



# Navy Crane Center



# NAVFAC P-307 Training

**CATEGORY 2 CRANE SAFETY REFRESHER  
WEB BASED TRAINING STUDENT GUIDE  
NCC-C2CSR-02**

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CATEGORY 2 CRANE SAFETY REFRESHER STUDENT GUIDE

1	WALK AROUND CHECK								
2	MACHINERY HOUSE CHECK								
3	OPERATOR CAB CHECK								
4	OPERATIONAL CHECK								
a	Area Safety *								
b	Outriggers and Stabilizers *								
c	Unusual Noises								
d	Wire Rope or Chain *								
e	Brakes and Controls								
f	Boom Angle								
g	Limit Switch								
h	Emergency								
i	Other Oper								
j	Load General Safe								
k	Flashing She								

ODCL CHECKS 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. These 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.

ODCL CHECKS FOR 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

INSTRUCTIONS – Check all applicable items indicated, prior to the first use each day. Suspend operations immediately upon observing an unsatisfactory condition of any item indicated with an asterisk (\*). Operations may continue if the condition has been reviewed and continued operation has been authorized by the activity engineering organization.

For any unsatisfactory item, identify the specific components and describe the deficiency in the "Remarks" block.

REMARKS  
*Bridge lights not working*

RECORDING RESULTS FROM ODCL CHECKS

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-operation check.



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) Winlocks, Stops, and Bumpers			
m) Tires, Wheels and Tracks			
n) Leaks			
o) Outriggers and Stabilizers *			
p) Load Chain *			
q) Area Safety *			



**ODCL SECTION ONE: 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.

**ODLC WALK AROUND: WALKWAYS, LADDERS, HANDRAILS**

Check the condition of walkways, ladders, and handrails for loose mountings, cracks, excessive rust, and loose rungs. Ensure safety chains and gates are functional.



**ODLC WALK AROUND: RAIL SWEEPS AND BUMPERS**

Inspect rail sweeps and bumpers, looking for obvious damage. Check for damage such as loose or broken bolts, cracking, bending and deformation. Look carefully for cracking or flaking paint that may indicate a crack or damage in the structure beneath. Where bolts and rivets are painted, cracked paint may indicate looseness.

**ODCL CHECKS: GENERAL HARDWARE**

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



**ODCL CHECKS: BRIDGE AND TROLLEY**

Visually check bridge girders and the trolley platform for obvious physical damage such as cracked paint, indicating loose or bent structural elements or deflection.



**ODCL CHECKS: TROLLEY RAILS AND STOPS**

Visually check trolley rails, stops and bumpers for signs of obvious damage, missing fasteners and bent or broken members. Also check for proper rail alignment and temporary rail stops.



**ODCL CHECKS: SAFETY GUARDS AND PLATES**

Do a visual check for damage, loose or missing safety guards, fasteners or parts.

**ODCL CHECKS: MACHINERY HOUSE CHECK**

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

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 *			



**ODCL HOUSEKEEPING**

Good housekeeping is important to the safety of all crane personnel. Oil, grease, or mud on floors, ladders, or landings can cause serious falls. Check to ensure that the machinery area and accesses are clean and free of materials and trash. Ensure tools and authorized materials are properly stored and that waste and rags are removed daily.



**ODCL CHECKS: LUBRICATION**

Visually check the bearings, bushings and pillow blocks to ensure that the crane has been properly lubricated. Look for signs of inadequate or excessive lubrication, and heat, often indicated by discoloration.





**ODCL CHECKS: LEAKS**

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

**ODCL CHECKS: BRAKE LININGS**

Inspect all brakes for signs of contamination from lubricants, overheating as evidenced by discoloration of the drum and scoring caused by rivet contact. If a brake is equipped with a manual release, ensure that the mechanism is not in the released position.



**ODCL CHECKS: ELECTRIC MOTORS**

Inspect electric motors for signs of damage including: physical damage, excessive carbon dust, and loose or missing fasteners.

**ODCL CHECKS: OPERATOR'S CABS**

This is a typical Operator's Cab Check section from an ODCL.

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) *			
i Danger / Cautions *			



**ODCL CHECKS: POSTING REQUIREMENTS**

The crane number, certification expiration date and crane capacity must be posted on the crane. There are several ways to post the required information. They may be posted as a copy of the certification papers, on signs, stenciled or painted on the crane or on a nearby wall. This information may also be found on a crane test card or on stickers.

**ODCL CHECKS: CAB CONTROLS**

Before energizing the crane ensure that all controls are in neutral position and check for proper action of the controllers and brake pedals.



**ODCL CHECKS: WARNING TAGS**

Before energizing the crane, look for warning tags. The red danger tag prohibits operation of equipment when its operation could jeopardize the safety of personnel or endanger equipment. The yellow caution tag is often used to provide temporary special instructions, or to indicate a specific caution. A yellow caution tag could be used to warn the operator of temporary rail stops, for example. The striped lockout tag 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. Remember, only authorized personnel may install or remove warning tags.



**ODCL VISIBILITY AND GLASS**

From the operator's cab, check for unrestricted visibility and clean, unbroken windows and mirrors.



4 OPERATIONAL CHECK			
	S	U	NA
a Area Safety *	<input checked="" type="checkbox"/>		
b Outriggers and Stabilizers *	<input checked="" type="checkbox"/>		
c Unusual Noises			
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 Flucting Sheaves			



**ODCL OPERATIONAL CHECKS**

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.

**ODCL CHECKS: WIRE ROPE**

Visually inspect wire rope for unusual wear, fraying, bird-caging, corrosion and kinking.



During the operational check, where possible, observe sections of wire rope that may not be visible during the walk around check, such as lower layers on the hoist drum that can only be seen when the hook is lowered.

**ODCL CHECKS: CONTROLS AND BRAKES**

Operate the controls through all speed points. Ensure the controls are functioning properly. Check for proper operation of dead man controls by removing your hand from the controller handle. The function should stop. Reset the function by returning the control to neutral.



**ODCL CHECKS: HORNS AND ALARMS**

Activate all horns and alarms to test for proper operation, volume and tone.

**REVIEW AND 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 into four sections, the walk around check, machinery house check, operator's cab check and the no-load operational check.



# NOTES

ODCL MODULE EXAM

*Online exam questions may appear in a different order than those shown below.*

1. What are the four sections of a properly performed pre-operational check?
  - A. electrical function check
  - B. no-load operational check
  - C. operator's cab check
  - D. walk around check
  - E. machinery house check
  - F. stability check
  
2. Any deficiency of a critical component or safety hazard must be reported immediately to...
  - A. crane maintenance
  - B. crane engineering
  - C. your supervisor
  - D. crane inspector
  
3. Dead man controls refers to controllers that automatically...
  - A. gently pushes your hand away from the handle when the crane stops
  - B. compensates for slow operator response
  - C. changes operational speeds to suit conditions
  - D. stops operations when it is released
  
4. Each item on the ODCL shall be marked...
  - A. stable, unstable, or not applicable
  - B. correct, incorrect, not applicable
  - C. satisfactory, unsatisfactory, or not applicable
  - D. serviceable, unserviceable, or not applicable
  
5. If you observe a yellow tag on a piece of equipment, you should...
  - A. review the special instructions and operate accordingly
  - B. verify the tag was from previous work
  - C. remove the tag and continue operations
  - D. fix the problem and operate the equipment
  - E. under no circumstances operate this piece of equipment

6. What method of inspection is used in the operator's daily check of the crane?
- A. review of the OEM manual
  - B. observing the crane in operation
  - C. CCI inspection
  - D. sight, sound and touch
7. If you observe a lock out tag on a piece of equipment, you should...
- A. verify the tag was from previous work
  - B. fix the problem and operate the equipment
  - C. remove the tag and continue operations
  - D. review the special instructions and operate accordingly
  - E. under no circumstances attempt to operate the equipment
8. The ODCL is used to identify...
- A. conditions that may render the crane unsafe
  - B. members of the current crane team
  - C. who is licensed to operate the crane
  - D. necessary and missing paperwork
9. If you observe a red tag on a piece of equipment, you should...
- A. verify the tag was from previous work
  - B. fix the problem and operate the equipment
  - C. under no circumstances attempt to operate the equipment
  - D. review the special instructions and operate accordingly
  - E. remove the tag and continue operations
10. If you discover a load bearing part, load controlling part or operational safety device that is unsatisfactory, you should...
- A. resolve the situation before continuing
  - B. stop, secure the crane and notify your supervisor
  - C. report the situation to crane inspection
  - D. report the situation to crane maintenance

11. On the ODCL critical components are identified by...

- A. ampersand (&)
- B. asterisks (\*)
- C. bold letters
- D. letter color: red for critical – yellow for cautionary

12. Discoloration of the brake drum is usually caused by...

- A. overheating
- B. overloading the crane
- C. lubrication
- D. normal operations

13. During inspection, cracked or flaking paint may indicate...

- A. structural damage or loose bolts
- B. aluminum paint on steel components
- C. latex paint over alkaloid primer
- D. poor quality paint

14. The crane number, certification expiration date and certified capacity are found...

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

15. A complete check of the crane is performed by the operator prior to...

- A. moving the crane to a new location
- B. the first use of the crane each day
- C. complex lifts only
- D. securing the crane each day



## COMPLEX AND NON-COMPLEX LIFTS

### 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

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

This is a list of Complex Lifts.

#### Complex Lift Categories

- Hazardous materials
- Large and complex geometric shapes
- Personnel lifts
- Lifts exceeding 80% of rated capacity of hoist
- 50% hoist capacity for barge-mounted mobile cranes
- Lifts of submerged or partially submerged objects
- Multiple crane or multiple hook lifts
- Other non-routine lifts

#### Complex Lift Procedures

##### Written procedures:

- SOPs
- Specific procedures
- Sketches as required

##### Supervisor or Working leader:

- Review on-site conditions
- Perform a pre-job briefing

##### Crane or Rigging Supervisor:

- Review on-site conditions for lifts over 80%
- Present during first evolution

#### SUPERVISOR RESPONSIBILITIES - COMPLEX LIFT PROCEDURES

A supervisor or working leader must review on-site conditions and conduct a pre-job briefing for all complex lifts. 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.

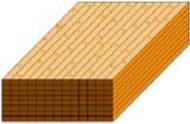
### LIFTS NOT CONSIDERED COMPLEX LIFTS

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 P307 are also excluded.



### LIFT REQUIREMENTS FOR 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.



### LIFT REQUIREMENTS FOR 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.

### LIFT REQUIREMENTS FOR 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, Title 29 Code of Federal Regulations, Part 1926.550g. 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.



### LIFT REQUIREMENTS FOR 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.

### LIFT REQUIREMENTS FOR MULTIPLE CRANE OR HOOK LIFTS

Lifts with two or more cranes are complex lifts. These lifts require special planning, coordination and skill. The weight carried by each crane must be calculated carefully. One signal person must be assigned to direct and control the entire operation.



### REVIEW AND 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.

# NOTES

COMPLEX AND NON-COMPLEX LIFTS MODULE EXAM

*Online exam questions may appear in a different order than those shown below.*

1. Personnel lifts are...
  - A. always considered complex lifts
  - B. considered complex only under special conditions
  - C. not considered complex if personnel lifting devices are used
  - D. not considered complex if personal protective gear is worn
  
2. A crane with a capacity of 100,000 pounds is performing a lift of 40,000 pounds. This is a(n)...
  - A. hazardous lift
  - B. non-complex lift
  - C. overload lift
  - D. complex lift
  
3. Detailed written procedures are required for...
  - A. complex lifts
  - B. non-Complex lifts
  - C. all lifts
  - D. some lifts
  
4. Lifts of test weights during maintenance or load test are...
  - A. included in the complex lifts requirements
  - B. evaluated according to the complex lift requirements
  - C. routine lifts because they are not complex shapes
  - D. excluded from the complex lift requirements
  
5. For personnel lifts, the total load must be...
  - A. less than 80% of the hook capacity
  - B. less than 50% of the hook capacity
  - C. less than the gross capacity if designated as a complex lift
  - D. less than the load chart capacity

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

- A. non-complex lifts
- B. hazardous lifts
- C. explosive lifts
- D. complex lifts

7. 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

8. For all complex lifts, a supervisor or working leader must review on-site conditions and...

- A. define the crane operating envelope
- B. inspect all rigging gear
- C. select rigging gear
- D. conduct as pre-job briefing

9. A crane with a capacity of 100,000 pounds is performing a lift of 90,000 pounds. This is a(n)...

- A. overload lift
- B. hazardous lift
- C. complex lift
- D. non-complex lift

10. Personnel in the platform must...

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

## CRANE COMMUNICATIONS: CAT 2 AND CAT 3

### 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. 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 signalers 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 operator. Your activity may approve local signals in addition to these standard signals.



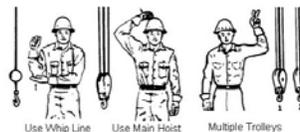
### COMMUNICATION - SIGNALERS

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.



### COMMUNICATION - RADIO

Radios can be used to direct crane lifts while keeping crane team members informed of the lift status. Follow the guidelines and work practices shown on your screen when using radios.



### HOOK AND TROLLEY SIGNALS

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

### COMMUNICATIONS - 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



### COMMUNICATIONS - MAIN HOIST

When calling for the main hoist, the signaler:

- taps a fist on his or her hard hat and
- follows the appropriate hook movement signal



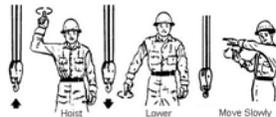
### COMMUNICATIONS - MULTIPLE HOOKS/TROLLEYS

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



### COMMUNICATIONS - 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.



### COMMUNICATIONS - HOIST UP

The hoist signal is given with:

- the forearm vertical, the index finger pointing up, and
- the hand moving in small horizontal circles



### COMMUNICATIONS - LOWER

The lower signal is given with:

- the arm extended downward,
- the index finger pointed down and
- the hand moving in small horizontal circles



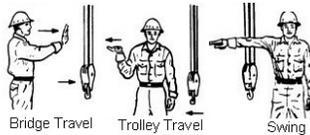
### COMMUNICATIONS - HOIST/MOVE SLOWLY

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



### COMMUNICATIONS - DIRECTIONAL SIGNALS

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



### COMMUNICATIONS - 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



### COMMUNICATIONS - 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.



### COMMUNICATIONS - SWING

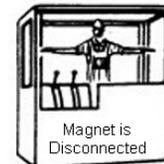
The signal for swing or rotate is:

- an extended arm
- the index pointed in the desired direction of rotation.



### COMMUNICATIONS - MAGNET SIGNALS

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



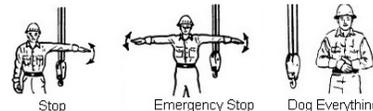
### COMMUNICATIONS - MAGNET DISCONNECT

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 extend arms
- palms up and fingers open.



### COMMUNICATIONS – STOP

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.

### COMMUNICATIONS - STOP

The stop signal is:

- an extended arm,
- palm down
- moving back and forth horizontally.



### COMMUNICATIONS -EMERGENCY STOP

The signal for an emergency stop is:

- both arms extended
- with palms down
- moving them back and forth horizontally.



### COMMUNICATIONS - DOG EVERYTHING

The signal to dog everything is:

- clasped hands in front of the body.



### REVIEW AND 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 COMMUNICATIONS MODULE EXAM

Online exam questions may appear in a different order than those shown below.

1. This signal indicates...

- A. emergency stop
- B. lower load
- C. dog everything



2. Another form of communications, other than hand signals, must be used if...

- A. activities designates alternative methods
- B. the signaler is not in clear view of the crane operator
- C. the signaler is in clear view of the rigger in charge
- D. ambient noise is greater than the lack of visibility

3. Any additional hand signals must be...

- A. approved by NOSH
- B. approved by the ASME
- C. approved by the activity
- D. approved by OSHA

4. This signal indicates...

- A. swing
- B. travel back
- C. stop
- D. emergency stop



5. This signal indicates...

- A. magnet disconnected
- B. emergency stop



6. For multiple crane lifts, \_\_\_\_\_ will communicate with the crane operators.

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

7. In the crane cab the crane operator must have clear view of the...

- A. EOM
- B. crane maintenance records
- C. ASME hand signal chart
- D. crane lift history

8. This signal indicates...

- A. travel
- B. raise hoist
- C. main hoist
- D. auxiliary hoist



9. Direct voice should only be used when...

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

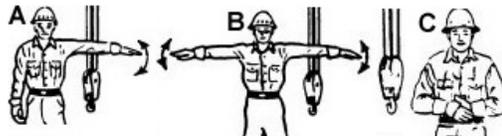
10. This signal indicates...

- A. emergency stop
- B. magnet disconnect
- C. stop
- D. swing



11. Which signal is used to indicate shutting down everything – commonly known as dog everything?

- A
- B
- C



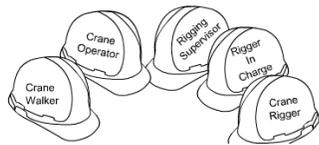
12. A universal language understood by everyone involved with weight handling is...

- A. hand signals
- B. direct voice commands
- C. spoken word
- D. signal flags

## CRANE TEAM CONCEPT

### 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.

### CRANE TEAM 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.



### CRANE TEAM 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.



### CRANE TEAM 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 RESPONSIBILITY

The crane operator is responsible for performing the pre-use check as well as the safe operation of the crane. The crane operator must have a full understanding of each lift prior to execution and moves only when directed by the signal person.



### CRANE OPERATOR RESPONSIBILITY

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

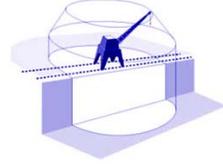
### CRANE OPERATOR RESPONSIBILITY

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.



### CRANE OPERATOR RESPONSIBILITY

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.



### RIGGER-IN-CHARGE RESPONSIBILITY

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.



### RIGGER-IN-CHARGE RESPONSIBILITY

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 RESPONSIBILITY

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.

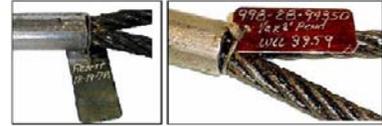


### CRANE RIGGER RESPONSIBILITY

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

**CRANE RIGGER RESPONSIBILITY**

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



**CRANE RIGGER RESPONSIBILITY**

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



**CRANE WALKER RESPONSIBILITY**

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.



**CRANE WALKER RESPONSIBILITY**

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



**CRANE WALKER RESPONSIBILITY**

The crane walker ensures the crane's travel path is clear by watching for potential obstructions and checking the proper alignment of the crane track switches.



### CRANE WALKER RESPONSIBILITY

Crane walkers stay near the emergency stop button to communicate the stop signals to the crane operator.



### SUPERVISOR RESPONSIBILITY

The supervisor is familiar with NAVFAC P-307 and supports the crane team concept.

**The supervisor:**

- Designates crane team personnel
- Reviews site conditions for complex lifts
- Reviews procedures for operations near electrical lines
- Investigates and reports crane accidents



### SUPERVISOR RESPONSIBILITY

The supervisor reviews onsite conditions for all complex lifts.

### SUPERVISOR RESPONSIBILITY

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



### SUPERVISOR RESPONSIBILITY

A supervisor oversees lifts exceeding 80% of hook capacity, 50% for barge mounted mobile cranes. If the lifts are repetitive in nature, the supervisor shall be present during the first evolution of the lift for each rigging crew.



### SUPERVISOR RESPONSIBILITY

The supervisor shall: inspect suspected accident scene, notify appropriate authority and ensure that the accident report is filed.

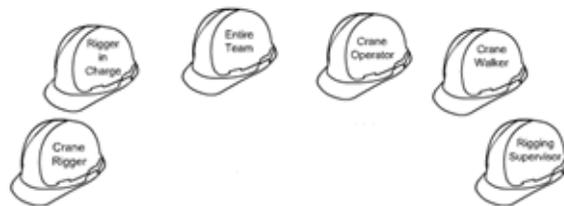
### SUPERVISOR RESPONSIBILITY

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 or 50% for mobile cranes mounted on barges.



### REVIEW AND 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

CRANE TEAM CONCEPT MODULE EXAM

*Online exam questions may appear in a different order than those shown below.*

1. Coordinating the activities of the crane team is the responsibility of the...
  - A. crane rigger
  - B. crane supervisor
  - C. activities
  - D. crane operator
  - E. rigger in charge
  
2. If an accident is reported, the preliminary investigation will be performed by the...
  - A. crane rigger
  - B. crane operator
  - C. supervisor
  - D. rigger in charge
  
3. 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
  
4. The crane operator is responsible for the safe \_\_\_\_\_ of the crane.
  - A. condition
  - B. return
  - C. repair
  - D. inspection
  - E. operation
  
5. Planning the lift route is the responsibility of the...
  - A. crane rigger
  - B. crane operator
  - C. crane supervisor
  - D. rigger in charge

6. Additional crane team members may be assigned by...

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

7. Crane operators are responsible for all of the following except...

- A. moving the crane only when signaled
- B. doing a thorough ODCL inspection
- C. slowing down when signals are unclear
- D. maintaining communication with signaler
- E. lifting and landing all loads safely

8. When rigging your own loads, you are responsible for \_\_\_\_\_.

- A. determining the load weight
- B. selecting and inspecting the rigging gear
- C. calculating the Center of Gravity of the load
- D. hooking up the load
- E. all of the above actions

9. The crane operator moves the crane only as directed by the...

- A. signaler
- B. rigger
- C. crane walker

10. The minimum Crane Team consists of...

- A. the Crane Operator, Crane supervisor, and Crane Rigger
- B. the Crane Operator and Rigger in Charge
- C. the Crane Operator, Rigger Supervisor, and Crane Rigger
- D. the Crane Operator, Crane Walker, and Crane Rigger

11. The crane operator must immediately stop operations when...

- A. any time a stop signal is given
- B. operations have exceeded allowed time
- C. communications are lost during a blind or complex lift
- D. the operating envelope is penetrated
- E. the weather forecast is not good

12. If you feel safety is in jeopardy during the performance of your task, you should...

- A. stop work and have the problem resolved
- B. use the OEM manual to solve the problem
- C. call your supervisor for clarification
- D. evaluate the lift plan

13. Securing the crane envelope is the...

- A. combined responsibility of all team members
- B. combined responsibility of the crane operator and the crane supervisor
- C. sole responsibility of the crane operator
- D. sole responsibility of the rigging supervisor

14. While the members of the crane team have individual responsibilities, each has 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

15. A \_\_\_\_\_ may be assigned by the rigger in charge to assist the operator with the pre-use check, select and inspect rigging gear, and rig loads.

- A. crane rigger
- B. crane supervisor
- C. crane engineer
- D. crane operator

## SAFE OPERATIONS 3

### SAFE OPERATIONS - 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. Understanding the crane is the operator's first responsibility. Crane operators at naval activities must often operate a variety of cranes. They must be familiar with each type of crane they are qualified to operate.



### SAFE OPERATIONS - OPERATION MANUAL

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



### SAFE OPERATIONS - 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.

### SAFE OPERATIONS - 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*.





### SAFE OPERATIONS - 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.

### SAFE OPERATIONS - 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.

### SAFE OPERATIONS - LIFTS NEAR PERSONNEL

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

Loads must never be moved or suspended over personnel

- Avoid moving loads near personnel work areas
- Look for an alternate route
- Evacuate personnel from the load path area



Personnel must never ride or climb on suspended loads



- Adjust rigging from other access if possible
- Look for an alternate route
- Never use the load as a means of transportation!

### SAFE OPERATIONS - RIDING LOADS

Personnel must never ride loads. Use only approved personnel-lifting devices if personnel must be lifted.



### SAFE OPERATIONS - 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. Never leave a suspended load unattended.

### SAFE OPERATIONS - LIFTING LOADS

When lifting loads position the freely suspended hook directly over the load for vertical lifting. This prevents side loads and prevents load shifting at lift-off. Take the slack out of rigging gradually and watch for hook movement that indicates the need to reposition the crane before lifting. Stop when the load lifts a few inches off the ground and check the hoist brake. Accelerate smoothly to reduce dynamic loading.



### SAFE OPERATIONS - LANDING LOADS

When lowering loads, be sure the surface that you plan to land on will support the load. Slow the load down as you approach the landing surface. To land heavy loads softly, stop the load a few inches off the ground and allow the load to settle before touching down.

### SAFE OPERATIONS - SECURING THE CRANE

When securing cranes remove gear from the hook, place all controls in the neutral position and engage all brakes and locks. Stow hooks near, but not in, the limit switches. For cranes located outdoors, secure the crane against wind movement and chock the wheels as necessary.



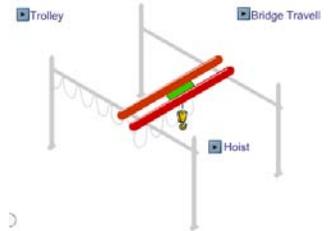


### SAFE OPERATIONS - TRAVELING

When traveling cranes with loads, stow unused hooks, follow OEM requirements and keep loads close to the ground while avoiding obstructions. 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.

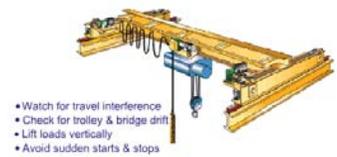
### OET AND GANTRY CRANE OPERATIONS

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.



### 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 & 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. 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 may cause a crane to skew. Skewing means that the bridge and trucks are out of alignment with the rails often resulting in wheel chatter from flange contact with the sides of the rail head.





### OET AND GANTRY CRANES - OPERATING

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.

### OET AND GANTRY CRANES - SECURING

Move cab-operated cranes to a boarding platform or ladder. Never attempt to walk the rails to enter or exit an OET crane. Secure main power switch, usually located on the bridge, for cab-operated cranes only. When necessary for OET or gantry cranes located out of doors, secure the crane against movement by the wind. Chock the wheels as necessary for travel trucks.



### REVIEW AND SUMMARY

Effective teamwork and practicing safe operating procedures can and will reduce accidents.

# NOTES

SAFE OPERATIONS 3 MODULE EXAM

*Online exam questions may appear in a different order than those shown below.*

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

- A. take the slack out of the rigging
- B. change speeds smoothly
- C. lift the load slightly to check the brake
- D. center the hook over the load

2. What information should be posted, clearly understandable, and readily available to the operator.

- A. Labeled controls for each function
- B. Operator's name
- C. ODCL Checks

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

4. 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

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

- A. certification Information
- B. crane Operator's license number
- C. travel speed through congested areas

6. Side loading a crane boom by dragging loads or lifting a load with a non-vertical hoist is not permitted due to...

- A. destructive stresses placed on the boom & sheaves
- B. possible overload due to Swing-out of the load after liftoff
- C. uncontrolled movement of load due to shifting
- D. any of the listed factors

7. 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. refuse to continue until safety is assured
- B. tell his supervisor at the end of the shift
- C. proceed slowly with caution
- D. note the incident on the back of the ODCL card

8. When operating cranes, the operator's PRIMARY responsibility is to...

- A. do pre-use checks
- B. operate safely
- C. use the shortest boom length possible
- D. keep the crane clean

## CRANE AND RIGGING GEAR ACCIDENTS

### CRANE 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 and 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.

#### Crane Operating Envelope

- Moves with the crane
- Must remain clear of obstructions



#### Includes:

- crane
- operator
- riggers and personnel
- other personnel
- rigging gear
- load
- supporting structure
- procedure

### Rigging Gear Operating Envelope

Area surrounding the load-rigging path



#### Includes:

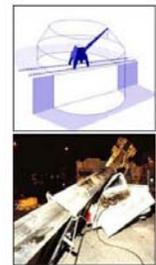
- rigging gear and equipment
- user of the gear
- load
- other personnel
- supporting structures
- load-rigging path
- rigging procedure

### RIGGING GEAR 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.

### CRANE ACCIDENT

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 or collision.



### RIGGING GEAR ACCIDENTS

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.



### 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

The majority of crane accidents are caused by personnel error and can be avoided. In most cases, crane accidents are due to inattention to the task, poor judgment, team members having too much confidence in their abilities, or operating the crane too fast.

### OPERATOR RESPONSIBILITIES

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

## ACCIDENT REPORTING PROCEDURES

If you have an accident with a crane or you find damage and suspect an accident has happened, you must stop operations as soon as safely possible, call emergency services if anyone is injured, secure the crane and power as required, notify supervision immediately, and preserve the accident scene to aid the investigation. The activity responsible for the weight handling operation at the time of the accident shall initiate and submit the accident report.

### Accident Procedures

- Stop operations as soon as safe
- Call EMS if personnel are injured
- Secure the crane and power as required
- Notify supervision immediately
- Ensure accident scene is preserved
- Notify the Navy Crane Center as soon as practical, but no later than 3 days after the accident occurs or is discovered.

The activity shall prepare a crane and rigging gear accident report and forward a copy to the Navy Crane Center within 30 days of the accident. Email is the preferred method of notification.

- **E-mail:** NFSH\_NCC\_ACCIDENT@NAVY.MIL
- Alternate contact (should E-mail be unavailable)
  - **Phone:** 757-967-4042
  - **DSN:** 387-4042
  - **FAX:** 757-967-3808

## ACCIDENT REPORTING - CONTRACTOR

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.

### Reporting Procedures - Contractor

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 30 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(s), photographs (if available), and corrective actions taken.

## ACCIDENT REPORTING - CONTRACTING OFFICER

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. 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.

### Reporting Procedures - Contracting Officer

The contracting officer shall:

- Notify the host activity of any WHE accident upon notification by the contractor
- Provide the Navy Crane Center and the host activity a copy of every accident report, regardless of severity, upon receipt from the contractor
- 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 24 hours of notification by the contractor

When the contracting office 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.

# NOTES

CRANE AND RIGGING GEAR ACCIDENTS MODULE

*Online exam questions may appear in a different order than those shown below.*

1. The crane operating envelope includes the crane, the operator, the riggers, the crane walkers, and...

- A. any supporting structures
- B. the load
- C. the area where the load will be landed
- D. rigging gear between the hook and the load

2. If component failure occurs, such as motor burnout, and does not result in damage, the component failure is considered...

- A. a crane accident
- B. crane maintenance's responsibility
- C. a non accident
- D. a rigging accident

3. The rigging gear operating envelope contains the rigging gear and miscellaneous equipment covered by P-307 section 14, the load itself and...

- A. load rigging path
- B. the gear or equipment's supporting structure
- C. the user of the gear or equipment

4. Who is primarily responsible for evaluating a crane operator's physical and emotional fitness?

- A. the Crane Operator
- B. the Crane Supervisor
- C. the activity Medical Officer
- D. the Dispatcher
- E. all listed personnel

5. During maintenance the rigging gear between the crane hook and the load fails and results in equipment damage. This is reported as a (an)...

- A. rigging gear deficiency
- B. rigger error
- C. operator error
- D. crane accident

6. 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. operating the crane too fast
- B. engineering lift specifications
- C. the crane operating envelope
- D. inattention to the task

7. To whom or to what are the majority of crane accidents attributed?

- A. personnel error
- B. riggers or signalmen
- C. equipment failure
- D. weather conditions
- E. crane operators

8. If you have an accident with a crane or you find damage and suspect an accident has happened, your first step is to...

- A. notify your supervisor immediately
- B. secure the crane and power as required
- C. call emergency services if anyone is injured
- D. stop operations as soon as safely possible

9. When rigging gear covered by P-307 Section 14 fails while suspended from a structure and drops the load it is a...

- A. crane accident
- B. load configuration error
- C. rigging gear accident
- D. rigging error

10. 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 (an)...

- A. operator error
- B. crane accident
- C. load configuration error
- D. crane walker's error



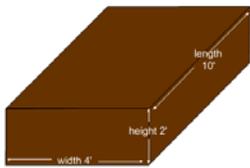


**CALCULATING OBJECT WEIGHT BY VOLUME**

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.



**FINDING WEIGHT OF MATERIALS - VOLUME**

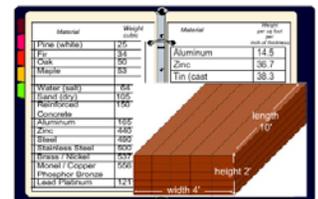
This chart shows the weight of various materials per cubic foot. Fir boards for example, weigh 34 pounds per cubic foot.

Material	Weight per cu ft	Material	Weight per cu ft
Pine (white)	25	Aluminum	14.5
Fir	34	Zinc	38.7
Oak	52	Tin (cast)	38.3
Maple	53	Steel	40.8
Water (sat)	64	Stainless Steel	41.7
Sand (dry)	105	Brass / Nickel	44.8
Reinforced Concrete	150	Mon el/ Copper/ Phosphor Bronze	46.4
Aluminum	165	Silver Lead	54.7
Zinc	440	Lead	59.2
Steel	490		
Stainless Steel	500		
Brass / Nickel	537		
Monel / Copper	556		
Phosphor Bronze			
Lead			
Platinum			

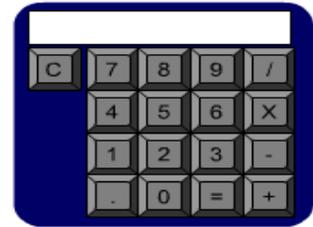
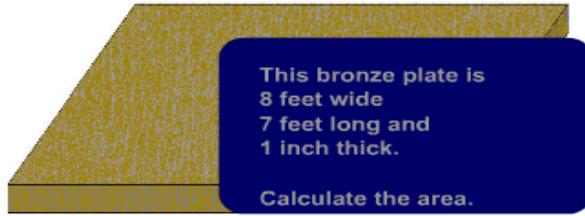
Standard Weight of Materials is a chart referencing weight of materials by volume  
 • the weight of materials  
 • per cubic foot

**OBJECT WEIGHT BY VOLUME (CU FT) AND WEIGHT OF MATERIALS**

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.

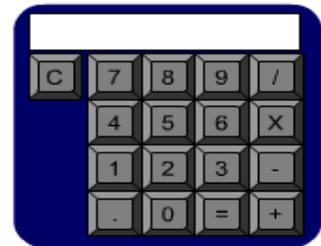
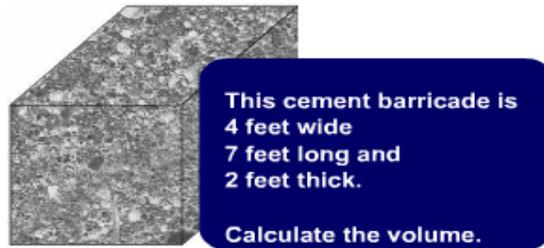


Knowledge Check: Area



- 15 square feet
- 15 cubic feet
- 56 square feet
- 56 cubic feet

Knowledge Check: Volume

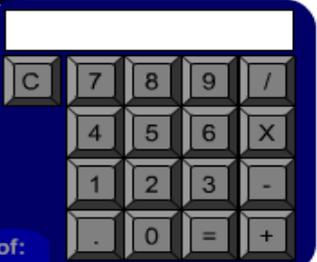


- 56 square feet
- 56 cubic feet
- 13 square feet
- 13 cubic feet

Knowledge Check: Using the Chart

Material	Weight per cubic foot	Material	Weight per square foot per inch of thickness
Pine (white)	25	Aluminum	14.5
Fir	34	Zinc	36.7
Oak	50	Tin (cast)	35.3
Maple	53	Steel	40.8
Water (salt)	64	Stainless Steel	41.7
Sand (dry)	105	Brass / Nickel	44.8
Reinforced Concrete	150	Monel / Copper /	46.4
Aluminum	165		
Zinc	440		
Steel	490		
Stainless Steel	500		
Brass / Nickel	537		
Monel / Copper / Phosphor Bronze	556		
Lead	710		

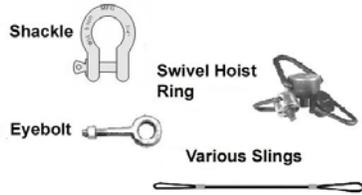
Calculate the weight of:  
a stainless steel block  
Length = 8 feet  
Width = 5 feet  
Height = 4 feet



- 8,500 pounds
- 6,720 pounds
- 714 pounds
- 80,000 pounds

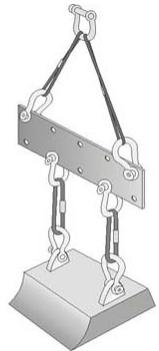
### COMMON RIGGING HARDWARE

Shackles, eyebolts, swivel hoist rings and slings are just a few examples of the common hardware 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.

### NEW RIGGING GEAR MARKINGS

Newly purchased rigging gear requires markings to include the name, logo or trademark of the manufacturer. 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.



### 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.

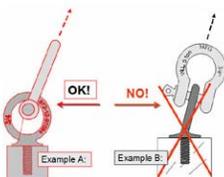
### SHACKLE USE

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.



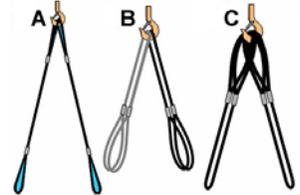
### SHOULDERED EYEBOLT USE

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.



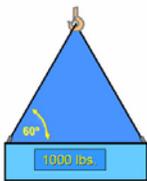
### SLING ON HOOKS

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 ANGLE STRESS

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. At 60 degrees, the total stress is 1,115 pounds, only 15 percent more than a straight vertical pull. Lower sling angles dramatically increase the stress on the slings. A 30 degree sling angle, for example, will double the stress on each sling. This can be verified with a dynamometer in-line with each sling.



### SLINGS - CHOKE CONFIGURATION

When slings are used in a choker hitch, the capacity is reduced depending on the choke angle and the sling material. For example, when the choke angle for wire rope is 121 degrees or greater, capacity is reduced to 75 percent of the vertical rated load. Choker hitch angles greater than 135 degrees are considered unstable and shall not be used.

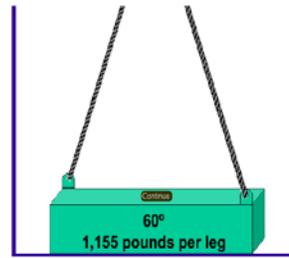
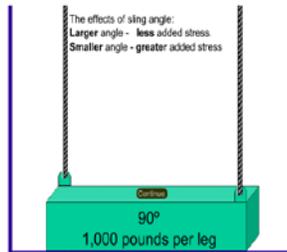


### SYNTHETIC WEB SLINGS

Follow the manufacturer's recommendations when using synthetic web slings. Synthetic web slings are very susceptible to damage and must be protected from heat, abrasion, cuts, chemicals etc. Do not tie knots in a sling or use a sling that has been knotted. Do not use synthetic web slings at temperatures above 180 degrees Fahrenheit except as allowed by the OEM.

# CATEGORY 2 CRANE SAFETY REFRESHER STUDENT GUIDE

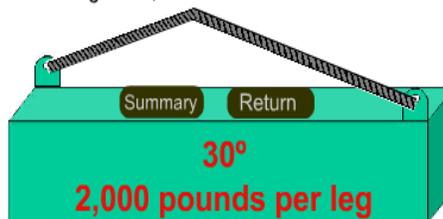
## Summary of Sling Angle Stress

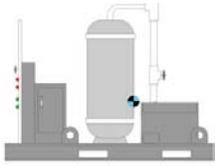


**60° angle** - the load increases to 1,155 lbs.  
Each leg has 1,155 lbs. of stress - **a 16% increase.**  
A 60° sling angle is the preferred angle to use.

**45° angle** the load increases to 1,415 lbs..  
Each leg has 1,415 lbs. of stress. - **a 43% increase.**

**30° angle** the load increases to 2,000 lbs..  
Each leg has 2,000 lbs. of stress. - **a 100% increase.**





### 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.



### REVIEW AND 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

RIGGING CONSIDERATIONS MODULE EXAM

*Online exam questions may appear in a different order than those shown below.*

1. 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
  
2. To find the weight of a complex load it may be necessary to calculate weight by...
  - A. area
  - B. volume
  - C. both volume and area
  - D. neither volume nor area
  
3. When using shouldered eyebolts, ensure that the shoulder is...
  - A. flush with the mounting surface
  - B. at a 360 angle to the mounting surface
  - C. across the plane
  
4. When figuring the load weight the crane will lift...
  - A. add the weight of the rigging gear to the load weight
  - B. subtract the weight of the rigging gear from the load weight
  
5. 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

6. Oak weighs 50 pounds per cubic foot. Calculate the weight of a stack of oak measuring 5 feet wide, 4 feet high and 10 feet long.

- A.  $5 \times 4 \times 10 + 50 = 250$  pounds
- B.  $5 + 4 + 10 + 50 = 69$  pounds
- C.  $5 \times 4 \times 10 = 200$  pounds
- D.  $5 \times 4 \times 10 \times 50 = 10,000$  pounds

7. Lower a sling angle...

- A. increases the stress on the slings
- B. decreases the stress on the slings
- C. has no effect on the stress on the slings

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

- A.  $10 \times 10 \times 1 = 100$  pounds
- B.  $10 \times 10 \times 1 \times 14.5 = 1450$  pounds
- C.  $14.5 \times 10 + 14.5 \times 10 \times 1 = 290$  pounds
- D.  $10 + 10 + 1 + 15 = 36$  pounds

9. 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

10. What is the ideal sling angle?

- A.  $60^\circ$  or more
- B.  $15^\circ$  or less
- C.  $30^\circ$  or less
- D.  $45^\circ$  or less

11. Calculate the volume of a stack of lumber that is 3 feet high by 5 feet wide by 10 feet long.

- A. 18 square feet
- B. 150 square feet
- C. 150 cubic feet
- D. 18 cubic feet

12. Inspect rigging gear for which of the following (as applicable).

- A. condition of paint
- B. corrosion
- C. cracks
- D. kinks
- E. punctures

13. Calculate the area of a plate that is 3 feet by 3 feet and is one inch thick.

- A. 9 square feet
- B. 9 cubic feet
- C. 6 cubic feet
- D. 6 square feet

14. When using a material weight chart, simplify the math by...

- A. rounding the unit weight down
- B. rounding the unit weight up
- C. rounding to the nearest whole number
- D. never rounding – use the figures given



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.

<b>Please rate the following items:</b>	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 \_\_\_\_\_