described in the “Remarks” block of the ODCL worksheet
   B. Delivered to maintenance and engineering for action

5. Select the best answer. Each item on the ODCL shall be marked:

   A. Correct, incorrect, not applicable
   B. Stable, unstable, or not applicable
   C. Serviceable, unserviceable, or not applicable
   D. Satisfactory, unsatisfactory, or not applicable

6. Select the best answer. What is the purpose of a hoist limit switch?

   A. To cause the operator to slow down
   B. To cut off power to the crane when contacted
   C. To prevent over-travel of the hook block and the possibility of two-blocking
   D. To prevent rotation of the hook

7. Select the best answer. Which of the following tags prohibits operation of equipment when its operation could jeopardize the safety of personnel or endanger equipment?

   A. Danger tag
   B. Lockout tag
   C. Out of Service tag
   D. Caution tag

8. Select the best answer. Who can remove a danger, caution, or lockout tag?

   A. The building custodian
   B. The crane operator
   C. All crane maintenance personnel
   D. The person who attached the tag or his or her supervisor when they are not available

Walk Around Check

This is a sample walk around check section from an ODCL.
Begin this check by walking around the crane and the job site, observing anything that is out of order or out of place as well as any potential hazards or interference.

1	WALK AROUND CHECK	S	U	NA
a	Safety Guards and Plates			
b	Carrier Frame and Rotate Base *			
c	General Hardware			
d	Wire Rope *			
e	Reeving *			
f	Block *			
g	Hook *			
h	Sheaves or Sprockets *			
i	Boom and Jib *			
j	Gantry, Pendants, and Boom Stops *			
k	Walkways, Ladders, and Handrails			
l	Windlocks, Stops, and Bumpers			
m	Tires, Wheels and Tracks			
n	Leaks			
o	Outriggers and Stabilizers *			
p	Load Chain *			
q	Area Safety *			

Safety Guards and Plates

Check for missing safety guards and plates.

General Hardware

As you walk around the crane look for missing and loose hardware such as nuts, bolts, brackets and fittings.

Wire Rope and Reeving

Visually check wire rope for unusual wear, fraying, birdcaging, corrosion, and kinking. Check end connections, where visible, for proper configuration, seating, and condition of wire rope.
Visually check the condition of wire rope or load chain reeving.
Ensure wire rope or load chain is running true in the hook block and boom point sheaves, and laying correctly on the drum or sprockets

Block and Hook

Visually check the condition of the block and ensure all swivels rotate freely.
Check the condition of the hook for cracks, excessive throat opening, or twist. If rigging gear is on the hook and cannot be easily removed, check the hook to the maximum extent possible without removing rigging gear.

Sheaves or Sprockets

Check, where practical, the condition of sheaves or sprockets to determine that they are free to rotate and are not cracked or chipped.

Walkways, Ladders, Handrails

Check the condition of walkways, ladders, and handrails for loose mountings, cracks, excessive rust, loose rungs, or any other signs of unsafe conditions.
Ensure safety chains and gates are functional.

Stops and Bumpers

Check stops and bumpers on the crane for cracks or other damage.

Wheels and Tracks

Check wheels to ensure they are not loose or damaged.
On track machines, look for excessive slack, broken or loose pads, or any other obvious defects.

Leaks

Check for evidence on the crane and on the ground beneath the crane, of any leakage of fuel, lubricating oil, hydraulic fluid, or engine coolant.

Load Chain

Check for damaged or deteriorated links.

Area Safety

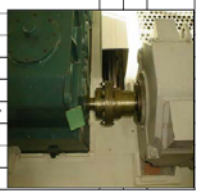
Check the work area and ensure that the exact locations of obstacles or hazards are known.
Ensure ground conditions are sufficiently firm to support a loaded crane.
Verify temporary connections are removed or cleared for operation (e.g., temporary shore power or hotel power).

Machinery House Check

This graphic represents the machinery check section of a typical ODCL.

Machinery House Check

2	MACHINERY HOUSE CHECK	S	U	NA
a	Housekeeping	✓		
b	Diesel Engine and Generator *	✓		
c	Leaks			
d	Lubrication			
e	Battery			
f	Lights			
g	Glass			
h	Clutches and Brakes *			
i	Electric Motors *			
j	Auxiliary Engine and Compressor			
k	Danger/Caution Tags *			
l	Fire Extinguishers			
m	Hoist Drum Pawls and Ratchets *			

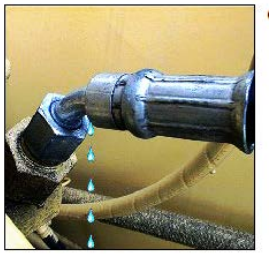


Housekeeping

Check to ensure that the machinery house and accesses are clean.
The crane operator is responsible for the cleanliness and housekeeping of the crane.
Ensure tools and authorized materials are properly stored and that waste and debris are removed.

Leaks

Inspect for excessive grease on machinery.
Look for hydraulic brake fluid leaks around brake linings and cylinders.
Check for lubricating oil leaks around gear cases.
If they appear to be more than normal seepage, report the condition to your supervisor.



Lubrication

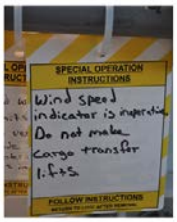
Check gear cases for lubricant level and evidence of over or under lubrication of crane components.

Clutches and Brakes

Check accessible portions of clutches and brakes for evidence of excessive heat, wear, or grease and oil on the linings. Check for evidence of loose fasteners and for missing or broken parts.
If a brake is equipped with a manual release mechanism, check to ensure the mechanism is not in the released position.

Electric Motors

Check all motors for evidence of loose fasteners, oil or grease splashes, and any indications of overheating.



Danger/Caution Tags

If danger or caution tags are posted, read, understand, and follow the directions on the tags.
Check the appropriate ODCL column as follows: "S" - all tags are properly hung: "U" - tags improperly hung or otherwise deficient: "NA" - no tags.

Fire Extinguishers

Ensure fire extinguishers are in place, seals are unbroken, and inspection tags are up to date.

Knowledge Check

1. Select the best answer. Discoloration of the brake drum is usually caused by:

   A. Overloading the crane
   B. Overheating
   C. Lubrication
   D. Normal operations

2. Select the best answer. During inspection, cracked or flaking paint may indicate:

   A. Latex paint over alkyd primer
   B. Structural damage or loose bolts
   C. Poor quality paint
   D. Aluminum paint on steel components

Operator's Cab Check

This is a typical Operator's Cab Check section from an ODCL.
The operator should enter the cab and ensure all controls are in the neutral or off position prior to starting the engine.
Start the engine and check the items in the Operator Cab Check section.

3 OPERATOR CAB CHECK				
		S	U	NA
a	Gauges		✓	
b	Indicator and Warning Lights	✓		
c	Visibility *	✓		
d	Load Rating Charts *	✓		
e	List/Trim Indicator (Floating Cranes) *			
f	Boom Angle/Radius Indicator *			
g	Fire Extinguisher			
h	Level Indicator (Mobile Cranes) *			
o	Danger/Caution Tags *			

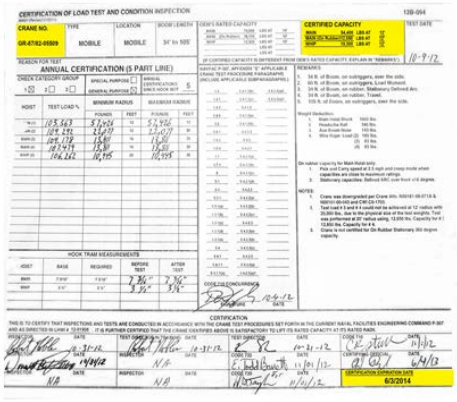
Gauges, Indicator and Warning Lights

Check gauges to ensure none are broken or missing and that they are operating normally.
Check indicator and warning lights to ensure none are broken or missing and that applicable indicator and warning lights are lit.

Visibility

Check visibility to ensure that all windows and mirrors are clean, unbroken, and that any vandal guards have been removed from windows.

Load Rating Charts



Ensure that the load rating charts are posted in the operator's cab and that they are legible.
Verify that the crane number is correct, the certification expiration date is not expired, and the crane capacity is listed.
The two expiration dates that are of particular importance to all crane operators are the expiration date of the certification of the crane being operated, and the expiration date of the operator's license. The operator cannot operate a crane if his or her license is expired, and a crane may not be operated to perform production lifts if the crane certification is expired.

Fire Extinguishers

Ensure fire extinguishers are in place, seals are unbroken, and inspection tags are up to date.

Danger/Caution Tags

If danger or caution tags are posted, read, understand, and follow the directions on the tags.
Check the appropriate ODCL column as follows: "S" - all tags are properly hung: "U" - tags improperly hung or otherwise deficient: "NA" - no tags.

Operational Check

The final check before placing the crane in service is the “No Load" operational check.
When possible, the no load operational check shall be conducted away from personnel and any hazardous surroundings.
A qualified rigger, if present during the operational check, should control access, observe crane operation, and report any unusual noises or other indications of unsafe conditions to the crane operator.

4	OPERATIONAL CHECK	S	U	NA
a	Area Safety *	✓		
b	Outriggers and Stabilizers *	✓		
c	Unusual Noises			
d	Control Action *			
e	Wire Rope or Chain *			
f	Brakes and Clutches *			
g	Boom Angle / Radius Indicator *			
h	Limit Switches *			
i	Emergency Stop *			
j	Other Operational Safety Devices *			
k	General Safety Devices			
l	Fleeting Sheaves			

When performing the operational check portion of the ODCL in cold weather or icy conditions, the operator should raise the blocks and boom before lowering them to avoid damage when sheaves may be frozen.
Operators should inform rigging personnel to stand clear of the area below the blocks and boom prior to operation.
The operator should hoist up slowly, in small increments, to break any ice and/or snow free, and monitor the sheaves to ensure proper movement and operation of the sheaves and wire rope.

Area Safety

Check the work area and ensure that the exact locations of obstacles or hazards are known.

Unusual Noises

After starting the engine, be alert for unusual noises, fluid leaks, improper functioning, incorrect readings of gauges, and loss of power or bad response to control of the engine or motors.

Control Action

Check controls through a range sufficient to ensure that they operate freely and that the corresponding component actuates properly when controls are activated.
Check hoist controls through the full speed range.

Wire Rope or Chain

Check for proper paying-out of the wire rope or chain, that the wire rope or chain and hook blocks do not twist/spin, and that the wire rope or chain is running freely through the sheaves or sprockets and blocks.
If the boom and hoist drums or load sprocket are visible from the operator's station, check for proper spooling of the wire rope on/off the drum or chain on/off the load sprocket.

After lowering the hooks and the boom for limit switch tests and hook inspections, observe sections of wire rope or chain that may not be visible during the walk around check.

Brakes and Clutches

Check brake and clutch actions and ensure they are functioning normally and that there is no slippage, excessive play, or binding. Exercise brakes and clutches to ensure they are dry.

Limit Switches

Checking of limit switches shall be performed at slow speed and include each upper hook hoist primary limit switch and the upper and lower boom hoist primary limit switches. (Verifying the operation of the upper and lower boom hoist limit switches is required only during the initial check of the crane each day.) Checking of hook hoist lower limit switches is not required if the hook can be lowered to its lowest possible position (e.g., bottom of drydock being worked at minimum radius) while still maintaining a minimum of two wraps of rope on the hoist drum (three wraps for ungrooved drums).

For cranes that do not have the requisite number of wraps, the hook hoist lower limit switch shall be checked where operationally possible, i.e., if the crane is at a location where the limit switch can be checked (where the lower limit switch is not checked during the pre-use check, it shall be checked if the crane is subsequently relocated to a position where it can be checked).

For cranes without hoist upper limit switches, do not check hoist overload clutches if so equipped. (See NAVFAC P-307, section 10 for specific precautions for these hoists.)

Checking of secondary limit switches is not required unless a specific operation is planned where the primary limit switch will be bypassed.

Emergency Stop

Check the emergency stop or power-off button. Know its location and ensure it is working properly. If the emergency stop is checked while a motion is in operation, check at the slowest possible speed. Note: This is not applicable to diesel engine shutdowns on portal and floating cranes.

Other Operational Safety Devices

Check any other operational safety devices as directed by the activity engineering organization. An example would be deadman controls.

These pictures show two types of deadman controls. A foot switch and a push-button thumb switch on top of the controller.

General Safety Devices

Check general safety devices such as sirens, horns, and travel alarms for proper operation.

Knowledge Check

1. Select the best answer. The crane number, certification expiration date and certified capacity are found:

   A. In the EOM
   B. In the operator's manual
   C. Posted on the crane
   D. Posted in the crane maintenance area
   E. In the load lift review

2. Select the best answer. Dead man controls refer to controllers that automatically …

   A. Change operational speeds to suit conditions
   B. Push your hand away from the handle when the crane stops
   C. Compensates for slow operator response
   D. Stop operations when released

3. Select the best answer. If you observe a red tag on a piece of equipment, you should:

   A. Remove the tag and continue operations
   B. Fix the problem and operate the equipment
   C. Verify the tag was from previous work
   D. Under no circumstances operate this piece of equipment
   E. Review the special instructions and operate accordingly

4. Select the best answer. If you observe a yellow tag on a piece of equipment, you should:

   A. Review the special instructions and operate accordingly
   B. Under no circumstances operate this piece of equipment
   C. Remove the tag and continue operations
   D. Fix the problem and operate the equipment
   E. Verify the tag was from previous work

Summary

Performing a thorough and complete pre-operational crane check is the first step toward safe and reliable crane operations.
The ODCL identifies unsafe conditions and enhances crane reliability.

It verifies proper operation of the crane and is conducted once each day.
The ODCL is reviewed by subsequent operators.
The operational check is required once per shift.
The ODCL is separated in to four sections, the walk around check, machinery house check, operator's cab check and the no-load operational check.

NOTES

COMPLEX AND NON-COMPLEX LIFTS

Welcome
Welcome to the complex and non-complex lifts module.

Objectives
Upon successful completion of this module you will be able to define complex and non-complex lifts, identify complex lifts, and state complex lift requirements.

Non-Complex Lifts
Non-complex lifts are ordinary in nature, do not require direct supervisory oversight, and are made at the discretion of the rigger in charge.

Complex Lifts Overview
Complex lifts have a moderate to high level of risk.
Activities are required to identify complex lifts and prepare detailed written procedures for their execution.
Procedures may be in the form of standard instructions or detailed procedures specific to a lift.

Complex Lift Categories
Complex lifts include: hazardous materials,
large and complex geometric shapes, lifts of personnel, lifts exceeding 80 percent of the capacity of the crane's hoist and lifts exceeding 50 percent of the hoist capacity for a mobile crane mounted on a barge (Excluded from this rule are lifts with jib cranes, pillar jib cranes, fixed overhead hoists, and monorails, and lifts of test weights during maintenance or testing when directed by a qualified load test director), lifts of submerged or partially submerged objects, multiple crane or multiple hook lifts on the same crane, lifts of unusually expensive or one-of-a-kind equipment or components, lifts of constrained or potentially constrained loads (a binding condition), and other lifts involving non-routine operations, difficult operations, sensitive equipment, or unusual safety risks.

Complex Lift Procedures
Activities shall identify complex lifts and prepare procedures (including rigging sketches where required) for conducting these lifts. Procedures may be standard written instructions or detailed procedures specific to a lift.
A supervisor or working leader must review on-site conditions and conduct a pre-job briefing for all complex lifts.
A supervisor or working leader must supervise lifts over 80% (except for category 3 cranes), multiple hook lifts when the weight exceeds 80% of any hoist, and lifts of ordnance involving the use of tilt fixtures.
If the lifts are repetitive in nature, supervisors must be present during the first complex lift evolution with each team.
Subsequent identical lifts by the same crew may be done under the guidance of the rigger-in-charge.

Complex Lift Exceptions

Exceptions to the complex lift requirements include lifts over 80% of capacity made with jib cranes, pillar jib cranes, fixed overhead hoists, and monorail cranes. These cranes are usually smaller capacity cranes used primarily to service only one workstation, machine or area.

Lifts of test weights during maintenance or load test are excluded from the complex lift requirements.

Ordnance lifts covered by NAVSEA OP 5 in lieu of the NAVFAC P-307 are also excluded; except for lifts using tilt fixtures, lifts where binding may occur, lifts of submerged loads, multiple crane or multiple hook lifts.

Knowledge Check

1. Select the best answer. Detailed written procedures are required for:

   A. All lifts
   B. Complex lifts
   C. Some lifts
   D. Non-complex lifts

2. Select the best answer. For all complex lifts, a supervisor or working leader must review on-site conditions and …

   A. Inspect all rigging gear
   B. Select rigging gear
   C. Define the crane operating envelope
   D. Conduct a pre-job briefing

3. Select the best answer. Lifts of test weights dring maintenance or load test are …

   A. Evaluated according to the complex lift requirements
   B. Included in the complex lift requirements
   C. Excluded from the complex lift requirements
   D. Routine lifts because they are not complex shapes

4. Select the best answer. A crane with a capacity of 100,000 pounds is performing a lift of 40,000 pounds. This is a(n):

   A. Overload lift
   B. Non-complex lift
   C. Complex lift
   D. Hazardous lift

Complex Lift Examples

Hazardous Materials

Lifting hazardous materials with a crane is a complex lift.

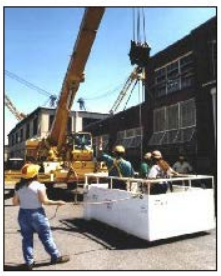
Materials such as oxygen, acetylene, propane or gasoline in bottles, cans or tanks that are properly secured in racks designed for lifting by a crane are **excluded.**

Large and Complex Shapes

Complex lifts also include large and complex shapes.

For example, objects with large sail area that may be affected by winds, objects with attachment points at different levels requiring different length slings, and odd shaped objects where the center of gravity is difficult to determine.

Personnel Lifts



Use cranes for lifting personnel only when no safer method is available.
Cranes, rigging gear and personnel platforms shall conform to OSHA requirements: 29 CFR Part 1926.1431 and ASME B30.23.
The total weight of the loaded personnel platform and rigging shall not exceed 50% of the rated capacity of the hoist.
A trial lift with at least the anticipated weight of all personnel and equipment to be lifted shall be performed immediately before placing personnel in the platform.
A proof test of 125% of the rated capacity of the platform must be held for 5 minutes. This may be done in conjunction with the trial lift.
A body harness and shock absorbing lanyard shall be worn and attached to a structural member within the personnel platform capable of supporting the impact from a fall. The harness and anchorage system shall conform to OSHA requirements.
Tag lines shall be used unless their use creates an unsafe condition.
Hoisting of the personnel platform shall be performed in a slow, controlled, cautious manner with no sudden movements of the crane.
Personnel shall keep all parts of the body inside the platform during raising, lowering, and positioning.
Before personnel exit or enter a hoisted platform that is not landed, the platform shall be secured to the structure where the work is to be performed, unless securing to the structure creates an unsafe situation.

Lifts over 80% of capacity

Lifts exceeding 80% of the capacity of the hoist are considered complex lifts.
Use a larger capacity hoist if possible to avoid exceeding 80% of capacity.

Knowledge Check

1. Select the best answer. Which of the following identify the two basic categories of crane lifts?

   A. Usual and unusual
   B. Complex and non-complex
   C. Critical and non-critical
   D. Common and non-common
   E. None of these

2. Select the best answer. Personnel lifts are …

   A. Not considered complex if personal protective gear is worn
   B. Considered complex only under special conditions
   C. Always considered complex lifts
   D. Not considered complex if personnel lifting devices are used

3. Select the best answer. Personnel in a man-lift platform or basket must …

   A. Wear aircraft reflective tape on their hard hat
   B. Wear a full body harness with a shock-absorbing lanyard
   C. Stand with knees bent to absorb motion shock
   D. Wear a safety belt with a shock-absorbing lanyard

4. Select the best answer. For personnel lifts, the total load must not exceed …

   A. The load chart capacity
   B. 80% of the hook capacity
   C. 50% of the hook capacity
   D. The gross capacity if designated as a complex lift

Summary

There are two types of lifts, complex and non-complex.
Complex lifts have a moderate to high level of risk involved.
All complex lifts require preplanning, written procedures and supervisory oversight.
Complex lift exceptions include: lifts by certain smaller cranes used primarily to service only one work area, cranes designed for simultaneous lifting, load tests, and ordnance lifts covered by NAVSEA OP-5; except for lifts exceeding 80 percent of the capacity of the crane's hoist, lifts using tilt fixtures, lifts where binding may occur, lifts of submerged loads, and multiple crane or multiple hook lifts.

NOTES

CRANE COMMUNICATIONS

Welcome
Welcome to Crane Communications.

Learning Objectives
Upon successful completion of this module you will be able to describe the communication methods used during crane operations at Navy facilities including: hand signals, radio communications and direct voice.

Crane Communication Methods
Standard hand signals provide a universal language, understood by everyone involved with weight handling; consequently, they are the most common method used in crane operations.
When presented properly, standard hand signals help prevent miscommunication and play a very important part in safe crane operations.
When making lifts where hand signals are not feasible (such as when the operator cannot see the signal person), the rigger giving the signals shall remain in constant voice communication with the operator. The operator shall stop the crane at any time and in any situation judged to be unsafe or when communication is lost or unclear. If communication is lost, the operator shall stop operation until communication is reestablished.
In addition, the operator shall immediately respond to a direction from any person to stop the crane.
Radio communications are well suited for blind and complex lifts.
As a general rule, direct voice should only be used when the operator and rigger are working in close proximity and ambient noise is not a factor.

Hand Signals

Hand signals are the most widely used method of communication between signa and crane operators.
Hand signals like those found in the American Society of Mechanical Engineers A.S.M.E. B30 standards must be posted in the crane in clear view of the operato
Your activity may approve local signals in addition to these standard signals.

Hand Signal Rules
Signalers must remain in clear view of the crane operator.
If the crane operator can't see you, another method of communication must be used.
Only one signaler communicates with the crane operator at a time.

Radio Communications
Radios can be used to direct crane lifts while keeping crane team members informed of the lift status.
Radio guidelines
The device, or devices, used shall be tested on-site prior to crane operations. Use an isolated channel and clear the line of other traffic. Limit background noise. The operator's reception of signals shall be by a hands-free system

Radio work practices

Voice directions given to the operator shall be given from the operator's directional perspective. Identify the crane and yourself. Each voice signal shall contain the following elements, given in the following order: function (such as hoist, boom), direction; distance and/or speed; function, stop command. Allow time between commands. Verify the command

Note: The operator shall stop the crane at any time and in any situation judged to be unsafe or when communication is lost or unclear. In addition, the operator shall immediately respond to a direction from any person to stop the crane.

Knowledge Check

1. Select the best answer. Direct vboice should only be used when:

   A. No other form of communication is available and ambient noise is high
   B. The operator and rigger are working in close proximity and ambient noise is low
   C. The rigger has not learned hand signals
   D. The operator and the rigger are working in close proximity and ambient noise is high

2. Select the best answer. In the crane cab, the crane operator must have a clear view of the …

   A. Crane lift history
   B. EOM
   C. ASME Hand Signal Chart
   D. Crane maintenance records

3. Select the best answer. For multiple crane lifts, _____ will communicate with the crane operators.

   A. One signaler at a time
   B. No signalers unless directed by the rigger-in-charge
   C. One signaler for each crane involved
   D. Up to three signalers

4. Select the best answer. A universal language understood by everyone involved with weight handling is:

   A. Signal flags
   B. Hand signals
   C. Direct voice commands
   D. Spoken word

5. Select the best answer. Any additional hand signals must be …

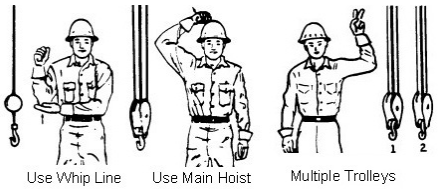
   A. Approved by the activity
   B. Approved by the ASME
   C. Approved by OSHA
   D. Approved by NIOSH

6. Select the best answer. Another form of communication, other than hand signals, must be used if …

   A. The signaler is not in clear view of the crane operator
   B. Ambient noise is greater than the lack of visibility
   C. Activities designate alternative methods
   D. The signaler is in clear view of the rigger-in-charge

Hook and Trolley Signals

These signals indicate which hook or trolley to use and are used in operating signals.



Whip Line or Auxiliary Hook

When calling for the whip line or auxiliary hoist:
the elbow is tapped with the opposite hand and followed with the appropriate hook movement signal.

Main Hoist

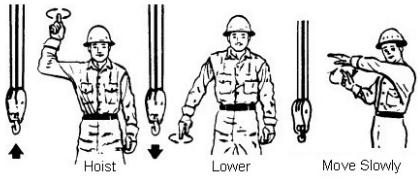
When calling for the main hoist, the signaler:
taps a fist on his or her hard hat and follows with the appropriate hook movement signal.

Multiple Hooks/Trolleys

When working with a multiple trolley crane, these signals indicate which trolley to use.
They are always followed by movement signals.

Hoist Signals

Hoist and lower signals are the same for all cranes.
The distinct circular motion helps the operator see the signal clearly from greater distances and helps distinguish them from other signals.



Hoist

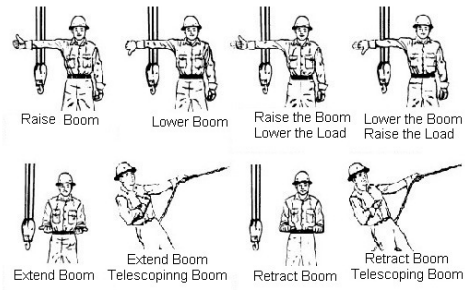
The hoist signal is given with the forearm vertical, the index finger pointing up, and the hand moving in small horizontal circles.

Lower

The lower signal is given with the arm extended downward, the index finger pointed down and the hand moving in small horizontal circles.

Hoist/Move Slowly

A hand held motionless in front of any signal indicates to move slowly.
In this clip the rigger is signaling to hoist slowly.



Boom Signals

Boom signals direct the operator to raise and lower or to extend and retract the boom.
Combination boom and hoist signals allow the load to remain at the same height while booming up or down.

Raise the Boom

The signal to raise the boom, or boom up, is given with an extended arm, fingers closed and thumb pointing upward.

Lower Boom

The signal to lower the boom, or boom down, is given with an extended arm, fingers closed and thumb pointing downward.

Raise Boom/Lower Load

The signal to raise the boom and lower the load is given with an extended arm, thumb pointing upward and fingers flexing in and out.

Lower Boom/Raise Load

The signal to lower the boom and raise the load is given with an extended arm, thumb pointing downward and fingers flexing in and out.

Extend

The signal to extend the boom is made with both fists in front of the body and thumbs pointing outward away from each other.

Extend One Handed

The one handed extend signal is made with one fist in front of the chest and the thumb pointing inward with a tapping motion.

Retract

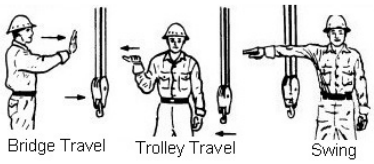
The signal to retract the boom is made with both fists in front of the body and thumbs pointing toward each other.

Retract One Handed

The one handed retract signal is made with one fist in front of the chest, and the thumb pointing outward, with a tapping motion.

Directional Signals

Directional signals are used to guide horizontal crane movements such as bridge, trolley and swing.



Travel

The signal for crane or bridge travel is made with an extended arm, hand open with palm facing outward, and the hand moving horizontally in the desired direction of travel.

Trolley

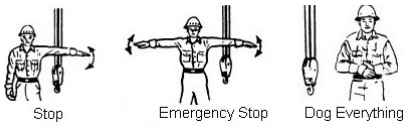
The signal for trolley travel is made with a palm up and fingers closed and the thumb moving in the desired direction of travel.

Swing

The signal for swing or rotate is an extended arm with the index pointed in the desired direction of rotation.

Signals for Stopping Crane Movements

Stop and emergency stop signals can be given by anyone.
When these signals are given, the operator must stop operations as quickly and as safely as possible.
The dog everything signal is used when all operations must be secured.



Stop

The stop signal is an extended arm, palm down, moving back and forth horizontally.

Emergency Stop

The signal for an emergency stop is both arms extended with palms down, moving them back and forth horizontally.

Dog Everything

The signal to dog everything is clasped hands in front of the body.

Magnet Signals Overview

Magnet signals are used to communicate the current status of the magnet - whether it is on or off.

Magnet Disconnected

The magnet disconnect signal is used to let the person on the ground know that the electricity has been secured and it is safe to disconnect the magnet from the crane.

The magnet disconnected signal is given with both arms extended, palms up and fingers open.

Knowledge Check

1. Select the best answer. This signal indicates:

   A. Main hoist
   B. Auxiliary hoist
   C. Travel
   D. Raise hoist

2. Select the best answer. When the signalers fingers are flexing in and out, this signal indicates:

   A. Lower the hoist
   B. Stop activities
   C. Lower the boom
   D. Raise the load – lower the boom

3. Select the best answer. This signal indicates to:

   A. Raise the load
   B. Extend the boom
   C. Stop
   D. Forward

4. Select the best answer. This signal indicates to:

   A. Retract the boom
   B. Move closer
   C. Separate the load
   D. Lower the load

5. Select the best answer. This signal indicates:

   A. Travel back
   B. Swing
   C. Stop
   D. Emergency stop

6. Select the best answer. This signal indicates:

   A. Stop
   B. Swing
   C. Magnet disconnect
   D. Emergency Stop

7. Select the best answer. This signal, given by the operator, indicates:

   A. Magnet disconnected
   B. Emergency stop

8. Select the best answer. This signal indicates:

   A. Retract boom
   B. Emergency stop
   C. Lower load
   D. Dog everything

Summary

In order for communications to be effective, they must be clear, concise, continuous, and understood by the crane team.
Hand signals are the primary means of communication between signalers and operators.
Radios are preferred for complex and blind lifts.
Voice communication should only be used in close proximity and where ambient noise is not a problem.

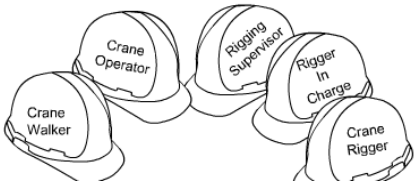
NOTES

CRANE TEAM CONCEPT

Welcome
Welcome to Crane Team Concept.

Learning Objectives
Upon successful completion of this module you will be able to explain the crane team concept, define how a crane team is organized, and understand the roles and responsibilities of each team member.

Crane Team Concept
The crane team concept was developed to help ensure that crane operations are executed without injury to personnel, and without damage to property or equipment. To accomplish this goal, the crane team works together to identify and eliminate obstacles to safety.

Crane Team Members


The basic crane team consists of the crane operator and the rigger-in-charge.
The supervisor may assign other personnel as required.
Additional members may include crane riggers, and a crane walker.
The rigging supervisor assigns the crane team members depending on the complexity and scope of work.
Either the rigging supervisor or rigger-in-charge may conduct team briefings.

Knowledge Check

1. Select the best answer. The Crane Team Concept was developed to ensure that all operations involving the crane are executed without:

   A. Injury to personnel
   B. Damage to property
   C. Damage to equipment
   D. All of the above

2. Select the best answer. The minimum Crane Team consists of:

   A. The crane operator, crane supervisor, and crane rigger
   B. The crane operator, crane walker, and crane rigger
   C. The crane operator and rigger-in-charge
   D. The crane operator, rigger supervisor, and crane rigger

3. Select the best answer. Additional crane team members may be assigned by …

   A. The EOM designation
   B. The crane rigger as required
   C. The crane operator as required
   D. The supervisor as required

Shared Responsibilities

While each member of the crane team has individual responsibilities, all team members share some common responsibility, including participation in pre-job briefings, watching for potential problems and making other team members aware of them.
All team members are responsible for keeping non-essential personnel away from the crane's operating envelope during lifting evolutions.

Pre-Job Briefing

A pre-job briefing for complex lifts is **conducted by** the rigging supervisor, operator supervisor or the working leader and shall be **conducted to ensure** that all crane team personnel understand the requirements of the lift.

Communications

Communications during the lift are just as important as the pre-lift brief.
All team members must be made aware of any problems that are discovered.
When making lifts where hand signals are not feasible, the rigger giving the signals shall remain in constant voice communication with the operator. It shall be understood that if the communication ceases, the operator shall stop operation until communication is re-established.

Safety

Stop crane operations before personnel board the crane.
Cranes should be positioned to allow safe boarding.
Stop work if you're unsure about the assigned task or, if you feel safety is in jeopardy.
Have problems resolved before resuming operations.

Crane Operator Responsibilities

The crane operator must ensure that his or her license is not expired, and that the certification of the crane is not expired prior to operation. These are the two expiration dates that are of particular importance to crane operators.
The crane operator is responsible for performing the pre-use check of the crane and the operator's main concern during crane operation is operating safely.
The crane operator must have a full understanding of each lift prior to execution and moves only when directed by the signal person.

Pre-Use Check

When performing the pre-use check of the crane, the operator follows and completes the Operator's Daily Checklist, the ODCL.

Full Understanding of the Lift

Before making a lift, the crane operator must have a full understanding of the lift and how it is to be executed.
The operator must know the exact or estimated load weight, the destination and the capacity of the crane as it is configured.

Stopping Operations

The crane operator must immediately stop operations when the operating envelope is penetrated, if communications are lost during a blind or complex lift, and anytime a stop signal is given by anyone.

Knowledge Check

1. Select the best answer. While the members of the crane team have individual responsibilities, each have joint responsibilities as well. Each member must:

   A. Support the Goal of safe crane operation
   B. Attend the pre-lift briefing. Any new members who replace another team member must be briefed as well.
   C. Keep the rigger-in-charge well informed of conditions affecting personnel or the equipment during lifts.
   D. Keep non-essential personnel out of the operating area
   E. Stop operations whenever safety is in question
   F. Perform all of the listed actions above

2. Select the best answer. Securing the crane envelope is the …

   A. Combined responsibility of the crane operator and the crane supervisor
   B. Combined responsibility of all team members
   C. Sole responsibility of the rigging supervisor
   D. Sole responsibility of the crane operator

3. Select the best answer. Crane operators are responsible for all of the following except:

   A. Lifting and landing all loads safely
   B. Slowing down when signals are unclear
   C. Doing a thorough ODCL inspection
   D. Maintaining communication with the signaler

4. Select the best answer. If you feel safety is in jeopardy during the performance of your task, you should:

   A. Call your supervisor for clarification
   B. Stop work and have the problem resolved
   C. Use the OEM manual to solve the problem
   D. Evaluate the lift plan

5. Select all that apply. The crane operator must immediately stop operations when …

   A. Communications are lost during a blind or complex lift
   B. The weather forecast is not good
   C. Operations have exceeded allowed time
   D. The operating envelope is penetrated
   E. Any time a stop signal is given

Rigger-In-Charge Responsibilities

The rigger-in-charge has overall responsibility for the safety, planning, and control of the lift.
The Rigger-In-Charge ensures that each load is rigged properly and the crane envelope is kept clear.
He or she also signals the crane operator or designates other personnel to provide signals and coordinates the activities of the crane team members.

Lift Planning

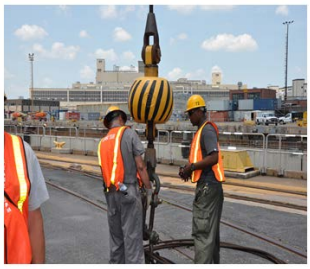
The rigger-in-charge plans all aspects of each lift. He or she determines the load weight and center of gravity of each load and then selects the proper rigging.
Next, the load path is determined and the method of communication is planned.

Crane Rigger Responsibilities

A crane rigger is responsible for carrying out assignments from the rigger-in-charge or the rigging supervisor.
These duties include assisting the crane operator with the pre-use check, selection and inspection of rigging gear, safely rigging the loads and keeping the rigger-in-charge informed.

Assisting with the ODCL

The crane rigger assists the operator in performing the pre-use check of the crane and work area.



Selecting and Inspecting Rigging

The crane rigger selects and inspects crane rigging gear, and establishes proper attachment points as directed by the rigger-in-charge.

Communicating

A crane rigger keeps the rigger-in-charge informed of questionable or unsafe conditions and changes that may affect the operation.

Crane Walker Responsibilities

Often a crane supervisor will assign a crane walker to the crane team. Like the crane rigger, the crane walker is responsible for carrying out the assignments of the rigger-in-charge and the rigging supervisor.

Assisting with the ODCL

A crane walker assists the crane rigger and crane operator in performing the pre-use check of the crane.

Safe Travel of the Crane

The crane walker ensures the crane's travel path is clear by watching for potential obstructions, monitoring portions of the crane such as the gantry, boom, and counterbalance to ensure adequate clearance is maintained, and checking the proper alignment of the crane track switches.

Communicating Stop

Crane walkers stay near the emergency stop button to be in a position to immediately notify the operator to stop operations should a potential problem arise.

Supervisor Responsibilities

The supervisor is familiar with NAVFAC P-307 and supports the crane team concept. The supervisor designates crane team personnel, reviews and inspects site conditions for potential safety problems and complex lifts, reviews procedures for operations near electrical lines, investigates and reports crane accidents, and supports the team anytime they feel they need to stop a lift due to safety concerns.

Site Conditions

The supervisor reviews onsite conditions for all complex lifts.

Operation near Power Lines

The supervisor assesses potential hazards and establishes procedures for safe operations around overhead electrical power lines.

Complex Lifts

A supervisor shall review on-site conditions for complex lifts and perform a pre-job briefing with all crane team personnel. A supervisor shall personally oversee all lifts exceeding 80% of the certified capacity of the crane's hoist (except for lifts using pillar, pillar jib, fixed overhead hoists, or monorail cranes) or 50% for mobile cranes mounted on barges. A supervisor shall also supervise multiple hook lifts when the weight exceeds 80% capacity of any hoist, and lifts of ordnance involving the use of tilt fixtures.

Accidents

The supervisor shall inspect suspected accident scenes, notify appropriate personnel, and ensure that the accident report is filed.

Knowledge Check

1. Select the best answer. If an accident is reported, the preliminary investigation will be performed by the:

   A. Rigger-in-charge
   B. Crane operator
   C. Supervisor
   D. Crane rigger

2. Select the best answer. Planning the lift route is the responsibility of the:

   A. Crane rigger
   B. Crane operator
   C. Crane supervisor
   D. Rigger-in-charge

3. Select the best answer. Coordinating the activities of the crane team is the responsibility of the:

   A. Rigger-in-charge
   B. Crane rigger
   C. Crane operator
   D. Crane supervisor
   E. Activities

Summary

Crane safety is no accident.
Crane safety is the result of effective teamwork among crane operators, riggers and crane walkers.
Remember, the purpose of the crane team concept is to ensure crane operations are accomplished without injury to personnel or damage to property or equipment.

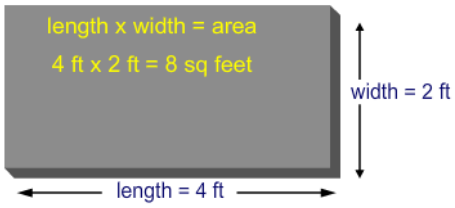
NOTES

RIGGING CONSIDERATIONS

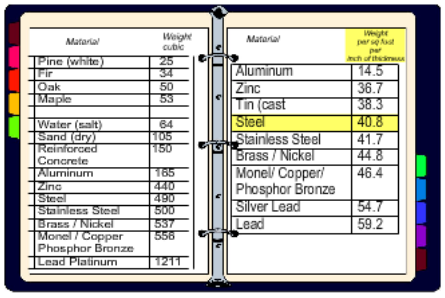
Welcome
Welcome to rigging considerations.

Objectives
Upon successful completion of this module you will be able to calculate weights, identify common rigging gear defects, and explain proper sling attachment. We will also discuss rigging practices, sling angle stress, center of gravity, and hook loading.

Calculating Area
Find the weight of flat objects, such as plates, by first determining the area. Next determine the weight per square foot. Finally, multiply the area by the material weight per square foot. Weight per square foot is often listed by unit of thickness. To calculate the weight of this plate, find the area by multiplying the length by the width, then multiply the area by the material weight per square foot.



length 4 ft
x width 2 ft
Total area = 8 sq ft

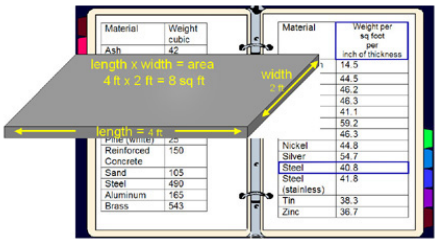


Material	Weight cubic
Pine (white)	25
Fir	34
Oak	50
Maple	53
Water (salt)	64
Sand (dry)	105
Reinforced Concrete	150
Aluminum	165
Zinc	440
Steel	490
Stainless Steel	500
Brass / Nickel	537
Monel / Copper Phosphor Bronze	556
Lead Platinum	1211

Material	Weight per sq foot per inch of thickness
Aluminum	14.5
Zinc	36.7
Tin (cast	38.3
Steel	40.8
Stainless Steel	41.7
Brass / Nickel	44.8
Monel/ Copper/ Phosphor Bronze	46.4
Silver Lead	54.7
Lead	59.2

Standard Weights of Materials
Displayed is a standard chart showing the weights of various materials per square foot, per inch of thickness, and weight per cubic foot.
In this example, we will use the weight per square foot page of the chart.

Object Weight by Area (Sq Feet) and Weight of Materials
To calculate the weight, find the unit weight or weight per square foot for the material. The standard materials weight chart lists steel as weighing 40.8 pounds per square foot. Simplify the math by rounding 40.8 up to 41 pounds. Multiplying 8 square feet by 41 pounds per square foot equals 328 pounds. This plate weighs 328 pounds.



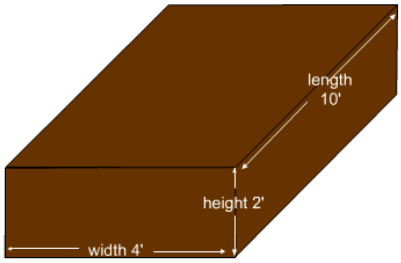
Example - Calculating Load Weight by Area

8 square feet of 1" thick steel plate
x 41 pounds per square foot
328 pound load weight

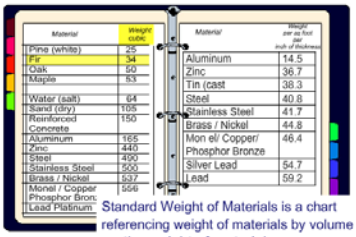
Calculating Load Weight by Volume
Find the weight of three-dimensional objects, such as cubes or cylinders, by first determining the volume. Next find the weight per cubic foot. Finally multiply the volume by the material weight per cubic foot.

Calculating Volume

To find the volume of a square or rectangular shaped three-dimensional object, multiply the length by the width by the height. Volume is always expressed in cubic units, such as cubic feet or cubic yards. In this example we will use cubic feet. Let's calculate the volume of this stack of lumber. The length is 10 feet. The width is 4 feet. The height is 2 feet. By multiplying 10 feet times 4 feet times 2 feet we obtain a volume of 80 cubic feet.



length x width x height = volume
10' x 4' x 2' = 80 cubic ft



Material	Weight cubic
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Maple	53
Water (salt)	64
Sand (dry)	105
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Aluminum	165
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Steel	490
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Material	Weight per sq foot per inch of thickness
Aluminum	14.5
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Steel	40.8
Stainless Steel	41.7
Brass / Nickel	44.8
Mon el/ Copper/ Phosphor Bronze	46.4
Silver Lead	54.7
Lead	59.2

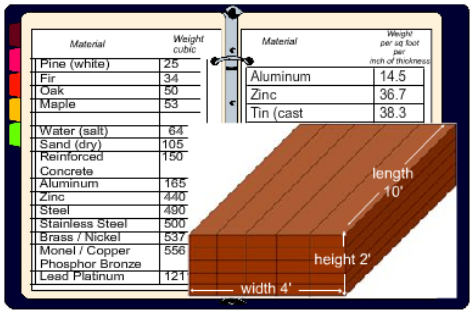
Standard Weight of Materials is a chart referencing weight of materials by volume
- the weight of materials
- per cubic foot

Standard Weight of Materials

This chart shows the weight of various materials per cubic foot. Fir boards for example, weigh 34 pounds per cubic foot.

Load Weight

To calculate the weight, we need to find the unit weight in cubic feet. Using the standard material weight chart, we find that fir lumber weighs 34 pounds per cubic foot. If the weight were listed in fractions or decimals, such as 33.8 pounds per cubic foot, we could simplify the math by rounding 33.8 up to 34 pounds. Multiplying 80 cubic feet by 34 pounds per cubic foot equals 2,720 pounds. This stack of lumber weighs 2,720 pounds.

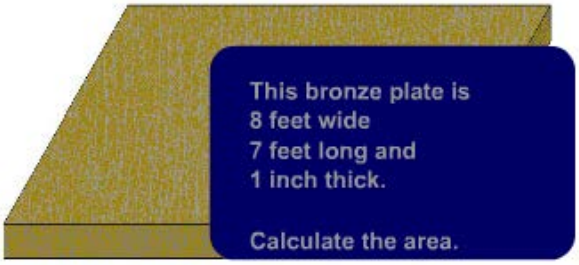


80 cubic ft of fir lumber
x 34 lbs per cubic foot
2,720 lbs

Knowledge Check

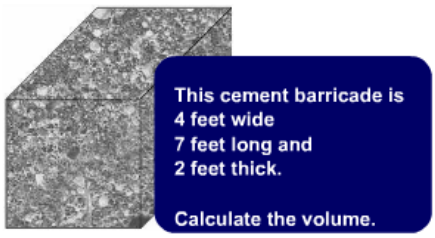
1. Select the best answer.

   A. 15 square feet
   B. 15 cubic feet
   C. 56 square feet
   D. 56 cubic feet



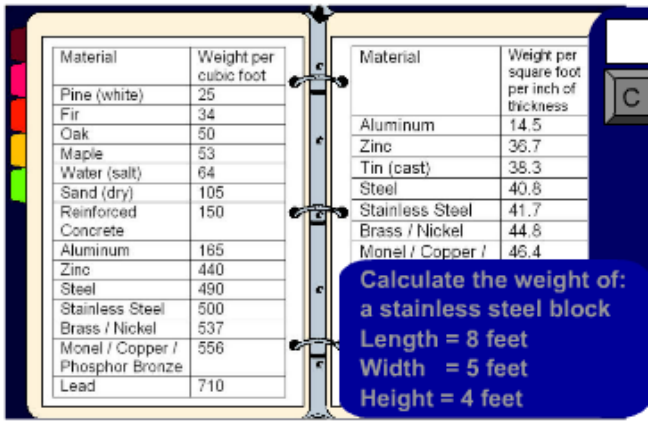
2. Select the best answer.

   A. 56 square feet
   B. 56 cubic feet
   C. 13 square feet
   D. 13 cubic feet



3. Select the best answer.

   A. 8,500 pounds
   B. 6,720 pounds
   C. 714 pounds
   D. 80,000 pounds

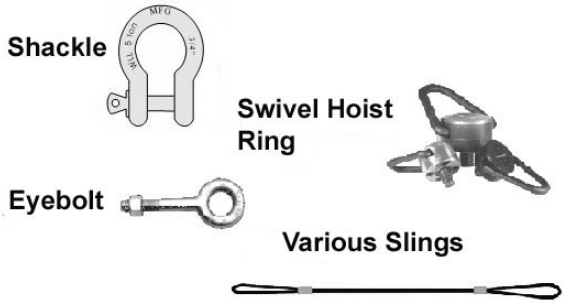


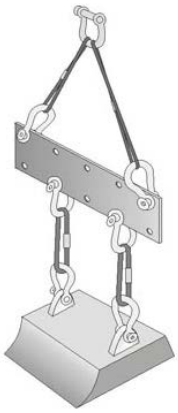
4. Select the best answer. Aluminum weighs 14.5 pounds per square foot per inch of thickness. Which formula expresses the correct weight of a 1 inch thick aluminum plate measuring 10 feet wide by 10 feet long?

   A. 10 X 10 = 100 pounds
   B. 10 X 10 X 14.5 = 1450 pounds
   C. 14.5 X 10 + 14.5 X 10 = 290 pounds
   D. 10 + 10 + 15 = 36 pounds

Common Rigging Gear

Shackles, eyebolts, swivel hoist rings and slings are just a few examples of the common rigging gear you may see at your activity. The most common slings are made from wire rope, chain, synthetic web, and synthetic yarns. Slings made from synthetic yarns are known as roundslings. Remember to add the weight of all rigging gear to the weight of the load to be lifted.





Below-the-Hook Lifting Devices

These are some examples of below-the-hook lifting devices you may use. Add the weight of the below-the-hook lifting devices to the total load weight. Spreader-bars and strong backs add vertical lifting points for the load. Equalizer beams can be used to keep loads level when lifting with two hooks or two cranes

Marking Requirements

All rigging gear used with cranes at Navy facilities must be marked in a manner that clearly identifies the rated load and an indication of inspection due date. A unique serial number traceable to the gear's inspection and test records is also required. It can be marked directly on the item or on tags, as shown in this picture. The terms working load limit, safe working load, rated capacity, and rated load, and their abbreviations are used interchangeably throughout the industry.

Additional Marking Requirements

Rigging gear shall be marked with the name, logo or trademark of the manufacturer (in addition to the rated load and re-inspection due date). Multiple leg sling assemblies must be marked with the rated load of the entire assembly, the rated load of each leg, and the angle that the rating is based on.

The rated load, spool number, and re-inspection due date must be marked on each piece of synthetic rope, synthetic webbing, or wire rope cut from a spool to be used for lashing.

Rigging Gear Inspection

Inspecting rigging gear before each use is just as important as inspecting the crane. Verify the rated load, inspection status, serial number, and condition. Look for wear, corrosion, cracks and distortion. Look for broken wires or kinks when inspecting wire rope slings. Check synthetic slings for cuts, tears or punctures.

Damaged Rigging Gear

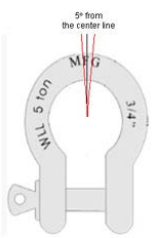
When damage to rigging gear is discovered during an inspection or when damaged rigging gear is returned to the gear room, and an accident is suspected, the gear shall be immediately removed from service and a comprehensive investigation initiated.

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 Gear 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.

Rigging Gear - General Use

Rigging gear is a tool, much like a hammer or screwdriver. We have all heard the phrase "use the right tool for the job." The same applies to rigging gear. **Always** use the proper rigging for the job. **Never** use damaged gear, and never use rigging gear with an expired inspection due date.

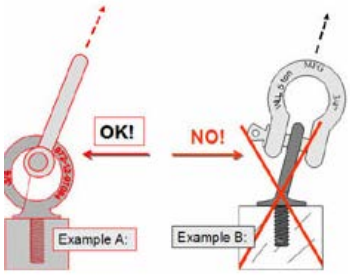


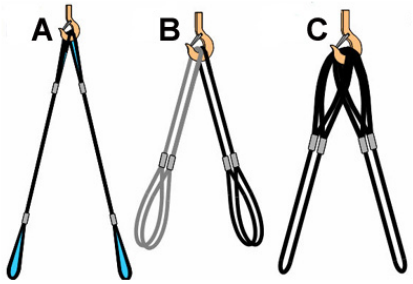
Shackle Use

When the angle of loading is more than 5 degrees from the vertical centerline of a shackle, reduce the rated load according to OEM requirements.
Never side load round-pin shackles.

Shouldered Eyebolt Use

When using shouldered eyebolts, ensure that the shoulder is flush with the mounting surface, and the eye is in the plane of the pull. Example A shows proper eyebolt use. All loads must be in the plane of the eye. Example B illustrates a side pull, which is prohibited. Remember: Angle pulls in the plane of the eye reduce the rated load and only shouldered eyebolts may be angle loaded.



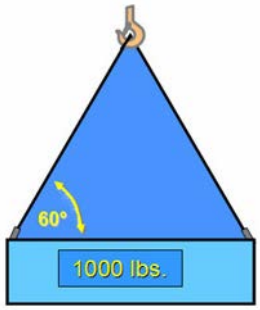


Slings On Hooks

In picture A we see the ideal application of two slings with eyes seated in the bowl of the hook. Picture B shows two slings doubled over the hook with the eyes attached to the load. Picture C shows two slings doubled with the eyes on the hook and the bight attached to the load. When wire rope slings are doubled over and a heavy load is applied, the wires may become permanently deformed or kinked. If slings become kinked, they should not be re-used in vertical applications.

Sling Angles

Sling angle stress must be considered when selecting rigging gear. A sling angle of 60 degrees or more from horizontal is ideal. When the length of each sling is equal to or greater than the distance between the attachment points, you will always have at least a 60 degree angle. In the illustration shown, the load weight is 1,000 pounds and each attachment point carries half of the load weight, or 500 pounds. At a 60 degree sling angle each leg will see 578 pounds of stress. Lower sling angles dramatically increase the load on the slings. A 30 degree sling angle, for example, will double the load on each sling. This can be verified with a dynamometer in-line with each sling.



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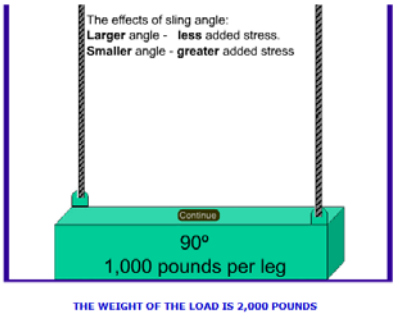

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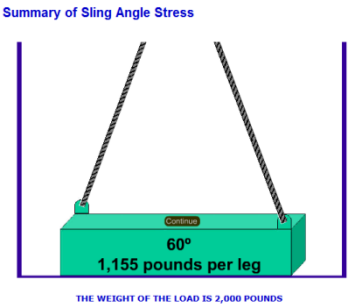
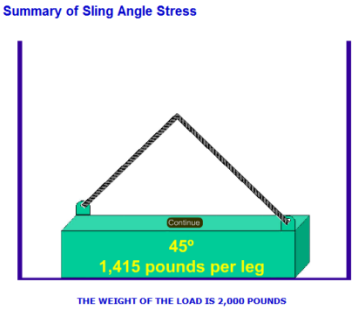
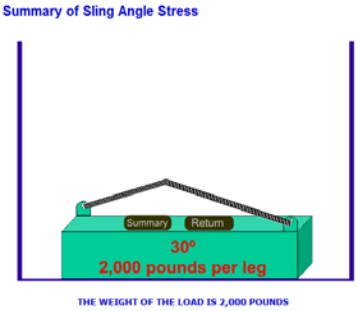
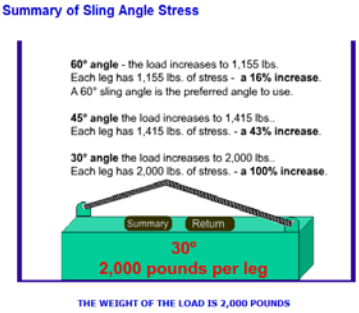


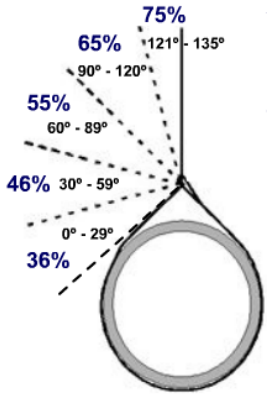






Choker Hitch Efficiency

This chart shows the efficiency of the sling's capacity when choking with a wire rope or synthetic rope sling. Refer to NAVFAC P-307 Table 14-4 for choker efficiencies of other slings.
For angles 121° to 135°, the rated load is reduced to 75% of the vertical capacity (80% for synthetic web and round slings).
This does not apply to braided multi-part wire rope slings.



Synthetic Sling Types

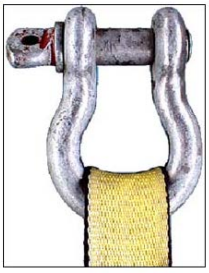
There are three types of synthetic slings, synthetic rope slings, synthetic webbing slings, and synthetic roundslings.
Synthetic slings should be used **only** when they can be protected from damage!
Natural fiber rope slings are **not to be used** for overhead lifting.

Synthetic Sling Use

Synthetic slings cannot be substituted for other slings specified on rigging sketches.
Avoid chemical exposure to synthetic slings and always use chafing gear!
Minimize exposure to sunlight and other sources of ultraviolet light. Store all synthetic slings indoors in a cool dry place.
And, always follow OEM recommendations when using synthetic slings.

Web Sling Use

Synthetic webbing slings shall be used in accordance with OEM recommendations.
Where a synthetic webbing sling is used in a choker hitch, the total capacity shall be reduced to reflect the efficiency percentages shown in table 14-4 of NAVFAC P-307.
Web slings must be installed flat around the load without kinks or twists.
Kinks and twists reduce friction on the load and can cause the sling to roll or slide out of position.
These slings are not affected by D-to-d ratio.
Eye length in relation to the diameter of the hook is critical.
The eyes of webbing slings are stitched and the stitching can be damaged if the eye is spread excessively.



Web Slings and Shackles

Shackles used with synthetic web slings must allow the sling to lay relatively flat without excessive curling of the edges.
Curling causes uneven loading of the sling.
Slight curling, however, is acceptable.

Web Sling Temperature Restrictions

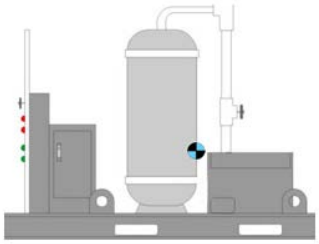
Do not use synthetic web slings at temperatures above 194° Fahrenheit or OEM recommendations, whichever is more restrictive.

Synthetic Rope Sling Use

Stranded synthetic rope slings shall not be used in a single part vertical hitch, unless a method is used to prevent unlaying of the rope.
When making single point lifts with eye and eye synthetic rope slings, use two slings or double up a single sling.
If they are allowed to spin, the splice could come undone and drop the load!
The minimum D-to-d ratio is 1 to 1.
This means a one half-inch diameter synthetic rope sling cannot bend around any object that is smaller than one half-inch.

Rope Sling Temperature Restrictions

Nylon and polyester slings shall not be exposed to temperatures exceeding 194 degrees Fahrenheit (140 degrees Fahrenheit for polypropylene slings) or OEM recommendations, whichever is more restrictive.



Center of Gravity

The location of the center of gravity must be determined prior to rigging loads. Loads without pre-determined attachment points may require calculations to determine the center of gravity. Engineering guidance may be required. Whenever possible, loads should be lifted from the top, above the center of gravity. If loads must be attached below the center of gravity, they must be restrained by tying the upper half of the load to the slings. If a load is hoisted without keeping the hook over the center of gravity, the load will shift as it clears the ground. If the load is unstable, re-adjust the rigging gear before making the lift.

Rigging Considerations and Hooks

When placing gear on a hook, seat the gear in the bowl and ensure the safety latch is working properly. Remember the included angle of the slings should never exceed 90 degrees.

Knowledge Check

1. Select the best answer. When lifting with 2 hooks or 2 cranes, loads may be kept level by using:

   A. Sling angle adjustments
   B. Horizontal dampers
   C. Equalizer beams
   D. Automatic load levelers

2. Select all that apply. Which of the following terms describing rigging gear can be used interchangeably with rated capacity or rated load.

   A. Net capacity
   B. Gross capacity
   C. Safe working load
   D. Working load limit

3. Select all that apply. Approved rigging hardware, such as a shackle, is required to have the following basic markings:

   A. Re-inspection Due Date
   B. Date of manufacture
   C. Working load limit (WLL)
   D. Manufacturer Name, Logo, or Trademark
   E. Material

4. Select the best answer. When using shouldered eyebolts, ensure that the shoulder is:

   A. Flush with the mounting surface
   B. At a 36^{o} angle to the mounting surface
   C. Across the plane

5. Select the best answer. Lowering the horizontal sling angle …

   A. Increases the stress or load on the slings
   B. Decreases the stress or load on the slings
   C. Has no effect on the stress or load on the slings

Rigging Considerations Summary

The person rigging the load is ultimately responsible for the safety of the load. Even when the operators are not directly involved in rigging a load, they must be able to identify proper rigging practices. Always know the weight of the load. Use properly marked undamaged rigging gear. Follow established rigging practices. Avoid excessive sling angles and keep the hook over the center of gravity at all times.

NOTES

SAFE OPERATIONS

Welcome
Welcome to Safe Operations.

Learning Objectives
Upon successful completion of this module you will be able to explain operator responsibilities, describe proper methods to lift and land loads, understand the requirements when working near overhead power lines, identify safe operating procedures and state securing procedures for cranes

Understanding the Crane


Most crane accidents can be avoided by consistently practicing basic safety procedures.
Team members are often to blame for crane accidents, due to inattention, poor judgment, overconfidence, or haste.
Crane operators at naval activities may be required to operate various types, makes, and models of cranes. Operators must be trained, licensed, and thoroughly familiar with the operating characteristics, including posted operational restrictions or limitations, of each type, make, and model of crane that may be operated.

Operator Training
Prior to being licensed, operator trainees must be thoroughly trained on the operation of the type of crane for which a license is to be issued.
The operator trainee shall operate the crane only under the direct observation of a licensed operator. The licensed operator shall retain full responsibility for the safe operation of the crane.
The supervisor shall approve lifting of loads based upon the candidate's demonstration of knowledge of the equipment and operation without loads.
The trainee shall not perform complex lifts.

Operations Manual
Operators must read and follow the manufacturer’s requirements, written procedures, safety instructions and precautions.

Posted Information
The operator must heed posted warnings and instructions on the crane such as hand signal placards, controller function labels, and warning labels.
Certification information should be posted in plain sight.

Pre-operational Check

To make sure the crane and work area are safe, the operator performs a mandatory daily crane inspection using the ***Operator's Daily Checklist.***
When performing the operational check portion of the ODCL in cold weather or icy conditions, the operator should raise the blocks and boom before lowering them to avoid damage when sheaves may be frozen.
Operators should inform rigging personnel to stand clear of the area below the blocks and boom prior to operation.
The operator should hoist up slowly, in small increments, to break any ice and/or snow free, and monitor the sheaves to ensure proper movement and operation of the sheaves and wire rope.
This should also be performed periodically throughout the day to ensure proper operation during cold weather or icy conditions.

Knowledge Check

1. Select the best answer. When operating cranes, the operator's primary responsibility is to:

   A. Keep the crane clean
   B. Do pre-use checks
   C. Use the shortest boom length possible
   D. Operate safely

2. Select the best answer. Crane operators at naval activities may operate various types, makes, and models of cranes for which they are licensed. How must safety and operator proficiency be assured under these circumstances?

   A. Operators must operate at reduced speeds until confident and capable
   B. Operators must receive written and performance tests by a crane license examiner as outlined in the NAVFAC P-307 manual
   C. Operators must be familiarized (as directed by a supervisor) before operating

3. Select the best answer. What information should be posted, clearly understandable, and readily available to the operator?

   A. Certification information
   B. Travel speed through congested areas
   C. Crane operator's license number

4. Select the best answer. Which of the following operator responsibilities is considered the basis for ensuring a safe and reliable crane?

   A. Periodic lubrication and servicing
   B. Operators Daily Checklist (ODCL)
   C. Proper set-up on outriggers
   D. Firm and level supporting surface

5. Select the best answer. What information should be posted, clearly understandable, and readily available to the operator?

   A. Labels for each control function
   B. Operator's License Number
   C. ODCL Checks

6. Select the best answer. When can an unlicensed crane operator trainee operate a crane?

   A. Only under the direct observation of a licensed operator
   B. When he or she needs to operate a crane to get the job done
   C. When their supervisor tells them to operate a crane
   D. In an emergency

Operator Awareness

When operating a crane, the operator must be aware of everything in the operating envelope including hazards, obstructions, and personnel.
At the same time the operator must be aware of the sound, feel and behavior of the crane.

Unsafe Conditions

Whenever an unsafe condition exists, operators must immediately stop operation and the condition must be resolved before continuing.
If you cannot resolve a safety issue with the team members, contact the supervisor for assistance.
Remember, operators have the **authority and responsibility** to stop and refuse to operate the crane until safety is assured.

Lifts Near Personnel

Loads must never be moved or suspended over personnel.
Choose an alternate load path or evacuate personnel from the area.

Riding Loads

Personnel must never ride loads.

Use only approved personnel-lifting devices if personnel must be lifted.

Overhead Lines

Whenever working near overhead power transmission lines, have the power de-energized and visibly grounded.

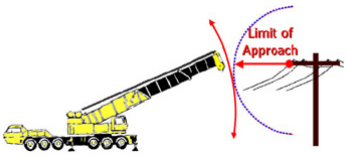
Required clearance for normal voltage in operation near high voltage power lines and operation in transit with no load and boom or mast lowered.

NORMAL VOLTAGE, KV (PHASE TO PHASE)	MINIMUM REQUIRED CLEARANCE, FT (M)
Operation Near High Voltage Power Lines	
0 to 50	20 (6.10)
Over 50 to 200	20 (6.10)
Over 200 to 350	20 (6.10)
Over 350 to 500	50 (15.24)
Over 500 to 750	50 (15.24)
Over 750 to 1000	50 (15.24)
Operation in Transit with No Load and Boom or Mast Lowered	
0 to 0.75	4 (1.22)
Over 0.75 to 50	6 (1.83)
Over 50 to 345	10 (3.05)
Over 345 to 750	16 (4.87)
Over 750 to 1000	20 (6.10)

When the power cannot be de-energized, the minimum required clearances described in figure 10-3 of NAVAC P-307 must be maintained.
If any part of the crane or load could approach the distances noted in figure 10-3 of NAVAC P-307, a designated signaler shall be assigned.
In addition, a supervisor shall visit the site, assess potential hazards, and establish procedures to safely complete the operation.
Follow the requirements of NAVFAC P-307 paragraphs 10.11.1 through 10.11.1.6 for crane operations near or below overhead electrical transmission lines, operation near communication towers, and travelling below power lines.

Limit of Approach

When operating a crane in the vicinity of overhead electrical transmission lines, for voltages less than 350 kV, the minimum required clearance is 20 feet. Where the voltage is known to be 350 kV or more, the minimum required clearance is 50 feet.



A designated spotter shall be assigned by the supervisor and be positioned to effectively gauge and monitor the clearance distance and communicate directly with the operator.
When operating in the vicinity of overhead transmission lines, the best crane set up is one in which no part of the crane or load can enter the clearance limit.
Even boom failure should not allow the crane, load line, or load to enter the limit.

Operating Practices

The crane operator must operate the crane in a safe manner, moving loads slowly and smoothly.
Avoid rapid starts and sudden stops to help reduce load swing. Anticipate stopping points, and slow down before bringing loads to a stop. Crane swing should be relatively slow to prevent outward swing of the load due to centrifugal force.
The operator shall remain at the controls at all times while a load is suspended from the crane. This does not include slings and other gear used to rig the

load and does not include a load attached to the crane with slack in the rigging gear. This also does not apply to under-running bridge cranes, jib cranes, pillar cranes, pillar jib cranes, monorails, and fixed overhead hoists used in industrial processes that require a suspended load such as cleaning, degreasing, painting, testing, and similar processes. For such cases, the suspended load shall be less than 80 percent of the crane's rated capacity, the area shall be secured to prevent unauthorized personnel from entering, the crane shall be tagged to indicate this condition, and the load shall not be suspended longer than required.

Lifting Loads

Prior to lifting, position the freely suspended hook directly over the loads center of gravity when attaching the load. This prevents side loading the boom or crane and prevents dragging or shifting of the load as it is picked up.
Sufficient tag lines shall be used to minimize load swing and rotation unless their use creates a hazard.
Take the slack out of rigging gradually and watch for hook movement that indicates the need to reposition the crane before lifting.
When lifting a load, stop hoisting when the load lifts a few inches off the ground and check to ensure there is no slippage of the hoist brake. This must be performed for every load.
Accelerate smoothly to reduce dynamic loading.
Extreme caution shall be used when making lifts out of water. When the load comes out of the water, buoyancy is lost and the load on the crane may increase. Also, just as the load leaves the water, the surface tension (suction) can increase the load on the crane momentarily. Water held inside the object may also increase the load weight.

Landing Loads

Prior to lowering loads, be sure the surface that you plan to land the load on will support the load.
When landing loads: slowly lower the load as you approach the landing surface, stop the load a few inches off the ground or landing surface, then slowly lower the rest of the way.
Ensure the load is stable and secure before slacking and removing the rigging gear.

Securing the Crane

When securing cranes remove gear from the hook, stow hooks near, but not in, the upper limit switches, place all controls in the neutral or off position, engage all brakes, rotate locking devices and drum pawls, and secure power.
Operators shall ensure local safety requirements are followed.
For mobile cranes, set the carrier brake and chock wheels if the crane is on an incline.

Traveling

When traveling cranes with loads, stow unused hooks, follow OEM requirements and keep loads close to the ground while avoiding obstructions.
Maintain communication with and operate under the direction of a signaler.
Use slow speeds for better load control.
Be aware of travel restrictions, and other cranes working in the area.

Remember to check clearances and watch for obstructions.

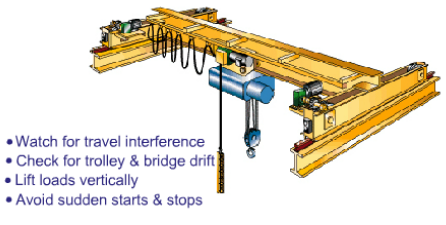
OET and Gantry Crane Operations

The bridge travel function is used to travel the crane in the selected direction along the length of the runway rails.
This allows the operator to move the entire crane along its supporting rail structure, in the selected direction.
The trolley function is used to move the hoisting machinery in the selected direction along the trolley rails.
The hoist function is used to raise and lower the hooks.

Operating Characteristics

There are a variety of operating characteristics and issues that the users of Category 2 and 3 cranes must consider. Listed below are just a few.
Operating of Category 2 and 3 cranes may be from the cab or from the ground using a pendant controller or remote controls. A disadvantage of operating a very high mounted overhead traveling crane from the cab is that the operator may have difficulty in judging position and in seeing signals.
Some cranes are equipped with dynamic lowering controls. A dynamic lowering control is an automatic device that speeds the lowering of an empty hook or light load, and slows a heavy load.
On some cranes a heavy load may lower when the hoist control is initially moved from the neutral position to the hoist position. The load may not lift until the hoist speed is high enough to support and raise the load. This characteristic is called hoist roll back.
When positioning heavy loads, the final vertical adjustment should be made by lowering the load because of hoist roll back.

OET and Gantry Cranes Operating



Overhead electric traveling cranes are generally operated indoors so congestion is often an issue. Watch for changes in the work area that may cause interference. Storage racks with material stacked too high are a common problem.
Operators should always check for trolley and bridge drift before operating the crane.
Lift loads vertically. Side pulls can cause uneven or overlapped spooling of the hoist wire and may cause the wire rope to be cut or severely damaged. In addition, ensure the hook and block are not swinging prior to hoisting. Improper or overlapped spooling of the wire rope on the drum can occur with or without a load on the hook when hoisting.
Avoid sudden starts and stops with the bridge. This can result in skidding and uneven wear on the wheels.
A sudden start with a heavy load on one end of the bridge or a slippery track may cause a crane to skew. Skewing is a condition where one end of the bridge gets ahead of the other end, frequently causing binding on the rails. Excessive skew may be straightened by slowly bumping the bridge into the end stops.

OET and Gantry Cranes – Operating II

Always board cab-operated cranes at designated places.
Access the crane cab or bridge walkway using fixed ladders, stairs, or platforms.
Remain aware of other cranes working on the same rail system.
For gantry cranes, watch travel truck clearances.
For cab-operated gantry cranes, this may require additional personnel to ensure a clear travel path.
Use radio controls according to the manufacturer's instruction.
Turn off power to the radio controller and properly store when finished operating.

Operating Techniques

When slowly taking the slack out of rigging gear, and when starting to move a light load or empty hook smoothly, the first hoisting point or slowest possible speed should be used.
A technique called "Inching", or performing a motion very slowly, a little at a time, can be used when a crane operation or function requires small movement.
Another technique, "Plugging", is the use of reverse power instead of a brake to slow or stop the bridge or trolley travel. This method of braking or stopping movement is not used for hoisting or lowering motions. As a precaution, the operator should be ready to use the foot brake to stop movement if the power or operation should fail.

Securing

Move cab-operated cranes to a boarding platform or ladder (Never attempt to walk the rails to enter or exit an OET crane); move the trolley out of the way of traffic or interferences if necessary; raise the hoist block near, but not into the upper limit switch; place the controls in the neutral or off position; and secure the power.
Operators shall ensure local safety requirements are followed.
When necessary for OET or gantry cranes located outside, secure the crane against movement by the wind. The bridge brake shall be locked, or the bridge shall be locked by setting the spud lock or by blocking the travel trucks or wheels as necessary.
Activities are required to develop instructions for securing WHE in adverse weather conditions. Operators shall be aware of these requirements.

Knowledge Check

1. Select the best answer. When lifting loads with a crane, which of the following is the first thing an operator should do?

   A. Center the hook over the center of gravity of the load.
   B. Lift the load slightly to check the brake
   C. Change speeds smoothly
   D. Take the slack out of the rigging

2. Select the best answer. The second step in the procedure for lifting loads is to:

   A. Hoist slowly and remove slack from the rigging gear
   B. Hoist slowly until the load lifts
   C. Hoist at one speed until the load lifts

3. Select the best answer. The third step for lifting loads is to:

   A. Lift until the load clears all obstacles and stop
   B. Lift the load until a desired height and stop
   C. Lift the load until completely suspended and stop

4. Select the best answer. While operating, the crane operator becomes concerned over the safety of the lift. The rigger-in-charge sees no problem and tells the operator to continue. The operator should:

   A. Tell his/her supervisor at the end of the shift
   B. Refuse to continue until safety is assured
   C. Proceed slowly with caution
   D. Note the incident on the back of the ODCL card

5. Select the best answer. Side loading a crane boom by dragging loads or lifting a load with a non-vertical hoist may result in:

   A. Destructive stresses placed on the boom and sheaves
   B. Possible overload due to swinging of the load after lifting
   C. Uncontrolled movement of the load due to shifting
   D. Any of the listed factors above

6. Select the best answer. In general, which of the following things should an operator do when traveling cranes with loads?

   A. Keep loads just high enough to clear obstacles
   B. Start slowly and increase speeds gradually
   C. Avoid sudden stops
   D. Stow or secure unused hooks
   E. Perform all of the listed actions above

7. Select the best answer. What is meant by “skewing”?

   A. Where one end of the bridge gets ahead of the other end, frequently causing binding on the rails
   B. Skewing is when the crane is used to push another crane
   C. Where the operator comes to a stop quickly, causing the crane to slide

8. Select the best answer. What is “inching”?

   A. Lifting a load one inch, then checking the hoist brake
   B. Performing a motion very slowly, a little at a time
   C. Selecting one inch shackles and slings for a lift

9. Select the best answer. What is “plugging”?

   A. Operating a crane function very slowly, a little at a time
   B. Depressing a crane function repeatedly on a pendant controller as fast as possible
   C. The use of reverse power instead of a brake to slow or stop the bridge or trolley travel
   D. Operating the hoist in the reverse direction to stop movement

Summary

In this module we discussed the following:
Operator responsibilities, including: taking the time to get familiar with the crane's operating characteristics, reading and following the operations manual, having the required information on the crane, and performing the ODCL.
Safe operating practices, operator awareness, and proper methods for lifting and landing loads.
The rules and requirements, including limits of approach, for operating cranes in the vicinity of overhead power lines; and
How effective teamwork and safe operating practices reduce accidents.

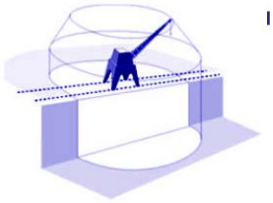
NOTES

CRANE AND RIGGING GEAR ACCIDENTS

Welcome
Welcome to Crane and Rigging Gear Accidents.

Instructional Objectives
Upon successful completion of this module you will be able to identify the elements in the crane and rigging gear operating envelopes, define a crane accident, define a rigging gear accident, identify the primary causes of accidents and explain the procedures to follow when an accident happens.

Accident Categories
There are two general categories of weight handling accidents: Crane Accidents and Rigging Gear Accidents.
Crane Accidents are those that occur during operation of category 1, 2, 3, or 4 cranes. Rigging Gear Accidents are those that occur when gear covered by NAVFAC P-307 section 14 is used by itself in a weight handling operation, i.e., without a crane. Or, when covered gear is used with multi-purpose machines, material handling equipment (forklifts), and with equipment covered by NAVFAC P-300 in a weight handling operation.

Crane Operating Envelope


In order to define a crane accident, you must first understand the crane operating envelope.
The operating envelope includes the crane, the operator, the riggers, the crane walkers, other personnel, the rigging gear between the hook and the load, the load itself, the supporting structures, such as the rails or the ground, and the lift procedure.

Rigging Gear Operating Envelope
The rigging gear operating envelope contains: the rigging gear and miscellaneous equipment covered by NAVFAC P-307 section 14, the user of the gear, the load itself, other personnel involved in the operation, the structure supporting the gear, the load rigging path, and the rigging 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. The area where the load will be landed
   C. Any supporting structures
   D. Rigging gear between the hook and the load

2. Select all that apply. The rigging gear operating envelope contains the rigging gear and miscellaneous equipment covered by NAVFAC P-307 section 14, the load itself and …

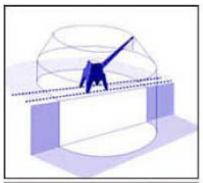
   A. The gear or equipment's supporting structure
   B. The rigging procedure
   C. The load rigging path
   D. Other personnel involved in the operation
   E. The crane removal procedure
   F. The user of the gear or equipment

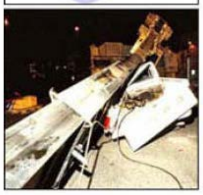
Near Misses

A near miss is a situation where an accident was avoided by mere chance or where intervention prevented an ongoing sequence of events that would have resulted in an accident.
Near misses and other unplanned occurrences with lessons to be learned that do not fall under the crane and rigging gear accident definitions, shall be reported using NAVFAC P-307, Section 12, Figure 12-2 (Near Miss Report). This report must be e-mailed (nfsh_ncc_accident@navy.mil) to the Navy Crane Center (Code 06) within 30 days of the occurrence.

Crane Accident Definition

A crane accident occurs when any of the elements in the operating envelope fails to perform correctly during operations, including operations during maintenance or testing,
resulting in the following: personnel injury or death, material or equipment damage, dropped load, derailment, two-blocking, overload (this includes load tests when the test load tolerance is exceeded), or collision.





Rigging Gear Accident Definition

Rigging gear accidents occur when any of the elements in the operating envelope fails to perform correctly during weight handling operations resulting in the following: personnel injury or death, material or equipment damage, dropped load, two blocking, or overload.

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.

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.
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 Gear 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 Exception

Component failure such as motor burnout, gear tooth breakage, bearing failure, etc., is not considered an accident just because damage to equipment occurred, unless the component failure causes other damage such as a dropped boom or dropped load.

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.

WHE Accident Response

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.

General Reporting Procedures

Activities shall notify the Navy Crane Center (Code 06) by fax, phone, or e-mail as soon as practical but not later than 24 hours after an accident involving a fatality, in-patient hospitalization, overturned crane, collapsed boom, or any other major damage to the crane, load or adjacent property.
For all other accidents the Navy Crane Center must be notified no later than three working days after the accident.
For each suspected accident, activities shall promptly perform a comprehensive investigation, prepare a Crane and Rigging Gear Accident Report and forward a copy to the Navy Crane Center within 30 days of the accident.

Contractor Accident Reporting Procedures

The contractor shall notify the contracting officer as soon as practical but no later than four hours after any WHE accident. Secure the accident site and protect evidence until released by the contracting officer. Conduct an accident investigation to establish the root cause(s) of any WHE accident.
Crane operations shall not proceed until cause is determined and corrective actions have been implemented to the satisfaction of the contracting officer.
Contractors shall provide to the contracting officer, within thirty days of any accident, a Crane and Rigging Gear Accident Report using the form provided in NAVFAC P-307 Section 12 consisting of a summary of circumstances, an explanation of cause or 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 and provide the Navy Crane Center and the host activity a copy of every accident report, regardless of severity, upon receipt from the contractor.
The contracting officer shall notify the Navy Crane Center of any accident involving a fatality, in-patient hospitalization, overturned crane, collapsed boom, or any other major damage to the crane, load, or adjacent property as soon as possible, preferably within twenty four 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.

When the contracting officer is not in the local area, the contracting officer shall designate a local representative to ensure compliance with the above noted requirements. The above requirements are in addition to those promulgated by OPNAVINST 5100.23 and related local instructions.

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. rigger error
   B. Operator error
   C. Crane accident
   D. Rigging gear deficiency

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. Crane walker's error
   B. Load configuration error
   C. Crane accident
   D. Operator error

3. Select the best answer. When rigging gear covered by NAVFAC P-307 Section 14 fails while suspended from a structure and drops the load it is a:

   A. Load configuration error
   B. Rigging gear accident
   C. Rigging error
   D. Crane accident

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 rigging gear accident
   B. A non-accident
   C. A crane 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. Personnel error
   C. Crane operators
   D. Riggers or signalmen
   E. Equipment failure

6. Select all that apply. Over-confidence and poor judgment among team members can contribute to crane and rigging gear accidents. Select additional factors that can contribute to accidents:

   A. Engineering lift specifications
   B. Inattention to the task
   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. Notify your supervisor immediately
   D. Secure the crane and power as required

NOTES

CATEGORY 2 CRANE SAFETY REFRESHER EVALUATION SHEET

Student Name: _____

Command/Activity/Organization: _____

Instructor: _____ Date: _____

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_____