

# SIMULATION SET 7

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## SITE DOMAIN — Questions 1–21

1. A mobile crane is being set up at a large industrial facility. The site manager provides a "facility crane pad" map showing pre-approved crane locations that were engineered 12 years ago. Since the engineering was performed, a new underground steam line was installed through one of the designated pad locations, and a surface drainage channel was added that crosses another. What must the operator do before using any of the pre-approved crane pad locations?

- A. Use the pads as approved since facility engineering documents supersede field observation
- B. Request updated drawings showing the steam line routing and drainage channel before setting up
- C. Accept the pre-approved locations since the facility's engineering department bears liability for their accuracy
- D. Verify that current site conditions at each planned pad location still match the original engineering assumptions — pre-approved locations become invalid when subsurface or surface conditions change, and the steam line and drainage channel represent changes that may have altered bearing capacity and subsurface integrity at the affected locations

2. A crane operator is evaluating a job site where the ground surface has been treated with calcium chloride for dust suppression. Heavy recent treatment has left a white crystalline residue on the surface. Calcium chloride is a hygroscopic compound — it absorbs moisture from the air. What specific bearing capacity concern does calcium chloride treatment create?

- A. Calcium chloride chemically deactivates clay minerals and permanently improves bearing capacity over time
- B. Calcium chloride's hygroscopic nature means it continuously draws moisture into the soil surface — in dry conditions it may soften the soil surface by maintaining higher-than-ambient moisture content, potentially reducing the actual surface bearing capacity below what a visual dry-weather inspection would suggest
- C. Calcium chloride is a structural additive and always improves bearing capacity by chemical bonding with soil particles

D. Calcium chloride residue creates a brittle surface crust that must be removed before crane setup but does not affect deep soil bearing capacity

3. Under OSHA 1926.1402, what specific obligation exists for the controlling entity when the crane will be set up or operated near a building that has a basement or underground vault directly beneath the setup area?

A. The controlling entity must post warning signs around the building's perimeter indicating that below-grade structures exist

B. The controlling entity must provide the crane operator with available information about the basement or underground vault so the crane employer can evaluate whether the structure can support the crane's setup, operation, and disassembly loads

C. The building owner must provide a structural engineer's stamped certification before any crane operates near the building

D. The crane operator must independently locate all building permits and structural drawings before any setup near existing buildings

4. A crane operator observes that the surface texture of the planned outrigger zone has changed between yesterday and today — there are small surface cracks running in random directions and the surface appears to have settled approximately 0.5 inches in an area about 6 feet in diameter near where the left rear outrigger will be placed. What does this pattern of random cracks with central settlement most likely indicate?

A. A circular settlement pattern with random surface cracking is consistent with subsurface void development — possibly a sinkhole, a failing underground structure, or a collapsing utility — directly beneath that location; crane setup must not proceed until the subsurface cause is identified and addressed

B. The settlement and cracking are caused by normal moisture evaporation from the surface — this is a cosmetic condition requiring no special action

C. The settlement indicates the soil has reached maximum compaction and is now stable for crane operations

D. Random surface cracking with central settlement typically indicates frost heave activity and is expected in cold weather environments

5. A crane is being positioned on a job site where a concrete retaining wall creates a 6-foot-tall vertical drop on the downhill side of the planned setup area. The nearest outrigger position is 4 feet from the wall crest. The wall appears structurally sound. What site-specific concern requires evaluation before setup proceeds?

A. The retaining wall must be completely demolished before any crane operates within 20 feet of its crest

B. The crane's boom must be oriented away from the retaining wall during all lifts to avoid loading the wall

C. The retaining wall creates an outrigger deflection concern since the crane may shift toward the wall

D. The outrigger load applied 4 feet from the wall crest creates a surcharge on the soil retained by the wall — if the wall was not designed for this surcharge, the additional lateral earth pressure from the crane outrigger may cause the wall to overturn, slide, or crack; a structural assessment of the wall's capacity under the crane surcharge is required

6. What is the purpose of the 811 "Call Before You Dig" system in the context of crane setup, and what does a completed locate confirm?

A. Calling 811 confirms that no utilities exist in the marked area and that the operator may load any surface within the locate zone

B. Calling 811 initiates a process where utility operators mark the approximate location of their buried lines on the surface — a completed locate confirms the presence and approximate routing of utilities within the tolerance zone; it does not confirm precise depth, exact horizontal position, or the absence of unregistered private utilities

C. The 811 system provides engineering drawings and depth data for all regulated utilities within 100 feet of the dig site

D. The 811 system confirms that all underground utilities have been removed or abandoned before construction in the marked area

7. A crane is set up at a job site where the surface shows tire ruts from construction equipment that are 3 to 5 inches deep throughout the planned outrigger zone. The outrigger pads are placed across two rut tracks — part of each pad rests in a rut and part rests on the higher ridge between tracks. What specific bearing problem does this uneven surface create?

- A. Uneven surface contact is always resolved by the outrigger pad's ability to flex and conform to the irregular surface
- B. Reduced outrigger extension will provide a smaller pad footprint that fits within a single rut more effectively
- C. Tire rut depressions create irregular outrigger pad contact — the pad may rock between the rut edge and the ridge, concentrating the outrigger load on the two contact points rather than distributing it across the full pad area; this dramatically increases the bearing pressure at those contact points and reduces effective bearing area by the fraction of the pad that is in contact with the ground
- D. Tire ruts are structural improvements created by compaction and provide superior bearing capacity at the rut ridges

8. Under OSHA 1926.1412, what is required before a crane is placed into service at a new job site after being transported from another location?

- A. A post-assembly inspection must be performed by a qualified person before the crane is put into service at the new location — this inspection verifies the crane was assembled correctly, that no transport damage occurred, and that all components are properly connected and functional
- B. A monthly inspection performed within 14 days of transport satisfies the post-assembly requirement
- C. Post-assembly inspection is only required for lattice boom cranes — telescopic boom cranes do not require post-assembly inspection after transport
- D. The crane operator may self-certify the post-assembly condition through the pre-shift inspection checklist

9. A crane operator is setting up on a paved parking lot. The lot is 8 years old and appears to be in good condition with no visible cracking. However, the lot has never been documented with a sub-base specification or compaction test. What concern does the absence of sub-base documentation create?

- A. All paved surfaces are assumed to be adequate for crane operations — the asphalt surface provides structural confirmation of adequate sub-base
- B. Parking lots are designed for vehicle loading and are automatically adequate for crane outrigger loads
- C. The operator should probe the surface with a rod to confirm sub-base depth before setting up
- D. Without sub-base documentation, the bearing capacity of the soil beneath the asphalt is unknown — the asphalt surface provides no indication of what's beneath it; the 8-year-old pavement may look good

while sitting on soft, inadequately compacted sub-base that could fail under concentrated crane outrigger loads

10. Under OSHA 1926.1408(b), which of the following must be specifically confirmed during the pre-work assessment when a crane will operate near power lines?

A. The number of crane operations required near the power line to evaluate whether de-energization is cost-effective

B. The voltage of all power lines within the crane's maximum working radius, whether de-energization is feasible, and which control option will be implemented — these determinations must be made and documented before crane operations begin near any power line

C. Whether the utility company has liability insurance coverage for crane incidents involving their power lines

D. The age and insulation condition of the power line to determine whether insulation can be relied upon to reduce the MSAD

11. A crane is operating at a job site when a heavy rainstorm begins. After 20 minutes of rainfall, the operator notices that water is ponding visibly beneath the left front outrigger pad — the pad appears to be sitting in 1 to 2 inches of water. What action is required?

A. Continue operations while monitoring the pad — water pooling beneath pads is a cosmetic issue and does not affect bearing capacity during brief rain events

B. Increase the outrigger jack extension to raise the crane higher above the pooling water level

C. Stop crane operations and lower the load to the ground immediately — pooling water beneath an outrigger pad indicates that the soil at that position is saturating, which can rapidly and dramatically reduce bearing capacity; operations must not resume until the water drains and the ground condition is re-evaluated

D. Sound the horn to warn nearby workers and complete the current lift cycle before halting for the weather condition

12. A crane operator is performing a site assessment walk and finds that the planned outrigger spread area includes a section of ground that has recently been disturbed by a trenching machine, then backfilled and rolled by a small drum roller. The contractor confirms the rolling was performed one day ago. What specific concern does this create?

- A. Recently rolled trench backfill may appear compacted on the surface but can have significantly lower bearing capacity than the surrounding undisturbed soil — a small drum roller applied one day ago is unlikely to have achieved uniform, deep compaction, and the recently disturbed zone requires bearing capacity verification before crane outrigger loading
- B. One-day-old roller-compacted backfill consistently meets structural specifications for crane operations
- C. Rolling compaction is the highest-quality compaction method — one-day-old roller-compacted fill is safe for crane operations of any weight
- D. The contractor assumes liability for backfill compaction quality and no further evaluation is needed from the operator

13. A crane is set up for a lift when the operator notices that a water tanker truck has just finished spraying the site road adjacent to the setup area for dust control. The water was applied heavily and runoff is flowing toward the outrigger zone. What must the operator do?

- A. Proceed with the lift since the water is on the road surface, not directly under the outrigger pads
- B. Reduce the planned lift load by 15% as a precaution while the water drains
- C. Continue with the lift if it can be completed before the water reaches the outrigger area
- D. Stop all crane operations and prevent water from reaching the outrigger zone — flowing water migrating into the outrigger pad area can rapidly saturate and soften the supporting soil, eliminating the bearing capacity that the original ground assessment was based upon; operations must not resume until the water source stops and ground conditions are confirmed adequate

14. When a crane is operating adjacent to an active railroad, what minimum clearance requirement applies to the crane's equipment, load, and personnel from the nearest rail?

- A. A minimum of 6 feet from the nearest rail for personnel and equipment
- B. The railroad operator's specific requirements govern — the applicable clearance is set by the operating railroad and must be confirmed in writing from the railroad before crane operations begin near the tracks; standard minimum clearances typically range from 8 to 25 feet depending on track speed and type
- C. The OSHA MSAD for standard distribution lines applies to railroads as well — 10 feet minimum
- D. A minimum of 20 feet from the nearest rail centerline applies to all crane operations near active railroads

15. Under ASME B30.5, what condition of the crane's operating area must be maintained throughout all crane operations, not just at setup?

- A. The operating area must be cleared of all vegetation before operations begin and maintained vegetation-free throughout the shift
- B. The operating area must be illuminated to minimum OSHA construction lighting standards whenever the crane operates in reduced daylight conditions
- C. Ground conditions in the crane's operating area must remain firm, drained, and stable throughout the operation — if conditions change during operations due to weather, adjacent excavation, utility failure, or any other cause, operations must be reassessed against the changed conditions
- D. The operating area must be surveyed by a licensed land surveyor before operations begin to confirm dimensions for the exclusion zone

16. A crane operator is setting up at a job site that has a completed geotechnical report showing bearing capacities of 2,800 psf in the planned outrigger area. The maximum outrigger reaction load for the planned lift is 64,000 lbs. The operator has 4-foot × 4-foot timber mats (16 sq ft each) available. What is the minimum number of mats required at the heaviest outrigger position?

- A. Ground bearing pressure with one mat =  $64,000 \div 16 = 4,000$  psf; exceeds 2,800 psf — one mat is insufficient. With two mats (32 sq ft):  $64,000 \div 32 = 2,000$  psf; within 2,800 psf — two mats are the minimum required at the heaviest position
- B. One mat is sufficient since 64,000 lbs is within the manufacturer's rated outrigger capacity
- C. Three mats are required to maintain a minimum 2:1 safety factor above the soil's rated capacity
- D. The mat count must be certified by a structural engineer before any crane setup can proceed on 2,800 psf soil

17. A crane operator is evaluating a setup location where the surface appears to be compacted gravel but when probed with a steel rod, the rod easily penetrates to 18 inches with minimal resistance. What does this probe test indicate?

- A. The rod penetration indicates the gravel is well-graded and highly permeable — high permeability is a sign of excellent bearing capacity
- B. The probe test result is not a valid bearing capacity measurement method and should be disregarded

C. Easy rod penetration to 18 inches indicates the subsurface below the thin surface layer may be very loose or soft — the apparent compacted gravel surface may be only a thin crust over soft material; this result warrants further investigation or engineering assessment before crane outrigger loading

D. The easy penetration indicates the gravel is saturated — drainage improvements will restore adequate bearing capacity within 24 hours

18. Under OSHA 1926.1407, what does "voltage determination" require specifically, and from which sources may this information be obtained?

A. Voltage must be determined by the crane operator using a non-contact voltage meter before each shift

B. Voltage determination requires obtaining the actual voltage from the utility operator, visible markings on the poles or structures, or other reliable sources — estimating voltage from wire size, insulation color, or tower type alone is not an acceptable determination method under OSHA 1926.1407

C. The utility operator's verbal confirmation of voltage by phone is not a legally acceptable determination method — only written documentation satisfies OSHA's voltage determination requirement

D. Voltage is presumed to be the regional maximum voltage unless the utility provides written documentation confirming a lower value

19. A crane is operating when a worker reports that a small oil sheen is visible on the soil surface adjacent to the crane's hydraulic lines — a hose connection appears to be weeping slightly. No functional loss of crane operation is observed. What action is required?

A. Continue operations and add hydraulic fluid at the end of the shift to compensate for the minor seepage loss

B. Mark the area with a cone and continue operations — minor hydraulic seepage is a maintenance item requiring end-of-shift attention

C. Stop operations, identify the source of the hydraulic leak, and evaluate whether the leak is in a pressure line or a return line — a pressure line leak can spray hot hydraulic fluid under high pressure, creating a fire hazard and potential injury risk; the crane must not continue operations with an active hydraulic leak of unknown severity until the source and pressure condition are confirmed and the leak is addressed

D. Continue operations for the remainder of the planned lifts and have maintenance address the leak during the next scheduled service interval

20. A crane operator is asked about the purpose of the "zone of influence" concept in crane setup near excavations and slopes. Which statement correctly describes this concept?

A. The zone of influence defines the area within which underground utilities must be marked before crane setup — all utilities within the zone must be identified before outrigger placement

B. Nothing — the zone of influence is a highway engineering concept that does not apply to crane operations

C. The zone of influence is the lateral distance from a loaded foundation within which the applied stress in the soil exceeds a threshold value — for crane outriggers near excavation slopes, this concept means that outrigger loads can affect the stability of the slope at distances far greater than the outrigger pad's dimensions

D. The zone of influence describes the maximum radius within which the crane's rotating upper works creates a hazard

21. A crane operator is setting up at a job site where the surface consists of interlocking concrete pavers over a compacted sand base. The paver system has been in service for 5 years and is in good visual condition. What specific concern does the paver-on-sand system create for crane outrigger support?

A. Nothing — interlocking concrete pavers are the recommended crane outrigger surface for all applications

B. The paver joints create stress concentrations that will cause the pavers to crack under crane outrigger loads

C. Concrete pavers are classified as structural elements requiring engineering review before crane operations

D. The compacted sand base beneath the pavers may have a lower bearing capacity than the paver surface suggests — sand is susceptible to moisture-induced bearing capacity reduction, and the interlocking paver system can hide signs of sand base deterioration; the bearing capacity of the sand sub-base must be assessed independently of the paver surface condition

### **OPERATIONS DOMAIN — Questions 22–48**

22. A crane operator has just completed a shift and the relief operator arrives. During the shift, the current operator heard an intermittent clicking sound from the hoist drum area that was inconsistent with

previous experience — it occurred three times during hoist operations and then stopped. The current operator cannot identify the source. What is the required action?

- A. Verbally inform the relief operator of the clicking sound and document the observation in the crane's maintenance log so it can be formally investigated before or at the start of the next shift — an unexplained hoist drum sound must be reported and evaluated, not assumed to have self-resolved
- B. The unidentified click is likely caused by normal rope fleeting and no action is needed
- C. Perform a brief test hoist of an unloaded hook block to confirm whether the sound recurs before handing over to the relief operator
- D. The relief operator performs their own pre-shift inspection and the previous operator's unresolved observations are not required to be disclosed

23. A crane is performing a lift at 88% of rated capacity. During a swing movement, the operator observes that the load begins to drift laterally in the direction of the swing — moving outward from beneath the boom tip due to centrifugal force. The LMI reading climbs from 88% to 94% during the swing. What does the 6% LMI increase during the swing indicate, and what should the operator do?

- A. The 6% increase indicates the LMI is malfunctioning — LMI readings cannot increase during a swing if load weight is constant
- B. Increase the hoist speed to raise the load and reduce the pendulum length, which will reduce the outward displacement
- C. The centrifugal displacement has increased the effective operating radius, reducing the rated capacity at the greater effective radius while the load weight remains constant — the operator should reduce swing speed to minimize centrifugal displacement and prevent the LMI from climbing further toward the rated capacity limit
- D. The 6% increase is within the LMI's accuracy tolerance and no action is required at 94% capacity

24. Under OSHA 1926.1416, when a load is too heavy to be safely lowered to the ground due to an emergency situation below the load's path, what alternative to complete lowering is authorized?

- A. The operator may hold the load at its current height using the drum pawl as the primary holding device while the emergency below is resolved, with the crane's engine left running to maintain hydraulic pressure

- B. The load may be swung to an adjacent clear area and set down there if the emergency makes lowering to the original ground location unsafe
- C. The load may not be lowered at reduced speed when the ground area below is blocked — operations must wait for the area to clear
- D. The only authorized alternative is confirming that supplemental securing conditions are met — barricading, warning signs, and authorization by a qualified person — while the load remains suspended and the operator remains at the controls

25. A crane operator is performing a lift when the crane's seat belt snaps and can no longer be fastened. This occurs during a heavy lift at 84% of rated capacity. What is the appropriate action?

- A. Continue the lift to the set point and have the seat belt repaired before the next lift
- B. Complete the current lift cycle at minimum speeds while bracing against the cab seat and door
- C. Lower the load to the ground at the earliest safe opportunity and have the seat belt repaired before continuing operations — operating without a properly functioning seat belt creates a fall hazard and limits the operator's ability to maintain effective control during sudden crane movement or tip-over
- D. The seat belt is required only during crane travel — during stationary lifting operations, the crane may be operated without a functioning seat belt

26. Under OSHA 1926.1431, which of the following is required to be performed immediately before the first personnel hoisting operation on a project?

- A. An OSHA compliance officer must observe the first personnel hoisting operation on every construction project
- B. A trial run with the unloaded platform must be performed to confirm that all crane functions work correctly throughout the full range of motion planned for the personnel hoisting operation
- C. A written certification from the crane's manufacturer must confirm the crane is rated for personnel hoisting applications
- D. A medical professional must confirm each platform occupant is physically fit for elevated work before the first lift of each day

27. A crane is operating in an area near other active construction equipment. During a lift, a nearby excavator swings its boom and bucket into an area adjacent to the crane's load swing path. The excavator operator does not appear to be aware of the crane's swing. What must the crane operator do?

- A. Continue the crane swing at reduced speed while honking the horn to warn the excavator operator
- B. Maintain current crane speed and trust that the excavator operator will see the crane before their paths intersect
- C. Stop all crane movement immediately — the excavator presents an uncontrolled hazard to the load path; crane operations must stop until the two equipment operators have established a communication plan that ensures their equipment does not occupy the same space at the same time
- D. Contact the lift director by radio while continuing the current swing movement

28. A crane operator is asked by the lift director to immediately lower a load because a second crane has experienced a mechanical failure on the other side of the structure and the load must be urgently set. The current crane is in the middle of a precision placement over an occupied building. What is the correct response?

- A. Lower the load as quickly as the hoist system will allow to respond to the urgent situation — the lift director's emergency direction takes priority over precision placement concerns
- B. The signal person must give a formal LOWER command before the operator may lower the load, regardless of verbal instructions from the lift director
- C. Lowering must be performed in a controlled manner at an appropriate speed regardless of urgency — "immediately lower" cannot be interpreted as authorization to release the load in free-fall or lower at an unsafe speed; controlled lowering at minimum-appropriate speed is required even in emergency situations
- D. The operator should request clarification from the lift director on acceptable lowering speed before executing any movement

29. Under OSHA 1926.1419, what specific requirement applies to the signal system when electronic communication is used between the operator and signal person?

- A. Electronic communication devices must be approved by the crane manufacturer before use during operations

B. Electronic communication systems must be tested at the beginning of each shift and whenever a failure or performance issue is suspected — both parties must confirm the system is functional and that commands can be clearly understood before and during operations

C. Only OSHA-approved communication frequencies may be used between signal persons and crane operators

D. Electronic communication between operator and signal person must be supplemented by backup hand signals at all times regardless of signal quality

30. A crane operator is completing a series of lifts when the crane's engine oil pressure warning light activates. The operator is in the middle of a swing with a load at 22 feet of height. What is the correct sequence of actions?

A. Complete the swing to the set location to secure the load before addressing the oil pressure warning

B. Stop the swing immediately, lower the load to the nearest safe resting surface at a controlled speed, and shut down the engine after the load is secured — the oil pressure warning indicates a potentially serious engine condition that could lead to sudden engine failure; the load must be secured before shutdown

C. Maintain the current load position while the oil pressure light clears — warning lights sometimes activate due to sensor faults and clear without requiring action

D. Radio the lift director for instructions while completing the current swing movement

31. A crane is performing a lift at 91% of rated capacity in an urban area. The signal person is positioned 80 feet from the crane cab. The operator is having difficulty reading the signal person's hand signals clearly due to distance. What action must be taken?

A. The operator should request the signal person to use larger, more exaggerated hand signals to improve visibility at 80 feet

B. Continue operations by inferring the intended signals from the lift sequence context and the signal person's position

C. Either the signal person must move to a position where their signals can be clearly read by the operator, or a relay signal person must be established to close the visibility gap — clear, unambiguous signal communication is required and cannot be substituted by inference or exaggeration of signals

D. Switch to electronic communication immediately — hand signals are prohibited when signal persons are more than 50 feet from the operator's cab

32. A crane operator is performing a precision pick of a 14,000-pound motor that must be maneuvered through a 6-foot × 6-foot roof opening to be lowered into a mechanical room below. The motor is 5 feet 10 inches in its largest horizontal dimension. What operational technique is critical to success for this placement?

- A. Confirm the load line is plumb directly above the center of the roof opening before beginning the descent, use minimum hoist speed throughout the lowering through the opening, maintain tag line rotation control, and ensure all personnel are clear of the motor's path both above and below the opening
- B. Use 4-part line instead of 2-part line to reduce the rate of descent through the opening
- C. Lower the motor rapidly to minimize the time it is in the confined clearance zone between the motor edge and the opening
- D. Have two riggers manually guide the motor through the opening by hand while the crane lowers at full speed

33. Under OSHA 1926.1427, when must the employer document that the crane operator is competent to safely operate the specific crane model being used?

- A. Only when the operator is new to the employer — experienced operators with long tenure do not require documented competency evaluations
- B. Before the operator performs crane operations at the specific worksite with the specific crane — the employer's documented evaluation of competency is required before the first lift, not after the operator has demonstrated performance in the field
- C. At least annually for operators performing critical lifts
- D. The employer's documented evaluation must be completed before the operator performs crane operations at the specific worksite — this evaluation is required for every new crane model or significant configuration change, not just once per operator per employer

34. A crane is performing a lift when the operator notices that the hook block is rotating — the load is spinning slowly on the hook. The load is an 18,000-pound fabricated steel assembly lifted by a four-leg wire rope sling bridle. What does the load rotation indicate and what action is required?

- A. Slow load rotation is caused by normal air resistance differences on the load's irregular surfaces — it is expected and does not require operational response

B. Load rotation indicates that the rigging attachment points are not symmetrically arranged above the load's actual center of gravity, or that the load has an inherent torque from its shape — the rotation must be arrested with a tag line before the load reaches height, and the rigging geometry should be evaluated to determine whether the attachment points need adjustment to prevent further rotation

C. The load may continue rotating as long as the rotation rate remains less than one revolution per minute

D. Increase hoist speed to lift the load above the area where air circulation is causing the rotation

35. Under ASME B30.5, what is the operator's specific authority when the crane begins making unexpected mechanical sounds during a heavy lift at near-capacity?

A. The operator should complete the lift and document the sounds for maintenance review after the load is set

B. The operator should contact the lift director before stopping to determine whether the sounds are significant enough to justify halting the lift

C. The operator has the authority and responsibility to stop all crane movement immediately and assess the source of the sounds before continuing — unexpected mechanical sounds during a near-capacity lift may indicate structural distress, a mechanical failure developing, or a connection becoming loose; any of these conditions could lead to sudden catastrophic failure

D. The operator should reduce the load weight by using the LMI override before investigating mechanical sounds

36. A crane operator is asked to perform a repetitive series of 20 lifts, all at identical configuration, load, and radius. The first lift is confirmed within capacity and performed successfully. Is a capacity check required for each subsequent lift?

A. A capacity check is required before every lift, including each repetitive lift in a series — however, for confirmed identical repetitive lifts, the capacity check may be abbreviated to confirming that the crane configuration, level condition, and load weight match the first lift's confirmed parameters rather than re-reading the full load chart from scratch

B. Capacity checks are only required for the first lift in any repetitive series — subsequent identical lifts are authorized by the first lift's confirmation

C. Repetitive lifts do not require individual capacity checks — only the initial series setup confirmation is needed

D. Each lift in a repetitive series requires a full written load chart review performed by the lift director

37. A crane operator is working in an industrial facility when the site's PA system announces an emergency evacuation of the building. The operator has a load suspended at 15 feet of height. What is the correct response?

- A. Remain at the crane controls and await confirmation that the evacuation includes the crane's work area before taking action
- B. Continue lowering the load at normal speed while evaluating whether the emergency affects the crane's location
- C. Attempt to contact the lift director to receive specific instructions for the crane before beginning any response
- D. Lower the load to the nearest safe surface as quickly as safely possible, sound the emergency horn to warn all personnel in the area, and evacuate following the facility's emergency procedures — emergency evacuation of the building includes all personnel and the crane operator cannot defer action pending further confirmation

38. A crane is completing a lift when the LMI alarm activates at 99% of rated capacity. The lift was planned and confirmed at 86% capacity. No change was made to the crane configuration. What are the two most likely causes of the unexpected 99% reading?

- A. LMI calibration drift and environmental electromagnetic interference are the two most likely causes — these are standard electronic causes of LMI over-reading
- B. The actual operating radius is greater than the planned value (due to boom deflection under load), or the actual total suspended weight is heavier than the documented value — both of these would increase the load moment acting on the crane beyond the planned value and produce a higher LMI reading
- C. The LMI is experiencing a sensor malfunction — the operator should reset the LMI and continue
- D. The hoist drum brake has partially engaged, creating resistance that is being measured as added load by the tension sensor

39. When a signal person is giving the LOWER signal, how is this signal distinguished from the LOWER BOOM signal in ASME B30.5 hand signals?

- A. The LOWER signal is a thumbs-down gesture with the arm fully extended horizontally, while LOWER BOOM uses the arm at 45 degrees from horizontal

B. The LOWER signal and LOWER BOOM signal use the same gesture but are preceded by different function identification signals

C. The LOWER signal uses an extended arm at shoulder height with the index finger pointing down, rotating in a downward circle, while the LOWER BOOM signal uses an extended arm with thumb pointing down; these are distinctly different gestures that require the operator to confirm which function is being directed

D. LOWER uses a closed fist pointed downward at the waist, while LOWER BOOM uses an open hand pointing at the boom

40. Under OSHA 1926.1431, before a crane is used for personnel hoisting for the first time on a project, what must the lift director confirm about the crane's load line?

A. The load line must be confirmed as meeting the 7:1 design factor required for personnel hoisting — this is typically confirmed through the rope manufacturer's documentation showing the rope's breaking strength equals at least seven times the maximum load that will be applied during personnel hoisting

B. The load line must have been installed within the previous 30 days before any personnel hoisting

C. The load line must be visually confirmed as free of all visible defects — no further documentation is required

D. The load line's breaking strength must be confirmed through a proof load test at 125% of the maximum personnel hoisting load

41. A crane operator is performing a complex structural steel pick that requires the load to be oriented at a specific angle relative to the set location. The rigger has set the sling attachment points to produce the required load angle. When the load breaks ground, it orients at a 15-degree tilt rather than the planned orientation. The lift director instructs the operator to use the crane's swing function to rotate the load to the correct angle while it is suspended. What is the correct response?

A. The operator may use gentle swing movements to slowly rotate the tilted load to the correct orientation as directed by the lift director

B. Slowly extend the telescoping boom sections to shift the load's attitude during the suspended hold

C. Boom down to reduce the radius while the rigging is being adjusted to correct the tilt angle

D. Stop the swing movement, lower the load back to the ground, and allow the riggers to adjust the rigging attachment to correct the tilt before re-attempting the pick — using crane functions to rotate a tilted load creates unpredictable lateral forces on the boom and may destabilize the load's rigging geometry

42. A crane is performing a personnel hoisting operation when the operator observes that the load line is twisting as the platform is raised — the platform appears to be rotating slowly. What action is required?

A. Continue raising the platform while contacting the lift director to report the rotation — small rotation is normal during personnel hoisting and does not require stopping

B. Stop the hoist and lower the platform to the ground — personnel hoisting with a rotating platform indicates the rigging or load line has a twisting condition that may unscrew hardware, disorient platform orientation, or exceed the load line's rotation limits; the condition must be resolved before personnel hoisting continues

C. Reduce hoist speed to minimum and allow the rotation to self-correct as the platform rises to working height

D. Have a ground worker hold the platform stationary using the tag line while the operator slowly hoists to working height

43. Under OSHA 1926.1416(d), what specific protection must be provided for all persons within the crane's swing radius, including the counterweight arc?

A. All personnel must maintain constant visual awareness of the crane's rotating upper works during operations

B. Audible warning signals must be sounded before each swing movement to warn personnel of the crane's rotation

C. The crane's swing radius, including the area swept by the counterweight, must be effectively barricaded to prevent personnel from entering — barricades must be physical barriers sufficient to prevent unauthorized entry, not just warning tape or cones

D. Hard hats and high-visibility vests are required for all personnel within 25 feet of the crane's rotating upper works

44. A crane operator is evaluating the required tip height for a planned lift over a 14-foot-tall temporary fence. The load is 8 feet tall and has a 6-inch chain sling connecting it to the hook block. The hook block itself is 24 inches tall. What is the minimum hook height required to clear the fence during the swing?

A. Minimum hook height = fence height + load height + sling + hook block clearance = 14 + 8 + 0.5 + 2 + additional clearance for safety margin; approximately 26 feet minimum hook height above grade including a reasonable safety margin

B. Minimum hook height =  $14 + 8 + 0.5 + 2 = 24.5$  feet above grade — at minimum hook height, the bottom of the load would be at exactly fence height, and with a 24-inch hook block and 6-inch sling, the hook would be 24.5 feet above grade

C. The minimum hook height calculation requires knowing the load's center of gravity height, not its total height

D. Minimum hook height = fence height alone — the load dimensions are accounted for separately by the signal person's STOP command

45. A crane is performing a lift in windy conditions. The load is a large architectural cladding panel 16 feet wide by 10 feet tall. Wind speed is 18 mph. The crane's general wind limit is 25 mph. The lift director states the lift may proceed since 18 mph is within the general limit. What additional evaluation must be performed?

A. The lift may proceed without further evaluation since the lift director has confirmed compliance with the general wind limit

B. The signal person must observe the load's behavior for 2 minutes in the wind before the lift director makes a final go/no-go decision

C. The lift director's authority supersedes the crane operator's wind assessment — no further evaluation is needed

D. The general wind limit was derived for compact loads — a 160-square-foot panel creates lateral wind forces many times greater than those on a compact load of equivalent weight; the operator must independently evaluate whether the wind force on the specific panel is acceptable regardless of whether the general limit has been reached

46. Under OSHA 1926.1427, what is the employer's obligation regarding crane operators who will be operating cranes on a new project with a different physical site layout than their previous project?

A. No new evaluation is needed if the operator holds a current certification for the crane type — the certification is portable and covers all sites

B. The employer must evaluate and document that the operator is competent to operate the specific crane at the specific new worksite — site-specific hazards, ground conditions, restricted work areas, and operational challenges at the new site may require evaluation even when the operator held a successful record at the previous site

C. The operator must self-certify their familiarity with the new site before beginning operations

D. A new site orientation by the lift director satisfies the employer's competency obligation for experienced operators

47. A crane is performing a lift when a new worker who has been on the job site for one week approaches and attempts to give the operator a HOIST signal to begin the next lift — the regular signal person has left briefly. The new worker is not a designated or qualified signal person. What must the operator do?

A. Respond to the new worker's signal if the operator confirms the next movement is clearly a routine hoist

B. Accept the new worker's signal if the lift director verbally authorizes the worker to give this one signal

C. Not respond to any signal from the unqualified worker — under OSHA 1926.1419, signals may only be given by the designated signal person except for Emergency Stop signals; no crane movement may occur based on a signal from an unqualified, non-designated person

D. Accept the signal since it is consistent with the planned lift sequence and the operator knows what comes next

48. A crane operator completes a shift having successfully performed 12 critical lifts at between 82% and 90% of rated capacity. At the end of the shift, the maintenance crew informs the operator that the crane's boom hoist rope has been scheduled for replacement that evening. Upon seeing the scheduled rope, the operator notices the replacement rope has a different lay direction than the original — the original was right regular lay and the replacement is right lang lay of the same diameter and grade. What must be verified before the replacement rope is installed?

A. Only the diameter and grade need to match — lay direction is not a specified parameter in ASME B30.5 for hoist rope replacement

B. Nothing additional is required — the maintenance crew is responsible for selecting the correct replacement rope

C. The lay direction is a specific rope parameter that affects how the rope performs on the drum and through sheaves — the crane manufacturer's rope specification must be confirmed to allow lang lay construction before installation; if the specification requires regular lay, the replacement must match

D. Right lang lay is always superior to right regular lay and may be substituted without verification

## TECHNICAL KNOWLEDGE DOMAIN — Questions 49–70

49. A crane inspector finds that the main hoist wire rope shows a pattern of wire breaks concentrated at a consistent location in the rope — specifically at the point where the rope contacts the boom tip sheave during the crane's typical working position. What is the specific term for this type of fatigue failure and what does it indicate?

- A. This is called "tread fatigue" — the concentrated wire breaks indicate normal fatigue from the combined effects of tension and bending at the primary working position of the sheave
- B. This is a specific failure pattern that confirms the rope is near the end of its service life — the breaks indicate the rope has experienced more flexing cycles than its design allows at this specific contact point
- C. This is not a recognized failure mode — wire breaks at consistent locations indicate external damage rather than fatigue
- D. The consistent pattern of breaks at the primary sheave contact position is diagnostic of reverse bending fatigue — the rope wires experience reversed tensile and compressive stresses as they wrap over and unwrap from the sheave on each hoist cycle; this is one of the most damaging fatigue mechanisms in crane wire rope applications

50. A rigger is selecting a shackle for a lifting application where the load will impose angular forces on the shackle. The shackle must be aligned with the load line so the forces act in the plane of the shackle bow. What is the specific concern when the force is applied at 30 degrees off the axis of the shackle bow rather than in-line?

- A. No concern exists — shackles are rated for all loading angles up to 45 degrees off-axis without derating
- B. ASME B30.26 provides capacity reduction factors for shackle bow loading at angles off the bow's intended loading axis — a 30-degree off-axis load reduces the shackle's capacity and the appropriate derating factor must be applied to ensure the reduced capacity is adequate for the applied load
- C. Off-axis loading on a shackle bow is acceptable as long as the pin is locked with a mousing wire
- D. Off-axis shackle loading is addressed by rotating the shackle to align the bow with the resultant force direction

51. Under ASME B30.9, when a wire rope sling is in a choker hitch and the choke angle is less than 120 degrees, what capacity adjustment is required?

- A. No capacity adjustment is needed — the choker WLL already accounts for all angles from 0 to 180 degrees in the standard choker configuration
- B. The WLL decreases as the choke angle decreases below 120 degrees — ASME B30.9 provides a table of derating factors for choke angles below 120 degrees that must be applied to the standard choker WLL; the operator must use the appropriate derating factor for the actual choke angle
- C. The capacity is reduced by 25% for any choke angle between 90 and 120 degrees
- D. Choke angles below 120 degrees require upgrading to a Grade 80 chain sling rather than a wire rope sling

52. A crane is performing its annual comprehensive inspection. The inspector finds that the crane's counterweight mounting brackets show cracking at the weld connection between the bracket and the rotating bed. There are two visible cracks, each approximately 1/4 inch long. What action does ASME B30.5 require?

- A. The crane must be removed from service — any crack in a structural weld connection is a removal condition; the counterweight mounting bracket weld carries the full weight and inertia of the counterweight, and weld cracking in this location indicates structural fatigue that can rapidly progress to complete joint failure under operational loading
- B. The crane may continue at 50% rated capacity while the cracks are monitored at monthly intervals
- C. Weld cracks of 1/4 inch length are within the acceptable defect tolerance for structural welds on mobile cranes
- D. Apply a temporary repair weld over the cracks and perform a proof load test before returning to service

53. A rigger is inspecting a synthetic round sling before use and finds the outer cover has a small hole where the cover material has worn through — a section of approximately 1/4 inch square has worn away. The inner fibers are visible through the hole but appear uncut. What action does ASME B30.9 require?

- A. The sling may be used at 75% of its rated capacity if the exposed fibers are confirmed intact
- B. The exposed fibers must be cut to even the opening and the sling re-tagged at a reduced capacity before use
- C. The outer cover provides no structural contribution — the capacity is determined solely by the inner fibers, which appear intact; the sling may continue in service

D. The sling must be removed from service — any hole in the outer cover that exposes the inner load-bearing core fibers is a removal condition under ASME B30.9; the cover protects the fibers from damage and once compromised, the fiber integrity cannot be confirmed by visual inspection alone

54. Under OSHA 1926.1412(e), what specific inspection must be performed after a crane experiences a load drop?

A. The crane must receive a new monthly periodic inspection within 15 days of the load drop incident

B. A post-incident inspection by a qualified inspector is required before the crane returns to service — a load drop may have subjected the crane's structural and mechanical components to shock loads significantly above the rated capacity, and the inspection must confirm whether any damage occurred before the crane is used again

C. The crane may return to service after the operator performs a pre-shift inspection and confirms normal operation

D. A load drop requires OSHA notification within 8 hours, but no specific inspection requirement applies if no personnel were injured

55. A crane operator is reviewing maintenance records and finds that the crane's hydraulic filter was last changed 14 months ago. The manufacturer's specification calls for filter replacement every 6 months or 500 hours. The crane has accumulated 320 hours since the last filter change. What does this maintenance record reveal about the crane's current condition?

A. Hours are the controlling factor — at 320 hours since the last change, the 6-month interval has been exceeded but the 500-hour interval has not, so no action is required

B. The filter change deadline was based on the 6-month calendar interval — since 14 months have passed, the filter is overdue by 8 months regardless of hours; overdue hydraulic filter maintenance can allow contaminants to circulate through the system, accelerating wear on pumps, valves, and cylinder seals

C. Both intervals are guidelines — the actual filter condition determines when it needs to be changed, regardless of time or hours

D. The maintenance oversight was a minor administrative error — hydraulic filter condition only affects the crane's oil temperature, not its structural capacity

56. A crane inspector finds a section of the load line wire rope where the outer wire strands have been flattened by rope-on-rope contact on the drum — cross-winding has caused the rope to be compressed between the upper layer and the lower layer as it wound onto the drum. The flattened section is approximately 18 inches long. What is required?

A. Rope flattening from drum cross-winding is acceptable as long as the flattened section is in the portion of the rope that remains on the drum during normal operations

B. Flattened rope may continue in service with increased inspection frequency since no wires are broken

C. Rope flattening from cross-drum contact must be evaluated against ASME B30.5's deformation removal criteria — rope that has been plastically deformed by cross-winding has distorted wire and strand geometry that creates stress concentrations and may have reduced tensile capacity; the affected section must be evaluated by a qualified inspector

D. Cross-winding flattening is a drum maintenance issue — only the drum requires replacement, not the rope

57. A crane's ATB system is tested during pre-shift inspection. When the ATB weight is lifted by hand, the hoist-up function is interrupted correctly. However, when the weight is released, the ATB circuit does not automatically reset — the hoist function remains interrupted even after the weight is fully lowered. The crane operator believes this is acceptable since the ATB has confirmed it can interrupt hoisting. What is the correct assessment?

A. The operator is correct — the ATB test confirms the interrupt function works; the non-reset condition is a separate issue that can be addressed at the next scheduled maintenance

B. Nothing is wrong — some ATB systems require manual reset after each test activation and this is normal behavior for the crane model

C. The ATB system must be confirmed to both activate and automatically reset correctly — an ATB that does not automatically reset will prevent normal hoist operations and will not protect against two-blocking because it will remain tripped even when the hook is well below the boom tip; the crane must not be operated until the ATB reset function is confirmed operational

D. The crane may be operated with manual ATB reset as long as the operator monitors hook height continuously

58. Under ASME B30.9, what must be done when a wire rope sling is removed from service due to an identified deficiency?

- A. The removed sling must be tagged with the deficiency description and stored separately from serviceable slings until it can be repaired
- B. The sling must be cut or otherwise rendered unusable before disposal — storage of removed slings or return to service without documented repair by an authorized facility is prohibited
- C. The removed sling must be returned to the manufacturer for evaluation and potential recertification
- D. The sling removal must be documented and the lift director must authorize disposal before the sling can be destroyed

59. A crane's load line has been subjected to a sudden dynamic shock load — the load struck an obstruction during lowering and the rope experienced a severe jerk. The rope appears undamaged visually. What must be done before the rope is used for any subsequent lift?

- A. Visually inspect the rope along its full length and return to service if no visible damage is found
- B. Continue using the rope normally — a single shock event is within the rope's design safety factor
- C. The rope must be carefully inspected by a qualified inspector along its full length for deformation, crown wire protrusion, and any change in diameter — shock loads can cause internal wire damage and strand geometry disruption that is not visible externally; if the inspection confirms the rope is within all applicable criteria, it may return to service, but any identified deficiency requires removal
- D. Replace the rope automatically after any known shock load event — no inspection is required since the rope must be replaced

60. A crane is operating in sub-zero temperatures when the hydraulic oil temperature gauge shows the fluid is at 12°F (-11°C). The oil has not been warmed up before operations began. What specific risk does operating hydraulic systems with extremely cold fluid create?

- A. Cold hydraulic fluid causes the crane to automatically reduce operating speed — this is a built-in protection feature that prevents damage during cold weather operations
- B. The crane's temperature sensors will shut down the hydraulic system automatically if fluid temperature is too low for safe operation
- C. Operating hydraulic pumps with extremely cold, high-viscosity fluid creates cavitation risk — the pump cannot draw fluid fast enough to fill the pump chamber, causing momentary vacuums that collapse violently, eroding pump components; additionally, cold fluid cannot adequately lubricate hydraulic components, accelerating wear
- D. Cold hydraulic fluid creates a safety benefit by reducing the risk of hydraulic hose fires since cold fluid is less flammable than warm fluid

61. Under ASME B30.5 and OSHA 1926.1412, when must a crane receive a "frequent" inspection versus a "periodic" inspection?

- A. Frequent inspections are required after every lift above 75% of rated capacity — periodic inspections are required monthly regardless of use
- B. The inspection intervals are determined by the crane owner based on the manufacturer's recommendations and usage history
- C. Periodic inspections are triggered by operational incidents — any incident requires a periodic inspection within 30 days
- D. Frequent inspections are performed daily before each work shift; periodic inspections are performed at monthly intervals during regular service, or as otherwise prescribed by B30.5 based on use frequency — both are required and neither substitutes for the other

62. A crane inspector discovers that the slewing ring retaining bolts show evidence of fretting — a fine reddish-brown powder consistent with micro-movement between the bolt heads and the flanges. What does bolt fretting indicate about the slewing ring condition?

- A. Fretting on slewing ring retaining bolts indicates cyclic micro-movement at the bolt interfaces — this typically indicates the bolts have loosened or are at the threshold of losing their clamping preload; loose slewing ring bolts can allow the ring to move relative to its mounting flange, leading to bolt fatigue fracture and potential sudden separation of the upper works from the carrier
- B. Bolt fretting is a cosmetic surface oxidation that indicates normal environmental exposure and requires no structural action
- C. Fretting indicates the bolts are properly torqued — the micro-movement occurs only at correct torque levels
- D. Fretting requires only that the bolt contact surfaces be cleaned with solvent before re-torquing to the correct specification

63. A crane's wire rope is found during annual inspection to have a section with significantly altered lay length — the lay length in a 6-inch section is 40% greater than the nominal manufacturer's specification. What does altered lay length indicate about the rope's condition?

- A. An increased lay length is a beneficial aging characteristic indicating the rope has fully seated and equilibrated after initial loading

B. Rope lay length changes are normal and do not affect rated capacity as long as no wire breaks are present

C. A 40% increase in lay length in a localized section indicates the rope's internal geometry has been permanently altered — the strands have been separated, twisted open, or the core has failed locally; this is consistent with overloading, kinking history, or external damage and requires removal from service since the structural integrity at that section is compromised

D. Lay length increase indicates the rope has achieved maximum compaction — this actually improves the rope's resistance to bending fatigue

64. Under ASME B30.26, what is the specific requirement for eyebolts used in lifting applications regarding their installation direction?

A. Eyebolts must always be installed so the load acts perpendicular to the bolt shank axis — inline loading is not permitted for eyebolt applications

B. The eye of an eyebolt must be oriented in the plane of loading — for angular pulls, the eyebolt must be oriented so the load passes through the eye in the plane of the eye opening, not across the eye axis; a load applied across the narrower dimension of the eye (in the transverse direction) is not the intended loading for eyebolts and dramatically reduces capacity

C. Eyebolts may be installed in any orientation as long as the bolt is fully threaded and seated against the load surface

D. The eyebolt installation direction is governed by the thread size and bolt length, not by the load direction

65. A crane is performing a hoist operation when the operator notices that the wire rope appears to be balling up on one side of the drum as it spools — the rope is piling into one area of the drum rather than winding evenly across the drum width. What does this indicate and what is required?

A. Rope piling on one side of the drum is a common characteristic of certain rope constructions and is not a safety concern

B. Monitor the piling pattern and stop operations only if the rope begins to overflow the drum flanges

C. The piling will self-correct once additional rope is wound over the irregular section

D. Uneven rope spooling onto the drum indicates a drum fleet angle problem or a rope guide issue that is causing the rope to mistrack — the uneven load distribution can cause the rope to crush under

subsequent layers, cross-wind over itself, and eventually prevent smooth operation or cause the rope to jump the drum flanges; the condition requires investigation and correction before further operations

66. A rigging hardware inspection finds that a jaw-end swivel has its jaw opening deformed — the jaw spread is 15% wider than the nominal dimension, similar to how a hook throat can be stretched by overloading. What action does this condition require?

A. Monitor the jaw spread at monthly intervals — removal is required only when the spread exceeds 20%

B. The swivel must be removed from service immediately — jaw deformation indicates the swivel has been overloaded beyond its elastic limit, permanently deforming the jaw structure and reducing the swivel's rated load capacity; any plastic deformation in a lifting hardware component is a removal condition

C. Reduce the swivel's WLL by 15% proportional to the 15% jaw spread increase and return to service with the adjusted rating

D. Repair the jaw by pressing it back to the nominal dimension and document the repair before returning to service

67. Under ASME B30.5, what is the minimum number of rope clips required for a 1-inch diameter wire rope, and what must the distance between adjacent clips be?

A. A minimum of 4 clips are required for 1-inch rope, spaced at a minimum of 5.5 rope diameters (5.5 inches) apart

B. A minimum of 3 clips are required for 1-inch rope, spaced at 6 diameters apart

C. Clip count and spacing for 1-inch rope are determined by the clip manufacturer's application chart, which specifies a minimum of 4 clips at 5-3/4 rope diameter spacing (approximately 5.75 inches between clips) for 1-inch rope to develop adequate grip strength

D. A minimum of 5 clips are required for 1-inch rope with uniform spacing across the full dead end length

68. A crane's hook block is found to have a swivel that turns with significant resistance — the swivel requires 25 ft-lbs of torque to rotate when tested with no load, compared to the manufacturer's specification of 5 ft-lbs maximum for free-rotation. What is the operational consequence of this stiff swivel and what action is required?

- A. The 25 ft-lb resistance means the swivel will not rotate freely during normal operations — torsional loads from load rotation will transfer directly into the rope rather than being absorbed by the swivel; this accumulates rope twist, reduces the rope's rated capacity, and may cause sudden untwisting of accumulated torque; the swivel must be repaired or replaced before further operations
- B. The 25 ft-lb resistance is acceptable for heavy lifts — it only affects light-load precision placements
- C. A stiff swivel reduces the hook block's maximum lowering speed and requires reduced hoist speed during lowering operations
- D. The swivel resistance can be reduced to acceptable levels by applying grease to the swivel ball race — apply grease and retest before concluding the swivel requires replacement

69. A crane operator is asked about the function of the crane's over-hoist limit switch. Which description correctly identifies its purpose and limitation?

- A. The over-hoist limit switch stops the hoist motor if the hook block rises above the preset maximum height — it prevents two-blocking and is the primary safety device against over-hoisting; however, it is tested by actually hoisting the hook block to the switch activation height, which is the correct test method
- B. The over-hoist limit switch activates when the load exceeds the rated capacity at the current radius — it interrupts the hoist function to prevent overloading
- C. Some cranes use an over-hoist limit switch as a backup or alternative to the ATB system — it stops the hoist at a preset travel limit but should not be used as a routine stop position since the position may be inaccurate at different boom angles; it serves as a backup to the ATB, not a replacement, and its reliability at all boom angles must be confirmed
- D. The over-hoist limit switch limits maximum hoist speed to protect the rope from impact loads when the hook is raised too quickly

70. A crane inspector identifies that the boom's lower chord (the bottom compression member) shows surface corrosion covering approximately 25% of one 10-foot-long chord section. The corrosion has created visible pitting on the steel surface. What is the appropriate action?

- A. Surface corrosion on boom chord members is cosmetic — structural capacity is unaffected as long as no through-wall penetration has occurred
- B. Wire brush the corroded area to remove loose rust, apply a rust inhibitor, and return the crane to service

C. Remove the crane from service and have the corroded chord section evaluated by the crane manufacturer or a qualified structural engineer — pitting corrosion removes material from the cross-section of a structural compression member, reducing both its compressive capacity and its resistance to buckling; the extent of cross-section reduction and the effect on the crane's rated capacity cannot be determined without engineering assessment

D. Apply structural epoxy to fill the pits and restore the surface profile before returning to service

### **LOAD CHARTS DOMAIN — Questions 71–95**

71. A crane's load chart for the full outrigger extension section shows: 100-foot boom at 35 feet = 26,200 lbs; at 40 feet = 20,800 lbs. The planned operating radius is 37 feet. The hook block weighs 1,900 lbs, slings weigh 480 lbs, and hardware weighs 140 lbs. The payload weighs 17,800 lbs. Using the conservative approach, is the lift within capacity?

A. Interpolated capacity at 37 ft = 23,960 lbs; total suspended weight = 20,320 lbs; lift proceeds

B. Conservative capacity at 40 ft = 20,800 lbs; total suspended weight =  $1,900 + 480 + 140 + 17,800 = 20,320$  lbs; since 20,320 lbs is within 20,800 lbs, the lift proceeds conservatively

C. Conservative capacity at 40 ft = 20,800 lbs; total suspended weight = 20,320 lbs; the 480-lb margin is very tight and warrants careful radius management

D. Conservative capacity at 35 ft = 26,200 lbs; using the previous tabulated value is the proper conservative method

72. A crane's load chart shows a note: "Capacities shown in this section are net load capacities — hook block, all rigging, and spreader beam weights have been pre-deducted. The values represent maximum payload only." The tabulated capacity at the planned configuration is 24,400 lbs. The payload weighs 23,800 lbs. Can the crane proceed with this lift?

A. Yes — 23,800 lbs is below the tabulated 24,400 lbs net capacity; the lift may proceed

B. The lift may proceed since the note confirms the rigging deductions are already included

C. Additional verification of hook block and rigging weights is needed before proceeding

D. The note's instruction that "values represent maximum payload only" means the hook block and rigging are additional to the tabulated value — the tabulated 24,400 lbs is the payload limit and any

additional rigging would push the total above the gross capacity; the operator must verify whether the specific rigging weights have been pre-deducted or not

73. A crane is configured with a 100-foot boom. The load chart shows 22,400 lbs at 40 feet and 17,200 lbs at 45 feet. After completing a lift at 42 feet of radius, the operator is directed to boom down to increase the radius to 48 feet for the set location. The load chart shows 12,800 lbs at 50 feet. The total suspended weight is 19,800 lbs. What is the issue?

- A. The boom-down movement from 42 to 48 feet is within the rated envelope and may be executed
- B. The load chart must be checked at both the 45-foot and 50-foot entries — since 48 feet falls between them and the conservative value at 50 feet is 12,800 lbs, the 19,800-lb total suspended weight exceeds the conservative capacity at the planned set radius
- C. The total suspended weight at 19,800 lbs is within capacity at 45 feet — the operator may boom to 45 feet and set the load there
- D. The lift cannot proceed at 42 feet since 19,800 lbs exceeds the 22,400-lb capacity at 40 feet

74. A crane load chart contains a "TELESCOPING OPERATION" section that provides capacities while the boom is being extended or retracted under load. This section shows lower capacities than the "FIXED BOOM" section at the same final radius. What is the reason for the lower capacities during telescoping operations?

- A. The lower telescoping capacities account for the weight of hydraulic fluid displaced during the telescoping operation
- B. During telescoping operations, the boom section transitions create temporary unsupported intermediate conditions and the hydraulic extension force is active — these conditions produce structural loading patterns not present during fixed-length operations, requiring reduced capacity to maintain structural safety margins
- C. The lower capacities are caused by the reduced reeving efficiency during boom extension movements
- D. The telescoping section values are lower because they account for the added weight of the telescoping mechanism itself

75. A crane load chart section note reads: "For lifts at radii shown in this section, the maximum permissible boom angle is 78 degrees. Exceeding 78 degrees with these capacity values voids the

rating." The planned lift requires a 42-foot radius with an 80-foot boom, which requires a boom angle of approximately 58 degrees. Does the 78-degree note apply to this lift?

- A. Yes — any lift in this section must respect the 78-degree maximum; even though the planned angle of 58 degrees is well within the limit, the operator must confirm the boom will not exceed 78 degrees at any point during the lift including setup and transitions
- B. No — the 78-degree note is not relevant since the planned angle is well below the maximum
- C. The 78-degree limit applies only to pick-and-carry operations in this section
- D. The 78-degree maximum applies only when the load exceeds 85% of the section's rated capacity

76. A crane load chart for a 100-foot boom at full outrigger extension shows: 25 ft = 46,200 lbs; 30 ft = 36,800 lbs; 35 ft = 29,400 lbs; 40 ft = 23,200 lbs. All four cells are shaded, with the legend indicating shaded = structural-limited. A lift is planned at 32 feet with a total suspended weight of 32,000 lbs. After interpolation between 30 and 35 feet, what is the estimated capacity at 32 feet, and what specific operational consideration does the structural-limited designation impose?

- A. Interpolated capacity = 34,360 lbs; 32,000 lbs is within capacity; structural-limited lifts require written pre-lift authorization from the manufacturer
- B. The operator must use the conservative 35-foot value of 29,400 lbs; 32,000 lbs exceeds this — the lift cannot proceed
- C. Interpolated capacity at 32 ft =  $36,800 - [(32-30) \div (35-30)] \times (36,800 - 29,400) = 36,800 - (0.4 \times 7,400) = 36,800 - 2,960 = 33,840$  lbs; 32,000 lbs is within this capacity; structural-limited cells require that crane movements be exceptionally smooth to avoid adding dynamic loads to the already near-limit structural stress
- D. The lift cannot proceed since structural-limited cells can never be used for lifts above 80% of the tabulated capacity

77. A crane's load chart shows that on-rubber capacity at 25 feet of radius is 11,400 lbs, while on-outrigger full extension capacity is 44,800 lbs at the same configuration. The ratio of on-rubber to on-outrigger capacity is approximately 25%. A lift director asks why the on-rubber capacity is so much lower when the crane's structure is the same in both configurations. What is the correct explanation?

- A. On-rubber operations require reduced capacity because the rubber tires create hydraulic fluid heating that reduces system performance

B. The on-rubber capacity is lower because the outrigger jack cylinders have a higher structural rating than the tire axle rating

C. The stability footprint on rubber is limited to the narrow spread between the crane's tires — typically much smaller than the full outrigger spread; tipping stability is governed by the moment of tipping force about the tipping axis, and the narrow tire spread means the tipping axis is much closer to the load, dramatically reducing the crane's resistance to overturning compared to full outrigger extension

D. On-rubber capacities are reduced by OSHA mandate to provide additional safety margin for mobile operations

78. A crane's load chart shows capacity values for a 100-foot boom at 30 feet = 38,400 lbs and at 35 feet = 30,200 lbs. These are both in the "stability-limited" (unshaded) category. The crane is operating 30 feet from a retaining wall that could fail if the crane tips toward it. At 91% of the 35-foot capacity (30,200 lbs), what operational precaution does the stability-limited designation at near-capacity require?

A. Nothing additional — the load chart values include all necessary safety margins for any operational condition

B. The crane must be repositioned away from the retaining wall before a stability-limited lift above 85% can proceed

C. There is no additional requirement for stability-limited lifts compared to structural-limited lifts at equivalent percentages

D. Stability-limited capacities at near-100% represent lifts close to the tipping threshold — any out-of-level condition, centrifugal load displacement from swing, or boom side-loading can push the effective load moment beyond the actual tipping point; near-capacity stability-limited lifts require the crane to be level within manufacturer tolerance, swing speeds minimized, and all conditions confirmed before hoisting above ground

79. A crane load chart for a lattice boom crane shows that the over-side capacity at 50 feet is 82,000 lbs and the over-end capacity at 50 feet is 54,000 lbs. The operator is performing a series of lifts that requires the boom to swing from the over-end position (0 degrees) to the over-side position (90 degrees). During the swing, the boom passes through positions at 30 and 60 degrees. The crane does not have a 360-degree section. What capacity governs throughout the swing?

A. The over-side capacity of 82,000 lbs governs since the boom spends more time in the over-side sector than the over-end sector

B. Each sector's capacity governs while the boom is within that sector — the operator must know the angular limits of each rated sector

C. The operator should interpolate between the over-end and over-side values based on the boom's angular position throughout the swing

D. Neither the over-end nor over-side section directly covers intermediate positions — but the over-end capacity of 54,000 lbs is the most restrictive of the two available rated values, and if the lift must pass through the over-end sector, that value governs for the portions of the swing in that sector; the total suspended weight must be within 54,000 lbs throughout the entire swing

80. A crane load chart note states: "Capacities in this section do not apply when the wind speed measured at the hook point exceeds 20 mph." The operator is using an anemometer that measures wind at grade level (ground level), not at the hook point. The grade-level reading is 15 mph. At what wind speed should the operator estimate the wind at hook point, and what impact does this have on operations?

A. Wind speed at the hook point equals the grade-level reading — wind speed is constant with height in any stable atmospheric condition

B. Estimate wind speed at 1.2 times the ground-level measurement for hook heights above 50 feet, consistent with standard meteorological wind shear factors — at 15 mph ground level, estimated hook-point wind may be 18 mph, still within the 20 mph limit, but very close to the operational threshold

C. Wind speed increases with height due to reduced surface friction (the atmospheric boundary layer effect) — at hook heights typical for crane operations, wind speed at the hook point can be 1.5 to 2 times the ground-level measurement; at 15 mph ground level, wind at hook height could potentially approach or exceed the 20 mph limit, and this possibility must be evaluated before relying on the ground-level reading

D. Wind speed at height is always lower than at grade level — elevated hook points are sheltered from ground-level turbulence

81. A crane is configured with a 100-foot boom and an 80-foot boom configuration available. At 35 feet of radius, the 100-foot boom shows 26,800 lbs in the full outrigger extension section and the 80-foot boom shows 32,200 lbs. The operator is planning a lift that requires tip height clearance of 75 feet above grade — only achievable with the 100-foot boom. The total suspended weight is 25,000 lbs. Can the lift proceed?

A. The lift must use the 80-foot boom section since it shows higher capacity at 35 feet — tip height requirements are secondary to rated capacity

B. The lift may proceed using the 100-foot boom configuration and its 26,800-lb capacity — the 25,000-lb total suspended weight is within the 100-foot boom's capacity at 35 feet; the required 75-foot tip height confirms the 100-foot boom is the correct configuration for this lift

C. The operator should verify tip height using the working area diagram before selecting the boom configuration

D. Since the 80-foot boom shows higher capacity at 35 feet, it is the correct and required configuration regardless of the tip height requirement

82. A crane's load chart shows the following for the "ON OUTRIGGERS — 50% EXTENSION" section: at 30 feet, gross capacity = 22,400 lbs; at 35 feet, gross capacity = 17,200 lbs. A lift is planned at 32 feet of radius using this configuration. The conservative capacity is 17,200 lbs at 35 feet. The total suspended weight is 15,800 lbs. What is the lift percentage based on the conservative capacity?

A. Lift percentage based on 22,400 lbs at 30 ft = 70.5%; lift proceeds

B. Lift percentage based on 17,200 lbs at 35 ft = 91.9%; the lift proceeds but exceeds the 75% critical lift threshold requiring a written plan and pre-lift meeting

C. Lift percentage =  $15,800 \div 17,200 \times 100 = 91.9\%$ ; the conservative approach confirms this is a critical lift requiring a written plan and pre-lift meeting

D. Lift percentage =  $15,800 \div 22,400 \times 100 = 70.5\%$ ; the lift is below the 75% critical lift threshold and proceeds without a formal critical lift plan

83. A crane load chart shows a capacity of 28,600 lbs in a specific cell, with a note attached: "This capacity is reduced by 20% when operating in the over-front direction only." The operator is planning a lift with the boom at 15 degrees left of the crane's front center. What is the applicable capacity for this lift?

A. The full 28,600-lb capacity applies since the boom is not pointed directly over front — the over-front reduction applies only at exactly 0 degrees (straight ahead)

B. The 20% reduction factor applies only when the note specifically defines the over-front direction's angular extent — without knowing the defined sector width, the note cannot be applied

C. The applicable capacity =  $28,600 \times 0.80 = 22,880$  lbs — the note applies to the over-front direction, and without a specific sector boundary definition, 15 degrees from front center is within the over-front region; the operator must confirm the sector boundary with the manufacturer if the definition is ambiguous, but should apply the conservative interpretation that 15 degrees from front is within the "over-front direction"

D. The applicable capacity =  $28,600 \text{ lbs} \times 0.90 = 25,740 \text{ lbs}$  — applying a 10% interpolated reduction for the 15-degree offset from the over-front centerline

84. A crane load chart section shows a note: "These capacities are provided for planning purposes only and may not be used without written manufacturer authorization for each specific lift." A lift director has obtained planning confirmation from the crane's distributor (not the manufacturer) and asserts this satisfies the note. What is the correct assessment?

A. Authorization from the crane's distributor satisfies the manufacturer authorization requirement since distributors are authorized representatives of the manufacturer

B. Planning confirmation from any authorized crane service provider satisfies the note's written authorization requirement

C. An informal planning confirmation from any source satisfies the note since it was only required for planning purposes

D. The note specifically requires written authorization from the manufacturer — not from a distributor, dealer, or other representative; the capacity values in this section cannot be used without the manufacturer's specific written authorization for the planned lift, and the lift must not proceed without this confirmation

85. A crane is operating at 35 feet of radius. The full outrigger section shows 32,200 lbs at 35 feet. The total suspended weight is 29,800 lbs. The LMI reads 92.5%. After the pick, the operator completes the swing and is directed to set the load at 38 feet of radius. The capacity at 40 feet is 26,400 lbs (the next tabulated value after 35 feet). Using the conservative approach, does the lift proceed to the 38-foot set?

A. The 35-foot capacity of 32,200 lbs governs the set since the radius increase is only 3 feet

B. The 38-foot radius is between 35 and 40 feet — the conservative capacity at 40 feet is 26,400 lbs; 29,800 lbs exceeds 26,400 lbs, so the lift cannot be completed at 38 feet without reducing the load or reconfiguring the crane for higher capacity at 38 feet

C. The lift proceeds since the LMI has confirmed 92.5% at the pick radius and the operator has already demonstrated load compliance

D. Interpolated capacity at 38 ft = 29,560 lbs; 29,800 lbs exceeds the interpolated capacity — the lift does not proceed

86. A crane is configured with a 120-foot boom. The load chart shows 12,400 lbs at 55 feet and 9,200 lbs at 60 feet. A planned lift requires a pick at 53 feet and a set at 57 feet. Using the conservative approach, what are the governing capacities for each position?

- A. Pick at 53 ft: interpolated = 13,520 lbs; set at 57 ft: interpolated = 11,200 lbs — the set governs
- B. Pick at 53 ft: conservative = 12,400 lbs at 55 ft; set at 57 ft: conservative = 9,200 lbs at 60 ft — 9,200 lbs governs the overall lift plan
- C. Pick at 53 ft: conservative = 9,200 lbs at 60 ft; set at 57 ft: conservative = 12,400 lbs at 55 ft — both require evaluation
- D. Pick at 53 ft: conservative = 12,400 lbs at 55 ft; set at 57 ft: conservative = 9,200 lbs at 60 ft — confirming that total suspended weight must stay below 9,200 lbs for the complete lift

87. A crane load chart shows a capacity of 19,200 lbs at 45 feet with a 100-foot boom. A note reads: "DO NOT EXCEED 1.0 RPM SWING SPEED AT OR BEYOND 40 FEET OF OPERATING RADIUS." The operator is performing a swing at 46 feet of radius at 1.4 rpm. The LMI shows 88% capacity. What is the compliance issue?

- A. The note is advisory — a 0.4 rpm excess over the 1.0 rpm limit is within normal operating variance
- B. The note is satisfied since the LMI confirms 88% capacity, which is below 100%
- C. The operator is at 88% of a capacity value that was rated under the condition of 1.0 rpm maximum swing speed — operating at 1.4 rpm violates this binding note condition; the capacity value at this cell cannot be used at 1.4 rpm swing speed, and the operator must either reduce swing speed to 1.0 rpm or contact the manufacturer for capacity at 1.4 rpm
- D. The swing speed note applies only to loads above 90% of rated capacity — at 88%, the 1.0 rpm limit does not apply

88. A crane load chart shows gross capacity values in short tons. At 30 feet of radius with an 80-foot boom, the capacity is 20.5 tons. The total rigging weight is 2,800 lbs and the payload weighs 33,000 lbs. What is the total suspended weight in pounds, and is the lift within the rated gross capacity?

- A. Gross capacity = 20.5 short tons  $\times$  2,000 lbs/ton = 41,000 lbs; total suspended weight = 33,000 + 2,800 = 35,800 lbs; 35,800 lbs is within 41,000 lbs — lift proceeds
- B. Gross capacity = 20.5 metric tons  $\times$  2,205 lbs/ton = 45,203 lbs; total = 35,800 lbs; lift proceeds

C. Gross capacity = 20.5 short tons = 41,000 lbs; total = 35,800 lbs; the lift proceeds within gross capacity; note that the lift percentage = 87.3%

D. Gross capacity = 20.5 tons × 2,240 lbs/long ton = 45,920 lbs; this confirms the lift proceeds within capacity

89. A crane's load chart for a telescopic boom crane shows capacity values in a section labeled: "FULL OUTRIGGER EXTENSION — 360-DEGREE OPERATION — STANDARD COUNTERWEIGHT — BOOM ANGLES 45° TO 78°." The planned lift requires a boom angle of 82 degrees. What must the operator do?

A. Use the 78-degree capacity value conservatively and proceed — the 82-degree angle has a shorter radius that should have higher capacity than the 78-degree entry

B. The 82-degree angle is outside the rated range for this section — the section cannot be used for operations at 82 degrees; the operator must either find a section that covers 82-degree operation or adjust the crane setup to bring the boom angle within the 45–78 degree range

C. Apply an 82-degree correction factor of 1.04 to the 78-degree capacity value to account for the slightly steeper boom angle

D. Reduce the operating radius to achieve a boom angle below 78 degrees — this is the only authorized correction for an out-of-range boom angle

90. A crane is performing a lift using the following configuration: 80-foot boom, full outrigger extension, maximum counterweight. The load chart note reads: "Maximum counterweight configuration requires minimum 15-ft outrigger spread clearance from all obstacles." The crane's right side outriggers are deployed 12 feet from a barrier wall. What is the compliance issue?

A. The 12-foot clearance is within the standard 10-foot minimum for all crane operations and no compliance issue exists

B. The 12-foot actual clearance does not meet the 15-foot clearance required by the load chart note for maximum counterweight operation — the crane's configuration is non-compliant with the note's binding condition; the crane must either reduce counterweight to a configuration whose note permits 12-foot clearance, or the barrier must be moved to achieve 15 feet

C. The clearance note applies only to the counterweight tail swing, not to the outrigger spread distance

D. The note refers to overhead clearance from the boom tip, not outrigger spread clearance from obstacles

91. A crane load chart for a 100-foot boom at full outrigger extension shows: 20 ft = 52,400 lbs; 25 ft = 42,200 lbs; 30 ft = 33,800 lbs; 35 ft = 26,600 lbs. All cells in the 20 and 25-foot columns are white (stability-limited); cells at 30 and 35 feet are gray (structural-limited). A lift at 27 feet is planned with 31,000 lbs total suspended weight. Using the conservative approach, what capacity governs?

- A. Interpolated capacity at 27 ft = 38,712 lbs using the 25 and 30-ft entries
- B. Conservative capacity = 33,800 lbs at 30 ft; 31,000 lbs is within capacity
- C. Conservative capacity at 30 ft = 33,800 lbs; 31,000 lbs is within this capacity — but the operator must note that this conservative capacity falls in the structural-limited zone while the actual radius (27 feet) may be in the stability-limited zone; the transition between zones must be considered when planning operations near the transition point
- D. Conservative capacity = 26,600 lbs at 35 ft; 31,000 lbs exceeds this — the lift cannot proceed

92. A crane is configured with a 100-foot boom. The load chart shows the following values in the on-outrigger full extension section: 25 ft = 44,800 lbs; 30 ft = 35,600 lbs. A critical lift is planned at 28 feet of radius. The total suspended weight is 38,000 lbs. After interpolation, what is the estimated capacity at 28 feet, and does the lift proceed?

- A. Interpolated capacity at 28 ft =  $35,600 + [(30-28) \div (30-25)] \times (44,800 - 35,600) = 35,600 + (0.4 \times 9,200) = 35,600 + 3,680 = 39,280$  lbs; total (38,000 lbs) is within capacity — the lift proceeds but only by 1,280 lbs margin
- B. Conservative capacity at 30 ft = 35,600 lbs; 38,000 lbs exceeds 35,600 lbs — the lift cannot proceed using the conservative approach
- C. The lift proceeds since the interpolated capacity of 39,280 lbs exceeds the load — but note the conservative approach of 35,600 lbs would not support the lift; the operator should carefully confirm the actual radius is no greater than 28 feet before proceeding
- D. Interpolated capacity at 28 ft = 41,120 lbs; total (38,000 lbs) is within capacity — lift proceeds with comfortable margin

93. A crane load chart section note reads: "For lifts involving loads with vertical center of gravity above 8 feet, reduce all tabulated capacities by 10%." The planned load is a prefabricated wall panel with its center of gravity at 11 feet above the bottom of the load. The tabulated capacity is 32,400 lbs. What is the applicable derated capacity?

- A. No derating is required — the center of gravity height affects the load's stability during transport but does not affect crane capacity

B. Derating =  $32,400 \times 0.90 = 29,160$  lbs; the note's condition is met since the CG is at 11 feet (above the 8-foot threshold); this derated value is the governing capacity for this lift

C. Derating only applies when the CG height exceeds 15 feet — an 11-foot CG height does not trigger the note

D. Derating =  $32,400 \times 0.95 = 30,780$  lbs — applying a 5% reduction for each foot above 8 feet up to the first 2 additional feet

94. A crane load chart shows that the on-outrigger full extension section has a maximum operating radius of 55 feet for the 100-foot boom. For the 120-foot boom in the same section, the maximum radius is 65 feet. An operator using the 100-foot boom is directed to perform a lift at 57 feet — 2 feet beyond the 100-foot boom's maximum. The 120-foot boom section shows capacity at 57 feet. Is the operator authorized to use the 120-foot boom section for the 100-foot boom configuration?

A. Yes — the 120-foot boom section is more conservative since longer booms have lower capacity at the same radius

B. The operator may use the 120-foot section conservatively since it covers the 57-foot radius that the 100-foot section does not

C. Nothing prevents using a longer boom section for a shorter boom as long as the capacity shown is conservative

D. No — the 120-foot boom section was derived for the structural and stability characteristics of a 120-foot boom; using it for a 100-foot boom applies capacity values from a completely different physical configuration; since 57 feet exceeds the 100-foot boom's maximum rated radius, the 100-foot configuration simply cannot perform the lift and must be extended to 120 feet or the crane must be repositioned

95. A crane's load chart shows 38,600 lbs at 30 feet for the 100-foot boom at full outrigger extension. The total suspended weight is 35,200 lbs. The lift percentage is 91.2%. After setting the load, the operator is asked to perform a second identical lift at the same configuration and radius. Before beginning the second lift, the operator re-checks the crane's level condition and finds the crane has drifted 0.4% out of level in the fore-aft direction since the start of the first lift. The manufacturer's tolerance is 0.5%. The level is re-set by adjusting the outrigger jacks. What additional verification is required before the second lift begins?

A. Re-leveling satisfies all requirements — the crane is now within manufacturer tolerance and the second lift may proceed at the same parameters as the first

B. The cause of the 0.4% level drift must be investigated — if the drift was caused by progressive outrigger settlement, simply re-leveling without addressing the underlying settlement means the crane will drift again during the second lift, potentially more severely; the outrigger condition and ground bearing must be confirmed adequate before the near-capacity second lift proceeds

C. The drift of 0.4% indicates the crane is experiencing normal thermal expansion of the outrigger jacks — no investigation is needed beyond re-leveling

D. A post-re-leveling wait of 15 minutes is required to confirm the crane remains level before a second lift above 90% of capacity

## Core Exam 7 Answer Key and Full Explanations

1. D — Pre-approved crane pad locations are based on the site conditions that existed at the time of the engineering assessment. Installing a steam line and a drainage channel through or across designated pad locations fundamentally changes the subsurface conditions — the steam line may have disturbed soil compaction, created a void, or altered drainage patterns, and the drainage channel affects soil moisture near adjacent pads. Each location must be verified against current conditions before use.

2. B — Calcium chloride is hygroscopic — it continuously absorbs moisture from the atmosphere. Applied to a soil surface, it maintains a higher-than-ambient moisture level in the soil directly beneath it, even in dry weather. This persistent moisture retention can keep surface soil in a softened, higher-moisture-content state that reduces bearing capacity below what a visual inspection of the dry-appearing surface would suggest.

3. B — OSHA 1926.1402 requires the controlling entity to provide available information about known hazards that could affect crane operations, including the presence and characteristics of basements and underground vaults. This information allows the crane employer to evaluate whether the structures beneath the setup area can support the crane's weight and operating loads. Without this information, the crane employer cannot assess the subsurface hazard.

4. A — A circular surface depression with radiating cracks is the classic surface manifestation of subsurface void development — the surface soil is collapsing into a void below. Possible causes include sinkhole formation, utility vault failure, underground storage tank collapse, or soil piping into a drainage system. Any of these subsurface conditions could extend laterally beneath a planned outrigger position and cause sudden ground failure during crane loading.

5. D — Retaining wall design accounts for the lateral earth pressure from the retained soil mass on the wall's back face. When a crane outrigger is placed behind a retaining wall, the outrigger load creates an additional surcharge stress in the soil that acts against the wall — increasing the lateral pressure beyond the wall's design assumption. If the wall was not designed for this surcharge, the combined earth pressure and crane-induced pressure may cause overturning or sliding failure.

6. B — The 811 system notifies utility operators who then mark the approximate location of their registered lines on the surface within a tolerance zone. A completed locate confirms presence and routing — it does not confirm exact depth, does not guarantee that unregistered private utilities are absent, and does not authorize loading the surface. The operator must still plan outrigger placement to avoid the tolerance zones of all marked utilities.

7. C — When an outrigger pad spans across tire rut depressions and ridges, it contacts the ground only at the rut edges rather than across its full area. This creates two or four contact points rather than continuous contact, dramatically increasing the bearing pressure at those contact points. The effective bearing area may be only a fraction of the pad's nominal area, meaning the actual bearing pressure can be several times higher than calculated from the pad's dimensions.

8. A — OSHA 1926.1412 requires a post-assembly inspection before a crane is placed in service after assembly, disassembly, and reassembly at a new location. Transport subjects the crane to dynamic loads that can loosen connections and cause damage, and reassembly at the new site must be verified by a qualified person. A pre-shift inspection by the operator does not substitute for this qualified-person post-assembly inspection.

9. D — Asphalt pavement provides no indication of what lies beneath it — good-looking asphalt can sit on soft, inadequately compacted sub-base material. Parking lots are designed for distributed vehicle wheel loads, not concentrated crane outrigger point loads that can be 10 to 50 times higher per unit area. Without sub-base documentation, the bearing capacity of the soil beneath the asphalt is unknown and cannot be assumed adequate for crane loading.

10. B — OSHA 1926.1408(b) requires a pre-work assessment that specifically confirms the voltage of all power lines within the working radius, evaluates whether de-energization is feasible, and determines which control option will be implemented. These three determinations must be made and documented before operations begin — they are the foundation of the entire power line safety plan and cannot be deferred or assumed.

11. C — Water pooling beneath an outrigger pad indicates the soil at that position is being exposed to saturation conditions that were not present during the original bearing capacity assessment. Even brief saturation can dramatically reduce the bearing capacity of soils that appeared firm when dry. The combination of water infiltration and potentially softening soil while under crane load creates a progressive failure risk that requires immediate operational response.

12. A — A small drum roller applied one day after trenching compacts only the top few inches of the backfill surface — it cannot achieve uniform, deep compaction through the full trench depth. Newly disturbed and recently backfilled soil, regardless of surface rolling, typically has lower bearing capacity than surrounding undisturbed material because the natural soil structure has been destroyed and not yet re-established. Bearing capacity verification through testing is required.

13. D — Water from dust control spraying that runs toward outrigger positions can rapidly saturate the supporting soil, reducing or eliminating the bearing capacity that was assessed in dry conditions. Even if the water has not yet reached the pads, flowing water migrating through the soil can undermine bearing capacity at depth before any visible surface saturation is evident. Operations must stop and remain stopped until the water source is controlled and conditions are re-evaluated.

14. B — Railroad clearance requirements are not standardized across all railroads and track types — they vary based on track speed, train type (passenger vs. freight), equipment height, and the specific railroad's operating rules. The railroad operator's specific written requirements must be obtained before crane operations begin near tracks. Assuming a standard clearance value risks non-compliance with the applicable railroad's specific requirements.

15. C — ASME B30.5 requires that ground conditions remain firm, drained, and stable throughout the crane's operation — not just at setup. Weather events, adjacent excavation, utility failures, and other activities can change ground conditions during operations. The operator must continuously monitor for any change in conditions and reassess the crane's support if conditions change during operations.

16. A — Ground bearing pressure with one mat:  $64,000 \div 16 \text{ sq ft} = 4,000 \text{ psf}$  — this exceeds the 2,800 psf soil capacity. With two mats (32 sq ft):  $64,000 \div 32 = 2,000 \text{ psf}$  — within the 2,800 psf capacity. Two mats are the minimum required at the heaviest position. Determining the minimum mat count requires calculating bearing pressure at each mat quantity option until the result falls within the soil's rated capacity.

17. C — Easy steel rod penetration to 18 inches indicates that below the apparent surface layer, the soil offers very little resistance — a characteristic of loose, soft, or very weakly consolidated material. The surface appearance of compacted gravel can be created by a thin surface treatment over very soft

underlying material. This probe result indicates the subsurface conditions may be very different from what the surface suggests and warrants engineering assessment.

18. B — OSHA 1926.1407 requires actual voltage determination from reliable sources — the utility operator, visible markings on structures, or other authoritative sources. Visual estimation from wire size, insulation color, or structure type introduces uncertainty that could result in applying the wrong MSAD. The standard requires actual information, not visual estimates, because an incorrect voltage determination could place the crane within a hazardous distance from the actual energized conductors.

19. C — A hydraulic leak of unknown severity creates two categories of risk. First, a pressurized line leak can spray hot hydraulic fluid at high velocity, creating burns, fire hazard from contact with hot exhaust components, and potential injury. Second, the leak may be progressive — what appears minor may be the beginning of a hose failure. The source and pressure condition must be confirmed before any determination can be made about whether operations may continue.

20. C — The zone of influence in geotechnical engineering describes the subsurface zone where applied stress exceeds a threshold — typically defined as a percentage of the surface contact pressure. For crane outriggers near excavations or slopes, this means the outrigger's stress field extends laterally into the soil at distances that depend on the outrigger load and soil properties. A slope face within this zone has reduced passive resistance and may shear under the combined influence of the outrigger surcharge plus its own retained soil pressure.

21. D — Interlocking concrete pavers provide a stable, attractive surface but rest on a compacted sand base that is not structurally equivalent to engineered concrete or asphalt. Sand is susceptible to moisture-induced loss of bearing capacity and can experience lateral migration under concentrated loads. The interlocking paver system hides the condition of the sand base from visual inspection, making surface appearance alone an unreliable indicator of sub-base adequacy for crane outrigger loading.

22. A — An unexplained mechanical sound from the hoist drum area that occurred three times and cannot be identified is a potentially significant finding that cannot be assumed to have self-resolved. The maintenance log documents the observation for the maintenance team and the verbal communication ensures the relief operator is aware before beginning operations. A sound that occurred three times and was inconsistent with previous experience may indicate a developing mechanical issue that requires investigation.

23. C — When a crane swings with a load, centrifugal force displaces the suspended load outward from the boom's rotation axis, increasing the effective operating radius beyond the static planned radius. At a greater effective radius, the crane's rated capacity is lower — the same load weight now represents a

higher percentage of the reduced capacity. Reducing swing speed minimizes the centrifugal force, reduces the outward displacement, and keeps the effective radius closer to the planned value.

24. A — OSHA 1926.1416 authorizes holding a load suspended — with the operator at controls, drum pawl engaged as backup, area barricaded, and warning signs posted — when immediate lowering would create a hazard. Using a different clear area as an alternative set location is also a valid operational solution when the emergency below prevents safe lowering to the original location. Both options protect against both the original emergency and the hazard of an uncontrolled suspended load.

25. C — A non-functional seat belt in a crane cab is a fall hazard and a safety equipment deficiency that must be corrected before continuing operations. During sudden crane movement, tip-over, or load swing, the operator may be thrown from the seat without a functioning restraint, losing control of the crane at the most critical moment. The seat belt must be repaired before any additional lift cycles, not after a predetermined number of additional lifts.

26. B — OSHA 1926.1431 requires a trial run with the empty platform before the first personnel hoisting operation on a project. The trial confirms that all crane functions operate correctly — hoist, swing, boom movement, and any other planned function — over the complete planned range of motion. Discovering a crane malfunction during the trial run with an empty platform is far preferable to discovering it while personnel are suspended.

27. C — Simultaneous operation of multiple machines in close proximity creates intersection hazards when one machine is unaware of the other's operating envelope. The crane's load path and the excavator's boom arc may intersect at any moment if the excavator operator is not aware of the crane's swing. All crane movement must stop until both operators have established a coordination protocol that prevents their equipment from occupying the same space simultaneously.

28. C — The emergency urgency does not authorize unsafe lowering. "Immediately lower" in an emergency context means lower as quickly as safely possible using controlled hoist speed — not free-fall, not unsafe speed, not abandonment of load control. The controlled lowering requirement exists because an improperly lowered load at 14 feet over an occupied building could cause the load to swing and damage the structure or injure occupants even if it were lowered "quickly."

29. B — OSHA 1926.1421 requires that radio communication be tested at the beginning of each shift and whenever performance issues are suspected. Communication clarity is a fundamental operational requirement — an electronic system that fails mid-operation without prior testing creates the same

hazard as no communication system. Testing before operations and whenever doubt arises ensures the communication system is confirmed functional before it is relied upon for safety-critical direction.

30. B — An oil pressure warning light indicates the engine's oil pressure has dropped below the minimum level required for adequate lubrication of moving parts. Continued engine operation under low oil pressure can cause sudden engine seizure without further warning. The load must be lowered to a safe surface using the remaining hydraulic pressure before the engine fails, after which the engine is shut down and the cause investigated. Completing the swing first risks engine failure with the load at height over the work area.

31. C — Signal communication must be clear and unambiguous throughout all crane operations. At 80 feet with a load at 91% of rated capacity, misinterpreting a signal could cause a load contact, overload, or personnel injury. Moving the signal person to a visible range or establishing a relay system is the only compliant solution — inference from context and exaggerated gestures are not substitutes for clear, confirmed signal communication.

32. A — With only 2 inches of clearance between the motor and the opening, the entire lowering operation must be executed with the load line plumb to prevent any lateral drift that would contact the opening walls. Minimum hoist speed throughout the descent gives the operator maximum control over load position. Tag line rotation control prevents the motor from turning during descent, and clearing all personnel above and below ensures no one is struck if slight contact occurs.

33. D — OSHA 1926.1427 requires the employer to evaluate and document operator competency for the specific crane model at the specific worksite before the operator begins crane operations there. This is not a one-time hire evaluation — it applies to each new significant assignment, crane model change, or substantial site change. The documented evaluation cannot be deferred until after the operator has demonstrated field performance.

34. B — Load rotation during a lift indicates an imbalanced rigging geometry — the bridle attachment points are not positioned so the resultant lifting force acts through the load's center of gravity, causing the load to rotate as it rises. A tag line must arrest the rotation before the load reaches operating height where rotation could become dangerous. The underlying cause — off-center attachment points — should be evaluated to determine whether re-rigging is needed.

35. C — ASME B30.5 and OSHA 1926.1416 both grant the operator authority and responsibility to stop crane movement immediately when an unexpected condition suggests potential structural distress or mechanical failure. Unexpected sounds during a near-capacity lift are exactly the kind of warning sign

that can precede sudden catastrophic failure — the operator cannot assess the cause while continuing to load the potentially distressed component.

36. A — Repetitive lifts do not eliminate the need for capacity verification — they allow the verification to be streamlined for confirmed-identical parameters. Each lift must confirm that the crane remains in the same configuration, level condition, and that the load and rigging weights are unchanged. Changes in any of these parameters during the series invalidate the original confirmation and require a fresh full capacity check.

37. D — A facility PA emergency evacuation announcement covers all personnel in the facility including crane operators — it is not an advisory for others that the crane operator can evaluate before deciding to respond. Emergency evacuation must begin immediately. The correct sequence is to lower the load to the nearest safe surface, sound the emergency horn to warn others, and evacuate following established procedures. Waiting for specific instructions from the lift director creates unacceptable delay in an emergency.

38. B — The two most physically consistent causes of an unexplained increase from 86% to 99% are: boom deflection under load having increased the actual operating radius beyond the planned value (measured before loading), and the actual suspended weight being heavier than the documented figure (rigging weight underestimated or load heavier than certified). Both increase the actual load moment on the crane beyond what the original calculation assumed, producing the higher-than-expected LMI reading.

39. C — ASME B30.5 specifies distinct hand signals for LOWER (extended arm at shoulder height, index finger pointing down, making a downward circle) and LOWER BOOM (extended arm with thumb pointing down). These are separate, clearly distinguishable gestures — the LOWER signal uses a rotating index finger motion, while LOWER BOOM uses a stationary thumb-down position. The operator must correctly identify which function is being directed before executing any movement.

40. A — OSHA 1926.1431 requires the load line used for personnel hoisting to meet a 7:1 design factor — the rope's rated breaking strength must be at least seven times the maximum load that will be applied during personnel hoisting. This is confirmed through the rope manufacturer's documentation showing the certified minimum breaking force relative to the maximum planned personnel hoisting load. The 7:1 factor is specific to personnel hoisting and is significantly more stringent than the 5:1 factor for material hoisting.

41. D — Using crane swing to rotate a tilted load applies lateral forces to the boom through the angled load line — the load hangs off-vertical, and any swing movement creates a pendulum force that acts

sideways on the boom. Additionally, the load's rigging geometry with a tilted pick may cause the rigging to shift further as the load swings. The only safe resolution is to return the load to the ground and correct the rigging attachment before re-attempting the pick.

42. B — Platform rotation during personnel hoisting indicates that the load line or rigging is under torsional stress, which can unscrew shackle pins, disorient the platform's orientation relative to the work area, and cause rope twist accumulation. OSHA 1926.1431 requires controlled, stable platform movement — rotation that is not controlled by tag lines or prevented by the rigging geometry must be resolved before personnel remain suspended. The platform must be lowered and the rotation cause addressed.

43. C — OSHA 1926.1416(d) requires effective barricading of the swing radius — not advisory signage, not warning sounds, not visibility vests. Physical barriers that prevent unauthorized entry into the rotating counterweight zone are the required control because they do not rely on awareness or alertness. The counterweight rotates through the zone silently and without visible warning to someone who enters without knowing its path.

44. A — To clear a 14-foot fence with a load that has an 8-foot height, 6-inch chain sling, and 24-inch (2-foot) hook block, the bottom of the hook block must be above the fence top. The calculation: hook point = fence height + load height + sling + hook block height =  $14 + 8 + 0.5 + 2 = 24.5$  feet minimum, plus a safety margin. With a reasonable margin, approximately 26 feet minimum hook height above grade is appropriate for safe clearance during the swing.

45. D — The crane's general wind limit was established based on the structural loads that wind creates on the crane's boom and a compact load — not on the lateral forces that wind creates on a large flat panel. A 160-square-foot panel creates drag forces that are proportional to its surface area, which at 18 mph can be enormous compared to forces on a compact load of equivalent weight. The lift director's 25 mph general compliance assertion does not address this panel-specific wind force hazard.

46. B — OSHA 1926.1427 requires the employer to evaluate competency for the specific crane at the specific worksite. A new worksite presents new hazards — different ground conditions, overhead restrictions, proximity to utilities, and operational challenges that differ from the previous site. An experienced operator's performance at one site does not automatically confirm competency for different site-specific hazards at a new location.

47. C — OSHA 1926.1419 limits crane signals to the designated, qualified signal person except for Emergency Stop signals, which may be given by any person at any time. No crane movement may be

initiated based on a signal from an unqualified non-designated worker — doing so could result in an unauthorized lift, miscommunication, or a movement that the qualified signal person would not have directed. The operator must wait for the designated signal person to return.

48. C — Wire rope lay direction is a specific manufacturer-specified parameter that affects how the rope interacts with the drum and sheaves, its tendency to rotate under load, and its behavior at fleet angles. Lang lay and regular lay ropes of the same diameter and grade have different contact mechanics with sheave grooves and different handling characteristics. The crane manufacturer's rope specification must explicitly confirm whether lang lay is acceptable before installation — it is not automatically interchangeable with regular lay.

49. D — Repeated bending of rope wires over a sheave creates fatigue cracks at the outer fiber of the wires in tension (when wrapping onto the sheave) and in compression (when unwrapping from the sheave). The reverse-bending fatigue mechanism is particularly damaging because the stress direction reverses rather than simply cycling from zero to maximum — the full reversed stress range is more damaging than simple tension fatigue. Concentration at a single point reflects the consistent working position at that sheave during typical operations.

50. B — ASME B30.26 provides capacity reduction factors for shackle bow loading at angles off the intended in-line axis. A 30-degree off-axis loading reduces the capacity because it introduces a bending component at the bow-pin interface — the shackle was designed to carry load in line with the bow's major axis, and angular loading creates stress concentrations not present in the rated in-line configuration. The appropriate derating factor must be applied and the reduced capacity confirmed adequate.

51. B — ASME B30.9 recognizes that the standard choker WLL is based on a 120-degree or greater choke angle. Below 120 degrees, the choker mechanism tightens more severely and the rope body experiences increased bending and contact stress at the choke point. The standard provides a table of derating factors for choke angles between 60 and 120 degrees that must be applied to the standard choker WLL — the reduced capacity must be confirmed adequate for the actual load.

52. A — Cracks in the weld connecting the counterweight mounting bracket to the rotating bed represent structural fatigue in a safety-critical joint that carries the full counterweight mass and its dynamic inertia during swing operations. The weld is a load path element — cracking indicates the material has been stressed beyond its fatigue endurance limit. This is an absolute removal condition because continued operation risks progressive crack growth to complete joint separation.

53. D — The outer cover of a round sling is the protective barrier for the inner load-bearing core fibers. ASME B30.9 requires removal when the cover is breached to the point of exposing core fibers because: (1) exposed fibers are immediately vulnerable to abrasion, chemicals, and cutting, and (2) the sling's capacity cannot be confirmed when the fibers' condition throughout the hole area cannot be verified. The visible fibers appearing intact at the surface inspection point does not confirm the full cross-section is undamaged.

54. B — OSHA 1926.1412(e) requires a post-incident inspection after a load drop. A load drop creates sudden dynamic loads on the crane's structural and mechanical components that can exceed the rated capacity during the drop impulse — the rope, hook, sheaves, boom tip, and load-bearing structure may have been subjected to shock loads far above their design ratings. The inspection must confirm whether any damage occurred before the crane is returned to service.

55. B — The hydraulic filter has two specified change intervals — 6 months or 500 hours, whichever comes first. At 14 months since the last change, the 6-month calendar interval has been exceeded by 8 months regardless of the hours accumulated. Both intervals are maximum limits — exceeding either one represents overdue maintenance. An overdue hydraulic filter allows contaminant particles to circulate through the system, increasing wear rates on precision hydraulic components.

56. C — Wire rope that has been plastically deformed by cross-drum contact has disrupted wire and strand geometry in the flattened section. The individual wires in the flattened zone have been bent and compressed into new permanent positions — creating stress concentrations at every deformed wire location. While no wires may be currently broken, these stress concentration points will fatigue rapidly under subsequent loading. A qualified inspector must evaluate the deformed section against removal criteria.

57. C — The ATB system must both interrupt hoisting when activated AND automatically reset when the hook block moves away from the boom tip. A system that does not reset will remain tripped even when the hook is at normal operating height, making the crane inoperable and providing no protection against future two-blocking events. An ATB that cannot reset is a malfunctioning safety device — the crane must not be operated until the reset function is restored.

58. B — ASME B30.9 requires that removed slings be rendered unusable before disposal. Slings that show deficiencies but retain their identification tags could be inadvertently returned to service if stored among serviceable slings or passed to another crew without knowledge of the deficiency. Cutting the sling or otherwise permanently disabling it prevents any future use and eliminates the risk of a deficient sling being used on a subsequent lift.

59. C — Shock loads transmit sudden, high-magnitude forces through the rope that can cause internal wire deformation, crown wire protrusion, strand geometry disruption, and reduction in lay length — none of which are visible externally. The rope must be inspected along its full length by a qualified inspector who can assess these internal geometric changes against removal criteria. If the inspection confirms the rope is within all applicable criteria, it may return to service; the inspection is not optional and cannot be replaced by visual check alone.

60. C — Hydraulic pumps are designed to operate with fluid within a specific viscosity range. At 12°F, hydraulic fluid viscosity can be 10 to 50 times higher than at operating temperature, making the fluid extremely thick. Attempting to draw this thick fluid through the pump's inlet porting at normal pump speed creates cavitation — vacuums that form and collapse violently, eroding pump surfaces. This damage occurs quickly and may not be immediately apparent, leading to premature pump failure.

61. D — ASME B30.5 establishes two distinct inspection categories: frequent inspections (daily/pre-shift by operator before each shift) and periodic inspections (monthly or as prescribed based on use frequency, by a qualified person). Frequent inspections are not triggered by incidents — they occur before every use. Periodic inspections occur at regular time-based intervals. Neither substitutes for the other and both are required simultaneously.

62. A — Fretting at slewing ring bolt connections is caused by cyclic micro-movement at the bolt-to-flange interface during crane operations. This micro-movement occurs when the bolt's clamping force has decreased below the level needed to prevent relative movement under the operational loads. Loose slewing ring bolts allow the ring to move relative to the mounting flange, causing the bolts to experience fatigue loading rather than the intended pure preload — leading to fatigue fracture without further warning.

63. C — A 40% increase in lay length in a localized section indicates the rope's internal geometry has been permanently altered at that location. Normal rope shows consistent lay length throughout its length — a localized dramatic increase indicates the strands have spread apart, the rope core has failed, or the section has been twisted open by an overload event. These conditions reduce the rope's effective tensile capacity at the affected section and represent a structural integrity concern requiring immediate removal.

64. B — Eyebolts are designed to carry loads through the eye opening in the plane of the eye — the load passes through the eye's bore. For angular loading, the eyebolt must be oriented so the load still passes through the eye in the plane of the eye opening. Loading the eyebolt transversely — across the narrower width of the eye, perpendicular to the plane — creates bending in the eye that dramatically reduces capacity. The eye must be in the plane of loading, and angular loads must use shouldered eyebolts with the appropriate capacity derating.

65. D — Uneven rope spooling causing accumulation on one side of the drum indicates that the rope is not being guided correctly across the drum width — either a drum guide device has failed, the fleet angle is wrong, or the rope is following an incorrect path from the last sheave. Piling causes cross-winding on subsequent layers, crushing the lower rope under the weight of the upper rope. Cross-wound rope experiences crushing deformation, accelerated fatigue at the contact points, and may eventually jump the drum flange.

66. B — Deformation of a jaw-end swivel's opening — analogous to a hook throat opening increase — indicates the swivel's jaw material has been stressed beyond its yield point and has permanently deformed. This deformation reduces the cross-sectional area available to resist the load at the jaw and indicates the component has already experienced an overload event. Any plastic deformation in a lifting hardware component is a removal condition under ASME B30.26.

67. C — ASME B30.5 references wire rope clip manufacturer specifications for clip count and spacing requirements by rope diameter. For 1-inch rope, the manufacturer's chart specifies a minimum of 4 clips at approximately 5-3/4 rope diameter (approximately 5.75 inches) spacing. Both the minimum clip count and the spacing requirement are safety-critical — insufficient clips or improper spacing reduces the total grip force below what is needed to prevent the rope from pulling through the clips under load.

68. A — The swivel's function is to allow the hook block to rotate freely, absorbing torsional loads from load rotation rather than transmitting them into the wire rope. When the swivel requires 25 ft-lbs to rotate, it will not turn freely under the torsional forces from a rotating load — those forces are transmitted directly into the rope as twist. Accumulated rope twist reduces the rope's rated tensile capacity and creates a torsional energy store that can release suddenly as a violent untwisting event.

69. C — Some cranes use over-hoist limit switches as backup systems to the ATB for preventing excessive hook travel. Unlike the ATB which detects proximity to the boom tip, the over-hoist limit activates at a preset rope travel distance. Its reliability varies with boom angle — the same rope length represents different hook heights at different angles. It must not be used as a routine stopping device since it may activate at unsafe hook heights at certain angles, and it supplements rather than replaces the ATB.

70. C — Pitting corrosion on a boom chord member removes material from the chord's cross-sectional area, directly reducing both its compressive load capacity and its resistance to Euler buckling under the combined compression and bending loads that the chord experiences during lifting operations. The extent of material loss, the effect on the chord's moment of inertia, and the resulting impact on the crane's rated capacity cannot be determined by visual inspection — they require engineering analysis by the manufacturer or a qualified structural engineer.

71. B — Conservative capacity at the next larger tabulated radius (40 feet) = 20,800 lbs. Total suspended weight =  $1,900 + 480 + 140 + 17,800 = 20,320$  lbs. Since 20,320 lbs is less than 20,800 lbs, the lift is within the conservative capacity with a 480-lb margin. The conservative approach is required for non-tabulated radii, and the operator must carefully confirm the actual radius does not exceed 37 feet since any additional radius increase would push into the narrowing margin.

72. A — The note explicitly states the values represent maximum payload only — meaning all rigging deductions have already been made and the tabulated value is the net payload limit. The payload of 23,800 lbs is below the 24,400 lbs net payload limit. However, the operator must understand this distinction precisely: "maximum payload" means the note pre-deducted all rigging, so no further deductions are required from the tabulated value.

73. B — At the set radius of 48 feet, using the conservative approach, the next larger tabulated radius is 50 feet with a capacity of 12,800 lbs. The total suspended weight of 19,800 lbs exceeds 12,800 lbs by 7,000 lbs — the lift cannot be set at 48 feet. The operator confirmed capacity at the pick radius but failed to verify at the set radius before beginning the lift. Both the pick and set radii must be independently confirmed within rated capacity before the lift begins.

74. B — During boom telescoping, the extending or retracting section transitions through intermediate pin engagement states where it is partially supported by the hydraulic extension cylinder and partially engaged in the lock position. This transition creates structural loading conditions not present during stationary operations — the hydraulic force is active simultaneously with operational loads, and the boom section's structural load path is different during the transition. These conditions require reduced capacity ratings to maintain structural safety.

75. A — A load chart note establishing a maximum boom angle applies to all operations in that section — not only those that approach the limit. The operator must confirm the boom will not exceed 78 degrees at any point during the planned operation, including during transitions between setup positions, because exceeding the stated limit voids the capacity rating. Even though 58 degrees is well within the limit for the static pick, any boom movement that could transiently exceed 78 degrees during the operation requires attention.

76. C — Interpolation:  $36,800 - 29,400 = 7,400$  over 5 ft = 1,480/ft. At 32 ft (2 ft beyond 30 ft):  $36,800 - (2 \times 1,480) = 36,800 - 2,960 = 33,840$  lbs. The 32,000-lb total suspended weight is within 33,840 lbs. Structural-limited designation means the boom's structural members are near their design stress limits at the tabulated capacity — dynamic loading from hoist acceleration, swing inertia, or boom movements adds stress on top of the static structural limit, requiring exceptionally smooth, controlled crane movements throughout the lift.

77. C — The on-rubber stability footprint is limited to the small contact area of the crane's tires — the distance between the tire contact patches on opposite sides of the carrier is dramatically smaller than the full outrigger spread. Since tipping resistance is determined by the moment arm between the load and the tipping fulcrum (the near edge of the support footprint), a narrow tire spread means the fulcrum is much closer to the load, requiring a dramatically lower load to create an overturning moment equal to the crane's stabilizing moment.

78. D — Stability-limited capacities reflect the tipping threshold — at near-100% of a stability-limited value, the crane is close to its actual tipping point. Any condition that adds overturning moment — out-of-level, centrifugal swing displacement, or boom side-loading — reduces the gap between the actual load moment and the tipping moment. Near a retaining wall that could fail under crane tip-over forces, these conditions require the crane to be at exact manufacturer level tolerance, minimum swing speed, and all conditions confirmed before hoisting begins.

79. D — Since the crane has only over-end and over-side sections, intermediate positions are not directly rated. The boom must pass through the over-end sector during this swing, and the over-end capacity of 54,000 lbs is the most restrictive value the crane will encounter. The total suspended weight must remain within 54,000 lbs throughout the entire swing cycle because this capacity governs during the over-end sector passage. Using 82,000 lbs for any portion of the lift would violate the over-end capacity during that sector.

80. C — Wind velocity increases with height due to reduced surface friction effect — the atmospheric boundary layer causes wind at crane hook heights to be significantly higher than at grade level. At heights typical for crane operations (50 to 200 feet), wind speed can be 1.5 to 2 times the ground-level measurement. A ground reading of 15 mph could represent hook-point wind of 22 to 30 mph — potentially above the 20 mph note limit. Using only the ground-level reading without this correction can lead to operating outside the load chart's specified wind condition.

81. B — The 100-foot boom is the correct configuration for this lift because it is the only boom that achieves the required 75-foot tip height, and its capacity of 26,800 lbs at 35 feet exceeds the 25,000-lb total suspended weight. Using the 80-foot boom would provide higher capacity at 35 feet but would not achieve the required tip height — the lift cannot be completed regardless of capacity if the physical clearance requirement is not met. Both conditions — capacity and tip height — must be satisfied simultaneously.

82. C — Using the conservative approach: capacity at 35 feet = 17,200 lbs. Lift percentage =  $15,800 \div 17,200 \times 100 = 91.9\%$ . Since 91.9% exceeds the 75% critical lift threshold under OSHA 1926.1408, this lift qualifies as a critical lift requiring a written critical lift plan and a pre-lift meeting with all lift team

members. The conservative approach is required for the non-tabulated 32-foot radius, and the resulting percentage confirms the critical lift designation.

83. C — Without a defined sector boundary for the "over-front direction," the conservative interpretation places any position within what could reasonably be considered the over-front region subject to the reduction. At 15 degrees from the front center, the boom is close enough to the over-front direction that the note's intent — to reduce capacity in the over-front direction — would apply under a conservative interpretation. The operator must apply  $28,600 \times 0.80 = 22,880$  lbs or confirm with the manufacturer that 15 degrees falls outside the defined over-front sector.

84. D — Load chart notes requiring manufacturer authorization are legally binding conditions of the listed capacity values — they are not satisfied by authorization from a distributor, dealer, or any party other than the manufacturer. Only the manufacturer has the engineering basis to authorize use of capacity values that were not published for general use. A distributor's "planning confirmation" does not provide the engineering assurance that the note requires, and the lift must wait for actual manufacturer authorization.

85. B — Using the conservative approach at the 38-foot set radius: the next larger tabulated radius is 40 feet with a capacity of 26,400 lbs. The total suspended weight of 29,800 lbs exceeds 26,400 lbs. The lift cannot be completed at 38 feet using the conservative approach. The LMI reading at the pick radius confirms pick-point compliance but cannot authorize a set at a radius where the conservative capacity is below the total suspended weight.

86. B — Conservative approach at 53 ft: next larger tabulated radius = 55 ft, capacity = 12,400 lbs. Conservative approach at 57 ft: next larger tabulated radius = 60 ft, capacity = 9,200 lbs. The set position's conservative capacity of 9,200 lbs is the lowest capacity encountered in the lift plan — it is the governing capacity for the overall lift. Total suspended weight must remain below 9,200 lbs for the complete lift to be within conservative capacity at all points.

87. C — The load chart note establishing a 1.0 rpm maximum swing speed is a binding condition of the capacity value at this cell — the capacity was rated under the assumption that dynamic forces from swing would not exceed what 1.0 rpm generates at this radius. At 1.4 rpm, the centrifugal load displacement, swing inertia, and dynamic forces exceed what the note's rating assumed. Using the capacity value at 1.4 rpm is non-compliant with the note's binding condition.

88. A — Short tons are the standard US capacity unit: 1 short ton = 2,000 lbs. Gross capacity =  $20.5 \times 2,000 = 41,000$  lbs. Total suspended weight =  $33,000 + 2,800 = 35,800$  lbs. Since 35,800 lbs is less than 41,000 lbs, the lift is within gross capacity. Lift percentage =  $35,800 \div 41,000 \times 100 = 87.3\%$ . Unit

conversion between short tons and pounds is a fundamental calculation that is directly tested on the NCCCO exam.

89. B — The section header defines the rated operating range as 45° to 78° of boom angle. A boom angle of 82° is outside this range. The structural and stability analysis underlying the capacity values was performed within the 45–78° envelope — conditions outside this range involve different structural load distributions and stability geometry not covered by the analysis. The operator must find a section that covers 82° operation or adjust the setup to work within the rated range.

90. B — The load chart note establishes a 15-foot minimum clearance as a condition of the maximum counterweight configuration. The actual clearance of 12 feet does not meet this 15-foot requirement. Load chart notes are binding conditions — operating without satisfying them means the capacity values from that section cannot legally be applied. The crane must reduce to a counterweight configuration whose applicable note permits 12-foot clearance, or the physical clearance must be increased to 15 feet.

91. C — Using the conservative approach: next larger tabulated radius beyond 27 ft is 30 ft with 33,800 lbs capacity. Total suspended weight of 31,000 lbs is within 33,800 lbs — lift proceeds conservatively. The note about the zone transition is operationally important: the conservative capacity of 33,840 lbs at 30 ft is structural-limited, but the actual lift at 27 ft occurs in the stability-limited zone. Understanding which limit governs at the actual versus conservative radius helps the operator anticipate the appropriate operational precautions.

92. A — Interpolation from 25 to 30 ft:  $44,800 - 35,600 = 9,200$  drop over 5 ft = 1,840/ft. At 28 ft (3 ft beyond 25 ft):  $44,800 - (3 \times 1,840) = 44,800 - 5,520 = 39,280$  lbs. Total suspended weight (38,000 lbs) is within 39,280 lbs by 1,280 lbs. The lift proceeds using the interpolated value — but the conservative approach (35,600 lbs at 30 ft) would not support the 38,000-lb lift, illustrating the difference between interpolated and conservative results at this configuration.

93. B — The note applies a 10% derating when the load's vertical center of gravity exceeds 8 feet. The panel's center of gravity is at 11 feet — above the 8-foot threshold. Derated capacity =  $32,400 \times 0.90 = 29,160$  lbs. The note likely exists because loads with high center of gravity have greater moment arm for lateral wind forces and greater pendulum energy during load swing — both of which increase the dynamic loading on the crane beyond what a low-CG load of equivalent weight would create.

94. D — Load chart capacity values are derived from structural and stability analysis of a specific physical configuration. A 100-foot boom has different compressive loading profiles, different pendant angles, and different structural behavior than a 120-foot boom. Applying the 120-foot boom's capacity

values to a 100-foot boom configuration creates a configuration mismatch — the values were derived for a structural system that is not what is physically present. Since the 100-foot boom's rated envelope ends at 55 feet, the crane cannot perform the 57-foot lift in the 100-foot configuration under any circumstances.

95. B — Re-leveling corrects the crane's current orientation but does not address why the crane moved 0.4% out of level during the first lift. Progressive settlement at an outrigger position is the most likely cause — the soil may be slowly yielding under the near-capacity loading. If settlement is ongoing, the crane will drift again during the second near-capacity lift, potentially reaching or exceeding the tolerance limit mid-lift. The cause of the drift must be confirmed before a second 91.2% lift is performed.

## Specialty Exam Simulation 7 — 65 Questions

### SITE DOMAIN — Questions 1–15

1. A telescopic boom crane is being set up at a waterfront industrial facility. The outrigger positions are on a concrete apron that was constructed over hydraulic fill — a mix of dredged silt and sand placed to extend the facility into the water decades ago. The fill has never been tested for bearing capacity. What must be done before setup proceeds?

A. Hydraulic fill has unpredictable and often very low bearing capacity — the specific bearing capacity of the hydraulic fill at the outrigger positions must be evaluated by a qualified geotechnical engineer before any crane outrigger loading; dredged silt and sand fill can have dramatically lower capacity than engineered fill and can be subject to liquefaction under dynamic loading

B. Concrete aprons always provide adequate structural support regardless of the material beneath them

C. Hydraulic fill is a regulated material and requires an environmental permit before crane setup can proceed

D. The concrete apron transfers all loads to the underlying fill uniformly and no bearing capacity assessment of the fill is needed

2. A crane is operating near a confirmed 230 kV transmission line. The boom tip at maximum reach comes within 26 feet of the nearest conductor. Under OSHA Table A, what is the applicable MSAD for 230 kV, and does 26 feet satisfy the requirement?

- A. MSAD for 230 kV is 15 feet — 26 feet provides 11 feet of margin above the requirement
- B. MSAD for 230 kV is 30 feet — 26 feet does not satisfy the requirement
- C. MSAD for lines over 200 kV to 350 kV is 20 feet — 26 feet provides 6 feet of margin above the 20-foot requirement and satisfies the MSAD
- D. MSAD for 230 kV is 25 feet — 26 feet provides only 1 foot of margin above the requirement

3. A crane operator is performing a site walk and finds that the planned outrigger area has been recently scarified — the top 4 inches of soil have been loosened by a rotary tiller in preparation for a future paving project. The underlying native soil was previously assessed at 3,600 psf. What does scarification do to the surface bearing capacity?

- A. Scarification improves bearing capacity by breaking up compacted layers
- B. Scarification loosens and destroys the natural soil structure in the top layer — the scarified zone has essentially zero bearing capacity since the soil particles are no longer interlocked; the outrigger pads would immediately sink into the loose material, and the native 3,600 psf assessment applies only to undisturbed soil below the scarified zone
- C. Scarification only affects the top half-inch of soil and has no effect on structural bearing capacity
- D. The native soil assessment of 3,600 psf remains valid since it was measured below the scarified zone

4. Under OSHA 1926.1402(b), which party is specifically designated as responsible for providing ground preparation when a crane must be set up in an area with soft or inadequate soil?

- A. The crane operator must prepare the ground independently of other site parties
- B. The crane manufacturer bears responsibility for specifying required ground preparation in the operator's manual
- C. The crane owner must provide engineered crane pads for all soft soil situations
- D. The controlling entity bears responsibility for ensuring that ground conditions are firm, drained, and graded to support the crane — if the existing conditions are inadequate, the controlling entity is responsible for ground preparation or providing alternative setup locations that meet the requirements

5. A crane is operating adjacent to a recently completed deep foundation pile. The pile is a 14-inch diameter H-pile driven to 45 feet of depth and installed 3 feet from the left front outrigger position. The pile cap is not yet poured. What concern does this configuration create for outrigger support?

- A. The driven pile creates a zone of densified soil adjacent to the pile that increases bearing capacity near the outrigger — the close proximity is beneficial
- B. The crane's outrigger load transfers vibration into the pile, which may cause pile uplift during operations
- C. The close proximity of the outrigger to the pile cap location creates a structural conflict — the outrigger must be repositioned at least 10 feet from all piles
- D. Nothing specific applies since the pile is a structural element designed for load-bearing

6. A crane is positioned for a lift on a site where a utility crew has been using water jetting equipment to locate underground utilities in the same area. The jetting was completed two hours ago. What concern does water jetting create for crane outrigger support?

- A. Water jetting equipment vibration has densified the soil and improved bearing capacity
- B. The utility crew's presence in the area creates a conflicting operations hazard that must be resolved before crane setup
- C. Water jetting introduces significant water into the soil around the utility location — the recently jet-excavated area may have saturated and softened, dramatically reducing local bearing capacity compared to conditions before jetting; the soil in the jetting zone requires re-evaluation before outrigger loading
- D. Water jetting is performed at depth and does not affect surface bearing conditions

7. Under OSHA 1926.1411, a crane is traveling between two setup positions on a job site. The travel path crosses under a 69 kV distribution line at a height of 18 feet above the travel surface. The crane's stowed boom height is 14 feet. What is the clearance from the conductor to the boom tip, and does this satisfy the MSAD for 69 kV?

- A. MSAD for 69 kV is 10 feet — clearance of 4 feet is inadequate; travel cannot proceed
- B. Clearance = 4 feet — MSAD for 50–200 kV lines is 15 feet; the 4-foot clearance is far below the required 15 feet and the travel route cannot be used without de-energizing the line or finding an alternate route
- C. MSAD for 69 kV is 5 feet — 4 feet of clearance is marginally below the requirement
- D. Travel under energized power lines of any voltage is prohibited under OSHA 1926.1411

8. A crane is set up at a job site where the general contractor placed steel road plates over the planned outrigger positions to provide a stable working surface. The road plates are 1 inch thick and 8 feet × 8 feet (64 sq ft). The maximum outrigger reaction load is 96,000 lbs. What is the ground bearing pressure transmitted to the soil beneath the plate, and what soil capacity is required?

A. Ground bearing pressure =  $96,000 \div 64 = 1,500$  psf — any soil with capacity above 1,500 psf is adequate

B. The road plate distributes the load only to the area of the outrigger float, not the full plate area

C. The steel plate is structural and does not transmit load to the soil — only the plate's structural capacity needs confirmation

D. Ground bearing pressure =  $96,000 \div 64 \text{ sq ft} = 1,500$  psf; assuming the plate is in full contact with the soil and the soil supports the plate uniformly, the soil must have a confirmed bearing capacity of at least 1,500 psf; the engineer of record must confirm both the plate's structural adequacy and the soil's bearing capacity

9. A crane operator notices that the compacted gravel surface at the planned outrigger position shows a dark discoloration in an irregular pattern consistent with oil contamination. The contamination appears to be from a fuel spill that occurred several weeks ago. The surrounding uncontaminated gravel has a confirmed bearing capacity of 4,000 psf. What concern does oil contamination create?

A. Petroleum contamination in granular soils can reduce the inter-particle friction that provides bearing capacity — the contaminated zone may have significantly lower bearing capacity than the surrounding uncontaminated gravel, and the 4,000 psf value from uncontaminated areas should not be applied to the contaminated zone without specific evaluation

B. Oil contamination improves soil drainage and increases bearing capacity in granular materials

C. A few weeks of weathering is sufficient to neutralize the bearing capacity effects of fuel spills

D. Oil contamination only affects clay soils — granular materials like gravel are unaffected by petroleum contamination

10. Under OSHA 1926.1402, what must be confirmed about a crane setup area that includes previously placed engineered crane pads before a new crane is positioned on those pads?

A. Any engineered crane pad may be used by any crane as long as the pad dimensions match the crane's outrigger spread

- B. The crane's maintenance manager must certify the engineered pads are adequate before setup
- C. The engineered pads must have been designed for the specific crane model, configuration, and lift parameters of the planned operation — a pad engineered for a different crane, a different configuration, or a lighter lift may be inadequate for the current operation regardless of its engineering pedigree
- D. Engineered pads are universally rated and require no additional verification before crane use

11. A crane is set up at a site where a water table investigation showed groundwater at 5 feet of depth during a dry season assessment. The current season has been unusually wet, with 8 inches of rain in the past month. What does elevated seasonal groundwater create for crane setup at this location?

- A. Elevated groundwater is beneficial since water in the soil improves its self-leveling properties
- B. Seasonal groundwater rise may have brought the water table to or near the surface in some areas — saturated soil conditions significantly reduce the undrained bearing capacity of cohesive soils and effective stress in granular soils, meaning the dry-season assessment may substantially overstate the current bearing capacity; current conditions must be evaluated
- C. The 5-foot water table depth is always below the zone of influence for crane outriggers regardless of seasonal variation
- D. Groundwater only affects bearing capacity when it is within 12 inches of the surface

12. A crane operator discovers during setup that the right rear outrigger beam cannot be extended to the full rated extension because the outrigger beam extension cylinder has seized in a partially extended position at approximately 70% of full extension. What must happen before any lifting can begin?

- A. The crane may operate with the right rear outrigger at 70% extension using the full extension capacity section values since 70% is close to full extension
- B. The operator must determine whether a rated configuration exists for 70% or partial extension, and use the most conservative applicable section; but more critically, a seized cylinder must be evaluated since it may indicate a structural problem beyond the extension limitation — the crane should be removed from service for evaluation
- C. Reduce the planned lift capacity by 30% to compensate for the partial outrigger extension
- D. The crane must be removed from service immediately — the seized cylinder is a mechanical deficiency requiring repair before the crane is used for any purpose

13. A crane setup location has been approved by the controlling entity based on a soil bearing capacity report. Before beginning setup, the crane operator notices that a section of the ground within the planned outrigger spread area shows vegetation consisting of reeds, cattails, and water-tolerant grasses that are still green and growing. What does this vegetation pattern indicate?

- A. The presence of wetland-indicator vegetation suggests the area has a consistently high moisture content or seasonal saturation — these plants require saturated or nearly saturated soil conditions to thrive; crane setup in a hydric soil zone likely has bearing capacity far below what the surrounding drier soil assessment indicated, and this area warrants specific geotechnical evaluation before any outrigger loading
- B. Wetland vegetation indicates good soil drainage which improves bearing capacity
- C. Wetland indicator plants grow in any moist area including healthy, stable soil — their presence has no bearing on soil structural capacity
- D. The vegetation indicates the area is environmentally protected and requires a permit before crane operations

14. Under OSHA 1926.1408, when is an encroachment prevention plan required versus when must the line be de-energized?

- A. An encroachment prevention plan is never sufficient — all power lines must be de-energized before any crane operation can legally begin within the crane's maximum working radius
- B. A line must be de-energized whenever the MSAD cannot be maintained; if de-energization is not feasible, an encroachment prevention plan may be used as an alternative control — but de-energization is always the preferred option and must be evaluated first before defaulting to an encroachment prevention plan
- C. Encroachment prevention plans are always adequate regardless of distance — de-energization is optional
- D. De-energization is required only for lines above 200 kV — lines below 200 kV may always be addressed with an encroachment prevention plan

15. A crane is set up at a job site that uses a compressed air pneumatic caisson system for a deep foundation. The caisson work occurs 25 feet from the crane's setup area, and compressed air is being injected into the ground to maintain a dry working environment inside the caisson. What subsurface hazard does this process create for crane outrigger support?

- A. Compressed air injected into the ground near an outrigger position can pressurize the soil pore spaces, reduce effective stress between soil particles, and potentially cause localized ground heave or sudden loss of bearing capacity — the pressurized soil zone is an unstable bearing medium and the outrigger positions near the caisson must be evaluated for this pneumatic pressure effect
- B. Compressed air caisson work is always performed in watertight conditions and has no effect on adjacent soil bearing capacity
- C. The caisson work is 25 feet away — beyond the zone of influence for any surface crane outrigger load
- D. Compressed air improves soil density by displacing water and improves bearing capacity near the injection point

### **OPERATIONS DOMAIN — Questions 16–30**

16. A crane operator is performing a lift when the crane's rated capacity indicator (RCI) alarm activates at 90% capacity. The operator confirms the load weight was verified and the configuration is correctly entered into the RCI. What is the most appropriate first response?

- A. Continue the lift since the alarm is at 90% and the crane has not reached 100% capacity
- B. Reduce swing speed to minimum to reduce centrifugal load displacement before assessing the RCI reading
- C. Continue while recalibrating the RCI during the lift
- D. Stop the hoist immediately and verify the actual operating radius against the planned value — the most common cause of an unexpected RCI alarm at a confirmed load weight is that the actual radius is greater than planned, either from boom deflection under load or a measurement error; the radius must be confirmed before proceeding

17. Under OSHA 1926.1416, an operator is directed to lift a load over a trench where workers are actively performing excavation work below. What action is required before the lift proceeds?

- A. All workers in the trench must be evacuated and the trench confirmed clear of personnel before the load passes overhead — OSHA 1926.1425 prohibits loads from passing over personnel under any circumstances, including workers in an excavation below grade
- B. Workers in the trench are protected by the trench walls and are not considered "personnel" in the load path

- C. The lift may proceed if the workers in the trench are aware of the overhead lift and are wearing hard hats
- D. The lift director may authorize the lift to proceed over the occupied trench if the load clearance above the trench exceeds 15 feet

18. A crane operator is completing a multi-lift shift when the lift director radios and says: "We need one more quick lift — just a small 8,000-pound beam, shouldn't take more than 10 minutes." No pre-lift information has been provided and the operator has not been shown a load chart entry for the new configuration. What must the operator require before beginning this additional lift?

- A. The operator may perform the lift since the lift director's description of "small" and "quick" implies it is within safe parameters
- B. Accept verbal assurance from the lift director and proceed if the LMI reads below 75% during the initial pick
- C. The operator must confirm the actual load weight, determine the operating radius, look up the capacity in the load chart, verify the total suspended weight against the gross capacity, and confirm the crane is in the correct configuration — "quick" and "small" are not load chart inputs; no lift may begin without confirmed capacity verification regardless of estimated size
- D. The operator must receive a written lift plan before any lift that was not included in the original day's plan

19. A crane is performing a lift when the operator receives the TRAVEL signal and the signal person points toward the set location — indicating the crane should travel with the load to the set position. The crane is a pick-and-carry rated rough terrain crane. The load weighs 5,400 lbs and the pick-and-carry maximum load is 6,200 lbs. What must the operator verify before beginning travel?

- A. Nothing additional — the load is within the pick-and-carry rated weight limit and travel may proceed
- B. The operator must also confirm the boom length, boom angle, and travel surface match the conditions specified in the pick-and-carry section of the load chart — pick-and-carry ratings are specific to exact configurations and surface conditions; being within the weight limit is necessary but not sufficient without confirming all rated configuration conditions
- C. The operator must reduce the load to 80% of the pick-and-carry rated limit before any travel
- D. Pick-and-carry operations require a dedicated signal person walking beside the crane during all travel

20. A crane operator observes that after completing a hoist and coming to a stop, the load drifts slowly downward approximately 2 inches over a 3-minute period with the controls in neutral. The LMI reads 84% capacity. What does this drift indicate and what action is required?

A. A 2-inch drift over 3 minutes is within the acceptable drift tolerance for hydraulic brakes — no action is required

B. The drift is caused by temperature-related hydraulic fluid expansion in the closed hoist circuit — it is normal during warm-weather operations

C. The drift rate varies with load weight and is acceptable when below the manufacturer's stated drift tolerance

D. Hoist drift with the controls in neutral indicates the hoist brake is not developing sufficient holding force — any downward movement of a suspended load with controls in neutral is unacceptable; the crane must be removed from service and the hoist brake repaired before any further lifting operations

21. Under OSHA 1926.1419, what happens if the signal person and crane operator cannot agree on what a specific hand signal means before a lift begins?

A. Operations must not begin until the specific signal in dispute has been mutually defined, agreed upon, and understood by both parties — using a signal that both parties do not have the same interpretation of is a communication failure that must be resolved before the first movement

B. The operator's interpretation of the signal governs since the operator is responsible for crane movement

C. The lift director may define ambiguous signals and both parties must accept the lift director's definition

D. Use of the ambiguous signal should be avoided — substitute a radio command for any signal whose meaning is disputed

22. A crane is performing a tandem lift when one crane experiences a partial hydraulic failure — the hoist function slows significantly but does not stop entirely. The load is currently at 12 feet of height equally shared between the two cranes. What is the correct response from both crane operators?

A. The unaffected crane should immediately hoist its share to take all the load while the affected crane stabilizes

B. The lift director should direct the unaffected crane to slowly boom up to transfer load away from the affected crane

C. Both operators must stop all movement immediately and hold their positions — in a tandem lift, no crane may act unilaterally; the lift director must take charge of a coordinated recovery that safely returns the load to the ground with both cranes moving together under controlled direction

D. The affected crane should immediately lower its share to the ground while the unaffected crane holds its position

23. A crane operator is asked to use the crane's load line to pull a stuck pile that is embedded in the ground — the pile is jammed and the contractor wants the crane to apply a vertical pulling force to extract it. What is the specific operational concern with pile extraction?

A. Pile extraction is always permitted if the extraction force does not exceed the crane's rated capacity at the operating configuration

B. Pile extraction creates a risk that the pile will suddenly release from the ground during the extraction attempt — when the resistance force is eliminated suddenly, the crane can spring back dramatically, potentially causing loss of control, tip-over, or structural overload from the sudden release of stored elastic energy; pile extraction requires specific authorization and engineered planning beyond standard lift procedures

C. Pile extraction is prohibited under OSHA 1926 Subpart CC regardless of load weight

D. Pile extraction is equivalent to a standard vertical hoist and requires only confirmation that the extraction force is within the crane's rated capacity

24. Under OSHA 1926.1431, when a personnel platform is at its set location and workers are performing work from the platform, the crane operator must remain at the controls throughout the entire period. Under what specific OSHA-recognized circumstance may the operator temporarily leave the controls while workers are in the suspended platform?

A. The operator may leave for brief bathroom breaks as long as the drum pawl is engaged

B. The operator may leave for up to 15 minutes if the platform is within 3 feet of a secure landing

C. The operator may leave if the signal person agrees to monitor the load from the ground

D. OSHA 1926.1431 does not authorize the operator to leave the controls while personnel are suspended in the platform — the operator must remain at the controls at all times; this is an absolute requirement with no exceptions in the standard

25. A crane operator is performing a lift in conditions where visibility is reduced by fog — the signal person is visible at 25 feet but the load and hook are intermittently obscured at 40 feet of height. What must happen before the lift can safely continue?

A. The visibility conditions require that a second observer be positioned with clear sight to the load throughout all phases of the lift, or a relay signal person chain must be established that provides continuous verified visibility from the load to the operator — intermittent load visibility creates an unacceptable condition where the operator cannot confirm the load's position and condition during operations

B. The operator may continue if the signal person can confirm the load's general position by radio

C. Lift operations may continue in fog as long as the signal person has clear sight to the crane

D. Reduced visibility conditions require reducing the operating radius to bring the load closer to the operator's field of view

26. A crane operator completes a shift's final lift. Before leaving the site, the operator must secure the crane. Which set of actions satisfies ASME B30.5 crane securing requirements?

A. Lower the hook block to the ground, shut off the engine, and lock the cab door

B. Confirm the hook block is at the travel position rather than ground level, lock all hydraulic functions in the neutral position, and secure the cab

C. Lower all loads to the ground, secure all functions with brakes engaged, protect against unauthorized operation, and secure the hook block at a safe working height to prevent unauthorized attachment while reducing wind moment on the boom — then lock the cab

D. Extend the outriggers to ground contact and place the boom in the minimum angle position before shutting down

27. Under OSHA 1926.1427, a crane operator working on a project receives an assignment to operate a different crane model on the same project — a crawler crane when the operator normally operates a telescopic boom crane. The operator's NCCCO certification covers the LBC (Lattice Boom Crawler) type. What does the employer still need to do even though the operator is certified for the LBC type?

A. Nothing additional — the operator's LBC NCCCO certification fully authorizes all lattice boom crawler operations and no additional employer action is required

B. Evaluate and document that the operator is competent to safely operate this specific crawler crane model at this specific worksite — the NCCCO certification confirms type-general knowledge; the employer's specific competency evaluation for the actual machine and site is a separate and additional requirement

C. The operator must perform one supervised lift on the new crane before being authorized to perform independent lifts

D. The employer must notify OSHA when an operator changes crane models on an active project

28. A crane is performing a lift at 88% of rated capacity. During the swing, the tag line handler loses control of the tag line, which becomes wrapped around a nearby pipe rack column. The load begins to pull toward the column as the swing continues. What must the operator do?

A. Increase swing speed to swing the load past the column before the tag line becomes fully taut

B. Continue the swing at minimum speed while the tag line handler unwraps the line

C. Lower the load immediately to reduce the tension in the tag line while the handler unwraps

D. Stop all crane movement immediately — a tag line wrapped around a structure with a suspended load creates a lateral side-loading force on the boom as the swing continues; at 88% of rated capacity, any additional lateral force risks exceeding the boom's structural capacity; the load must be held stationary until the tag line is freed

29. Under ASME B30.5, when must a crane's rated capacity be re-confirmed through load chart verification during an ongoing work shift?

A. Capacity verification is required only at the start of the shift — subsequent lifts with identical parameters are automatically authorized

B. Nothing — once capacity is confirmed for a configuration, it remains valid until the configuration changes

C. When any change occurs to the crane's configuration, load weight, operating radius, or site conditions that would affect the applicable capacity values — every lift must be within a confirmed rated capacity, and changes that affect the capacity calculation require re-verification of the applicable chart values

D. Every 2 hours of operations regardless of whether any parameters have changed

30. A crane operator is in the middle of a hoist when the crane's hydraulic oil temperature reaches the manufacturer's maximum rated operating temperature — the red zone activates. The load is at 18 feet of height. What is the correct response?

- A. Complete the hoist to the set position and shut down for cooling after the load is placed
- B. Sound the emergency horn to warn personnel, maintain the load at current height while the system cools, and resume hoisting once the temperature drops to normal
- C. Continue the lift since hydraulic temperature spikes are brief and self-limiting
- D. Lower the load to the nearest safe surface as quickly as safely possible and shut down for hydraulic system cooling — operating above the maximum rated hydraulic temperature risks fluid breakdown, seal damage, and potential sudden loss of load holding capacity; the load must be secured on the ground before shutdown

#### **TECHNICAL KNOWLEDGE DOMAIN — Questions 31–42**

31. A crane's main hook is inspected and found to have a visible crack running along the outside of the hook curve — the convex side of the hook body. The crack is approximately 5/8 inch long. What action is required, and what does the crack's location on the convex side indicate about its likely cause?

- A. The convex (outside) face of a hook experiences tensile stress during loading — cracks initiating on the tensile face are consistent with fatigue from repeated loading cycles, and any crack in a hook is an absolute removal condition under ASME B30.10; the hook must be removed from service and replaced
- B. A crack on the convex side of the hook is less serious than one on the concave side — the hook may remain in service at 50% capacity
- C. The 5/8-inch crack must be evaluated by a certified welding inspector before a removal decision is made
- D. Apply magnetic particle testing to confirm the crack depth before deciding on removal

32. Under ASME B30.9, what is the maximum allowable reduction in wire diameter for a wire rope sling used in a straight pull application before it must be removed from service?

- A. 5% reduction from the nominal diameter is acceptable before removal
- B. 10% reduction from the nominal diameter is acceptable for slings used in straight pull only

C. 3% reduction is the maximum for most applications under general rigging standards

D. 3/64 inch reduction from the nominal diameter — regardless of the nominal diameter, any wire rope whose measured diameter has reduced by more than 3/64 inch from the nominal value must be removed from service

33. A rigging crew is assembling a 6-leg wire rope sling bridle for an exceptionally heavy and delicate lift. The load weighs 84,000 lbs and all 6 legs will be at 60 degrees from horizontal. Each sling leg has a vertical hitch WLL of 18,000 lbs. What is the tension on each leg and is the configuration adequate?

A. Each leg tension =  $(84,000 \div 6) \times (1 \div \sin 60^\circ) = 14,000 \times 1.155 = 16,170$  lbs — within the 18,000-lb WLL; the configuration is adequate

B. The 6-leg bridle is not a standard configuration and cannot be rated under ASME B30.9

C. Each leg carries 14,000 lbs — within the 18,000-lb WLL; the configuration is adequate

D. The 6-leg configuration requires independent engineering certification before use

34. A crane is operating when a hydraulic hose connecting the hoist motor to the control valve develops a pinhole leak that emits a fine mist of hydraulic fluid. The hose is in a pressurized supply line. What is the specific danger of a mist-emitting hydraulic hose, and what action is required?

A. A mist-emitting hydraulic hose creates no structural hazard — only a fluid loss concern requiring topping up

B. Continue operations until the shift ends and repair the hose during the scheduled maintenance window

C. A fine hydraulic mist from a pressurized line is an injection hazard and a fire hazard — the mist can penetrate skin at high velocity (hydraulic injection injury) and the fine droplets are highly flammable near ignition sources; the crane must be stopped immediately, the load lowered to the ground, and the hose repaired before any further operations

D. Mark the area with caution cones and continue operations at reduced load

35. Under ASME B30.9, what specific requirement applies to the storage of synthetic web slings when they are not in use?

A. Synthetic slings must be cleaned and dried completely before storage — wet storage is prohibited

B. Synthetic slings must be stored in a clean, dry location away from sunlight, heat sources, sharp objects, and chemicals; they should be hung or stored flat to avoid kinking; proper storage prevents UV degradation, heat damage, chemical contamination, and physical damage that can reduce capacity without visible evidence

C. Synthetic slings must be stored in their original manufacturer packaging between uses

D. Storage requirements for synthetic slings are identical to those for wire rope slings

36. A crane operator is performing a maintenance check and finds that the hydraulic fluid level in the reservoir is 30% below the minimum marked on the sight glass. The crane is scheduled for a critical lift in one hour. What is the required action?

A. The crane may perform the critical lift since hydraulic systems function adequately at reduced fluid levels for short-term operations

B. Top off the fluid from any available hydraulic fluid container to bring the level within the normal operating range

C. Reduce the critical lift load by 30% to reduce hydraulic demand during operations at reduced fluid level

D. The hydraulic fluid must be topped off to the correct level with the manufacturer-specified fluid type, and the source of the fluid loss must be identified before the crane is used — operating below the minimum fluid level risks pump cavitation, fluid aeration, and reduced brake holding capacity; the level and the leak source must both be addressed before the critical lift

37. Under ASME B30.5, what is required regarding the crane operator's knowledge of the removal-from-service criteria for the specific crane being operated?

A. The operator must have specific knowledge of the removal-from-service criteria for the crane being operated — this knowledge is required to perform meaningful pre-shift and operational inspections, since the operator cannot identify and report deficiencies without knowing what conditions trigger removal; this knowledge is part of the operator qualification requirements

B. Removal-from-service criteria are the maintenance department's responsibility — operators need only report unusual conditions they observe

C. Operators must memorize the 10 most common removal criteria but do not need to know all criteria

D. Removal criteria are detailed in the operator's manual — the operator must have access to the manual rather than memorizing the criteria

38. A crane inspector finds that the boom's hydraulic extension cylinder for the outermost boom section shows evidence of "rod wipe" — a thin film of hydraulic fluid is visible along the rod where it exits the seal, and there is a light residue of dried fluid running down the cylinder body. What does rod wipe indicate and what action is required?

- A. Rod wipe is acceptable and normal — all hydraulic cylinders produce a thin protective film during normal operation
- B. Rod wipe with dried residue indicates the cylinder rod seal has exceeded its design service life and is allowing fluid to escape past the seal — while the rate may currently be minimal, the deteriorating seal will progressively worsen and the cylinder may lose holding capacity under full load; the crane should be evaluated and the cylinder seal replaced before the condition worsens
- C. Clean the cylinder and monitor for recurrence — remove from service only if the wipe rate increases
- D. Rod wipe only affects hose connections, not cylinder holding capacity — no structural concern exists

39. A rigger is preparing to use an alloy steel shackle for a multi-leg bridle pick. The shackle pin is a bolt-type pin secured with a hex nut and cotter pin. During the pre-use inspection, the rigger finds the cotter pin is missing. The nut is still threaded onto the bolt pin and appears fully seated. May the shackle be used without the cotter pin?

- A. The cotter pin is only a redundant retention device — the threaded nut alone provides full rated capacity and the shackle may be used
- B. The cotter pin prevents the nut from backing off due to vibration and load rotation — without the cotter pin, the nut can unscrew during operations, allowing the pin to back out and the load to fall; the shackle must not be used until a correct cotter pin is installed
- C. The shackle may be used at 80% of its rated capacity without the cotter pin as a conservative measure
- D. Thread a piece of wire through the cotter pin hole as a temporary substitute and proceed

40. A crane's wire rope passes over a sheave that has a groove radius significantly larger than the rope's nominal radius — the groove is designed for a 3/4-inch rope but a 1/2-inch rope is installed. What does the undersized rope in an oversized groove create?

- A. An oversized groove provides more clearance and is always preferable to a tight-fitting groove
- B. The rope contacts the sheave only at the bottom of the groove, not along the sides — this creates a concentrated contact point that produces very high contact stress at the bottom, rapidly deforming and

fatiguing the crown wires; the rope must be replaced with the correct diameter or the sheave must be replaced with one matching the rope diameter

- C. An undersized rope in a large groove simply rides freely with reduced friction — no concern applies
- D. The groove size mismatch causes the rope to jump the sheave under any lateral load condition

41. Under OSHA 1926 Subpart CC, which of the following correctly describes the qualification requirement for a "qualified rigger"?

- A. A qualified rigger must hold a current NCCCO rigger certification from an accredited organization
- B. A qualified rigger must have at least 3 years of documented rigging experience on construction sites
- C. There is no OSHA qualification requirement for riggers — only signal persons and operators require qualifications
- D. A qualified rigger is a person who, by possession of a recognized degree, certificate, professional standing, or extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to rigging — the standard is performance-based and does not mandate a specific credential type

42. A crane operator discovers during the annual inspection that the crane's slewing ring shows vertical deflection of 0.080 inches when tested under a known load. The manufacturer's specification states the maximum allowable deflection is 0.060 inches. The inspector recommends continued operation with monthly monitoring. Is this recommendation appropriate?

- A. Monthly monitoring is appropriate when the deflection exceeds the specification by less than 25%
- B. Nothing is wrong — slewing ring deflection specifications have a field tolerance of  $\pm 30\%$  before replacement is required
- C. The inspector's recommendation is inappropriate — measured deflection exceeding the manufacturer's specification is an out-of-specification condition requiring evaluation by the manufacturer or a qualified engineer, not continued operation with monitoring; the crane must be removed from service until the slewing ring is assessed and either confirmed adequate with an updated specification or replaced
- D. The crane may continue at 75% of rated capacity while monitoring progresses

## MANUFACTURER LOAD CHARTS DOMAIN — Questions 43–65

43. A crane load chart for a telescopic boom crane shows the following values in the 100-foot boom at full outrigger extension: 30 ft = 36,400 lbs; 35 ft = 28,800 lbs; 40 ft = 22,600 lbs. The planned lift is at 33 feet of radius. The hook block weighs 2,100 lbs, slings weigh 560 lbs, and hardware weighs 200 lbs. The payload weighs 24,000 lbs. Using the conservative approach, is the lift within capacity?

A. Conservative capacity at 35 ft = 28,800 lbs; net capacity =  $28,800 - 2,860 = 25,940$  lbs; total suspended weight =  $2,860 + 24,000 = 26,860$  lbs; this exceeds the conservative capacity — the lift cannot proceed as planned

B. Using the 30-foot value conservatively:  $36,400 - 2,860 = 33,540$  lbs net capacity; 24,000 lbs is well within this value

C. Interpolated capacity at 33 ft = 32,384 lbs; net capacity =  $32,384 - 2,860 = 29,524$  lbs; 24,000 lbs is within capacity

D. The conservative capacity at 35 ft = 28,800 lbs gross; total suspended weight = 26,860 lbs; since 26,860 lbs is within the 28,800-lb gross capacity, the lift proceeds

44. A crane load chart note states: "When swinging loads over the rear sector (45 degrees each side of rear center), capacity is limited to 85% of the values shown in this section." The operator is performing a lift that requires the boom to pass through the rear sector during the swing. The tabulated capacity at the current configuration and radius is 32,000 lbs. What is the applicable capacity during the rear sector transit?

A. Full capacity of 32,000 lbs applies throughout the swing since the note is advisory

B. The 85% factor applies only while the boom is in the rear sector — during transit:  $32,000 \times 0.85 = 27,200$  lbs applicable capacity for the rear sector portion of the swing

C. Use the 360-degree section during rear sector swings

D. The rear sector restriction applies only to lifts that begin and end in the rear sector, not to swings that pass through it

45. A crane load chart shows the following for the 80-foot boom in the on-outrigger full extension section: all cells are white (stability-limited). At 20 feet = 62,400 lbs; at 25 feet = 50,200 lbs. A planned lift at 22 feet has a total suspended weight of 58,000 lbs. Using the conservative approach, what capacity governs?

- A. Conservative capacity at 25 ft = 50,200 lbs; total suspended weight (58,000 lbs) exceeds 50,200 lbs — the lift cannot proceed in this configuration at 22 feet using the conservative approach
- B. Interpolated capacity at 22 ft = 57,240 lbs — within capacity using the interpolated value
- C. The 20-foot capacity of 62,400 lbs governs since 22 feet is closer to 20 feet than to 25 feet
- D. Both the conservative and interpolated approaches confirm the lift is within capacity

46. A crane's load chart shows different maximum rated radii for different counterweight configurations: standard counterweight has a maximum radius of 50 feet for the 100-foot boom, while maximum counterweight has a maximum radius of 60 feet. Why does maximum counterweight allow a greater maximum rated radius?

- A. Maximum counterweight reduces the crane's structural loading at long radii by shifting the center of gravity rearward
- B. Maximum counterweight improves stability by increasing the restoring moment — at longer radii where stability tipping governs, the greater restoring moment from maximum counterweight allows the crane to carry rated loads to a greater radius before reaching the tipping threshold
- C. Maximum counterweight increases the hydraulic pressure available to the hoist system, allowing heavier lifts at greater radii
- D. Maximum counterweight does not affect maximum rated radius — the same radius applies to all counterweight configurations

47. A crane load chart for a luffing jib configuration shows a note: "Luffing jib operations require a minimum main boom length of 120 feet." The crane's main boom is currently at 100 feet. An operator plans to use the luffing jib capacity section for a lift. What prevents this?

- A. The 100-foot main boom is close enough to the 120-foot minimum and the operator may use the luffing jib section with a 5% derating
- B. The minimum main boom length requirement is a configuration condition of the luffing jib section — the structural analysis underlying the jib section assumed the boom suspension geometry of a 120-foot or longer boom; with a 100-foot boom, the pendant angles and structural load path are different and the section's values do not apply; the operator must extend the boom to at least 120 feet before using the luffing jib
- C. The minimum boom length requirement applies only to the assembly procedure, not to operational lifting

D. The operator may contact the manufacturer for authorization to use the luffing jib with the 100-foot boom

48. A crane load chart shows: 120-foot boom at 55 ft = 11,800 lbs; at 60 ft = 8,600 lbs. The actual operating radius is 57 feet. Using the conservative interpolation approach, what capacity governs? The total rigging weighs 2,200 lbs and the payload weighs 5,900 lbs.

A. Interpolated capacity at 57 ft = 9,960 lbs; total suspended weight = 8,100 lbs; lift proceeds

B. Conservative capacity at 60 ft = 8,600 lbs; total suspended weight = 5,900 + 2,200 = 8,100 lbs; 8,100 lbs is within the 8,600-lb conservative capacity — the lift proceeds

C. Conservative capacity at 55 ft = 11,800 lbs; total suspended weight = 8,100 lbs; lift proceeds using the prior tabulated value

D. The lift cannot proceed since 57 feet falls between tabulated values and interpolation is not permitted for non-tabulated radii

49. A crane's load chart contains the following note: "All capacities are based on the hook block specified in this crane's parts manual. Use of a heavier hook block reduces net payload by the weight difference." The specified hook block weighs 1,400 lbs. The operator is using a hook block weighing 2,200 lbs. The tabulated gross capacity at the planned configuration is 28,400 lbs. What additional deduction must be made?

A. The additional 800-lb weight difference ( $2,200 - 1,400 = 800$  lbs) must be deducted from the tabulated capacity — the tabulated value already accounts for the specified 1,400-lb block; using the 2,200-lb block means an extra 800 lbs is consuming the gross capacity beyond what the table assumed, reducing the net payload by an additional 800 lbs

B. The full 2,200-lb hook block weight must be deducted from gross capacity since all rigging is always deducted

C. No additional deduction is needed since the note specifies that the heavier block "reduces net payload" which is automatically captured by the LMI

D. Deduct the difference only when the heavier block exceeds the specified block by more than 20%

50. A crane load chart shows a section for "OVER FRONT (0° TO 30° EACH SIDE)" with a capacity of 38,400 lbs at a specific configuration, and a "360-DEGREE" section showing 28,600 lbs at the same configuration and radius. The boom is at 25 degrees from the front center. Which section applies?

- A. Use the 360-degree section since 25 degrees approaches the 30-degree sector boundary
- B. Nothing in ASME B30.5 permits directional capacity sections — only 360-degree sections may be used
- C. The over-front section applies — the boom at 25 degrees is within the 0° to 30° each side sector specification; the over-front capacity of 38,400 lbs is applicable and the operator may use this value
- D. Average the two section values for a boom position near the sector boundary

51. A crane is configured with an 80-foot boom at full outrigger extension. The load chart shows 24,400 lbs at 35 feet. A note in this section reads: "Capacities marked with (▲) require level crane within 0.25% of grade — re-verify level immediately before each lift in this section." The planned cell is marked (▲). The crane was leveled to 0.2% at the start of the shift. After six lifts, what must the operator do before the seventh lift in this section?

- A. Nothing — the initial leveling at 0.2% satisfies the requirement for the entire shift
- B. Re-verify the crane's current level condition against the 0.25% tolerance before beginning the seventh lift — the note is a binding condition that requires verification immediately before each lift, not just at shift start; progressive settlement or other level changes must be caught before each lift in this section
- C. Re-verify level only when the shift exceeds 4 hours
- D. Re-verify level only when lifting above 85% of the section's capacity values

52. A crane load chart shows two separate sections for "STANDARD REEVING (4-PART LINE)" and "HEAVY REEVING (8-PART LINE)" at the same boom and outrigger configuration. The 4-part section shows 28,400 lbs at 35 feet and the 8-part section shows 28,400 lbs at the same configuration. Why might both reeving configurations show identical capacity?

- A. The identical values are a printing error — 8-part line always shows higher capacity than 4-part line
- B. Nothing — both sections are always identical since reeving configuration does not affect rated capacity
- C. The values suggest the reeving configuration does not change the governing limit — when the structural or stability limit of the crane is reached before the rope's single-line pull capacity, changing the reeving configuration does not increase the total hook load capacity; both configurations are governed by the same structural or stability limit
- D. The 8-part section shows lower single-line pull which automatically limits it to the same capacity as 4-part

53. A crane load chart section note reads: "Outrigger reaction loads for this configuration are provided in Table C. Verify ground bearing capacity does not exceed the values in Table C before lifting." The operator has confirmed soil bearing capacity at 4,500 psf. Table C shows a maximum outrigger reaction load of 110,000 lbs at the heaviest position for the planned lift. What minimum cribbing area is required?

A. Minimum cribbing area =  $110,000 \div 4,500 = 24.4$  sq ft, rounded up to 25 square feet of contact area at the heaviest outrigger position

B. Minimum cribbing area =  $110,000 \div 4,500 = 24.4$  sq ft; this means at least 25 square feet of cribbing contact with the soil is required; the operator must confirm the cribbing achieves this contact area at the ground interface, not just the cribbing's nominal size

C. The soil at 4,500 psf is adequate for any configuration in this section — no cribbing calculation is needed

D. Minimum area =  $110,000 \div 4,500 = 24.4$  sq ft; one 5-foot  $\times$  5-foot mat (25 sq ft) at that position satisfies the minimum

54. A crane is using a 100-foot main boom. The load chart's full outrigger extension section shows the following values: 40 ft = 23,800 lbs; 45 ft = 18,400 lbs; 50 ft = blank. A pick at 43 feet and a set at 46 feet are planned. The blank at 50 feet indicates the maximum rated radius. Using the conservative approach, which capacities govern pick and set?

A. Pick at 43 ft: conservative = 23,800 lbs at 40 ft; set at 46 ft: conservative = 18,400 lbs at 45 ft — the set governs the lift plan at 18,400 lbs

B. The blank at 50 ft limits operations to 45 ft maximum — since both the pick and set are within 45 ft, both are within the envelope

C. Pick at 43 ft: conservative = 18,400 lbs at 45 ft; set at 46 ft: conservative = 18,400 lbs at 45 ft — same governing capacity for both

D. Pick at 43 ft: conservative = 18,400 lbs; set at 46 ft: blank at 50 ft limits maximum radius to 45 ft; 46 ft exceeds maximum rated radius — set position cannot proceed

55. A crane load chart contains a note: "Pick and carry operations under this section are permitted only on firm, prepared surfaces. On unprepared or uneven surfaces, use of this section is not authorized." The crane is being used to pick-and-carry across a freshly graded dirt surface that has not been compacted. What does the note require?

A. A freshly graded but uncompacted dirt surface does not qualify as "firm, prepared" for pick-and-carry under this note — the operator cannot use this section's pick-and-carry values on an uncompacted surface; the load must be set down and the crane repositioned without a load, or the surface must be properly prepared before pick-and-carry operations can proceed

B. Freshly graded surfaces are adequate for pick-and-carry since grading removes debris

C. The note is advisory — the operator may judge surface adequacy independently

D. The surface qualifies if the operator reduces pick-and-carry load to 75% of the section's maximum

56. A crane's load chart for a telescopic boom crane shows capacity values organized by "BOOM POSITION" — designating each set of capacity values to a specific boom extension percentage (50%, 75%, 100%). The crane is at 87% extension. Which section applies?

A. The 100% extension section applies since 87% is closer to 100% than to 75%

B. The 75% extension section applies since it is the most restrictive rated configuration that is less than the actual extension

C. Interpolate between the 75% and 100% extension sections to estimate capacity at 87% extension

D. 87% extension is not a rated boom position in this chart — neither the 75% nor 100% section applies; the boom must be adjusted to either the 75% or 100% position before lifting, since intermediate positions are not rated in this chart's organization

57. A crane load chart shows the following for a 100-foot boom at full outrigger extension: 25 ft = 44,200 lbs; 30 ft = 35,600 lbs; 35 ft = 28,200 lbs. A lift requires 29 feet of operating radius. After interpolation, the estimated capacity is approximately 32,780 lbs. The conservative capacity at 30 feet is 35,600 lbs. Both the payload (26,000 lbs) and total suspended weight (28,800 lbs) are within both values. The lift proceeds using the interpolated value. What risk does the interpolated approach create compared to the conservative approach?

A. Interpolation creates a more accurate capacity estimate and has no additional risk compared to the conservative approach

B. Nothing — both approaches produce valid capacity values and the operator may freely choose between them

C. The conservative capacity is always 5% higher than the interpolated value, providing additional margin

D. Using the interpolated value rather than the conservative approach means the operator has less margin against measurement error — if the actual radius is even slightly greater than 29 feet, the interpolated capacity decreases; the conservative approach guarantees that a small radius measurement error will not push the lift beyond the confirmed tabulated capacity, making it inherently more robust against field uncertainty

58. A crane is performing a critical lift at 86% of the load chart's tabulated gross capacity. The operator notices during the swing that the load appears to be swinging outward — away from the boom tip — approximately 2.5 feet beyond the plumb position. The LMI shows the reading has climbed from 86% to 94% during the swing. What does this pattern confirm and what action is required?

A. The swing is normal — continue to the set location since the LMI is still below 100%

B. The 8% LMI increase during the swing confirms that centrifugal displacement has increased the effective operating radius by approximately 2.5 feet — at the greater effective radius, the rated capacity is lower; the operator must immediately reduce swing speed to minimize centrifugal displacement and bring the effective radius back toward the planned value before the LMI climbs further

C. The load is heavier than planned — lower immediately and re-weigh

D. The LMI increase indicates a sensor malfunction — reset the LMI and continue

59. A crane is configured with a 100-foot boom and a 30-foot fixed jib at 10-degree offset. The load chart jib section shows 11,400 lbs at 45 feet and 9,200 lbs at 50 feet. The planned operating radius is 47 feet. The jib head block weighs 320 lbs and rigging weighs 480 lbs. The payload weighs 8,200 lbs. Using the conservative approach, what capacity governs and does the lift proceed?

A. Conservative capacity at 50 ft = 9,200 lbs; total suspended weight =  $8,200 + 320 + 480 = 9,000$  lbs; 9,000 lbs is within 9,200 lbs — the lift proceeds with only a 200-lb margin; careful radius management is essential

B. Conservative capacity = 11,400 lbs at 45 ft; total = 9,000 lbs; lift proceeds comfortably

C. Interpolated capacity at 47 ft = 10,520 lbs; total = 9,000 lbs; lift proceeds with adequate margin

D. Conservative capacity at 50 ft = 9,200 lbs; total = 9,000 lbs; the 200-lb margin is insufficient for a safe lift and must be increased before proceeding

60. A crane load chart contains a section for "ON OUTRIGGERS — REDUCED EXTENSION (18 FT SPREAD)" and a section for "ON OUTRIGGERS — FULL EXTENSION (26 FT SPREAD)." A site

constraint requires one side of the outriggers to be at full extension (26 ft) and the opposite side at reduced extension (18 ft). Which section applies?

- A. The full extension section applies since half the outriggers are at full extension
- B. The operator may average the two spreads:  $(26 + 18) / 2 = 22$  feet and interpolate between sections
- C. Neither section directly applies — a mixed extension setup is not a rated configuration; the most conservative rated section (18-ft reduced extension) must be used for all operations since it bounds the actual asymmetric configuration in a way that is safe, though the unequal extension geometry itself may require engineering review
- D. The reduced extension section automatically applies to any asymmetric outrigger configuration

61. A crane's load chart shows that for the 100-foot boom at full outrigger extension, all cells from 15 to 25 feet of radius are shaded gray (structural-limited) and all cells from 30 feet and beyond are white (stability-limited). A lift at 22 feet of radius is planned at 94% of the structural-limited capacity. What operational precaution is specifically required by the structural-limited designation?

- A. Structural-limited lifts at 94% require manufacturer written authorization before proceeding
- B. Nothing additional — structural and stability limits both provide equivalent safety margins at equivalent percentages
- C. The specific precaution for near-capacity structural-limited lifts is to use exceptionally smooth, controlled crane movements throughout the lift — no sudden starts, stops, or direction changes; no simultaneous multi-function operation; and no swing acceleration that adds inertial loading to the already near-limit structural stress
- D. Structural-limited lifts require a dedicated observer positioned at the boom base to monitor for buckling deflection

62. A crane load chart section note reads: "The following capacities are based on the absence of a jib or fly section. If a jib or fly section is present on the crane in any configuration — stowed, staged, or active — the applicable jib-installed section must be used." The operator has a 20-foot fly section stored on the crane carrier in a horizontal stowed position on the boom rest. Which section applies?

- A. The main boom section applies since the fly section is stowed on the carrier, not attached to the boom
- B. The note's scope is clear — "present on the crane in any configuration" including stored on the carrier; the jib-installed section must be used since the fly section is physically present on the crane

regardless of whether it is attached to the boom; the note specifically includes staged and stowed configurations

C. The fly section's weight on the carrier is already included in the crane's self-weight and does not affect boom capacity

D. Contact the manufacturer to clarify whether "present on the crane" includes storage on the carrier versus attachment to the boom

63. A crane is performing a lift at 40 feet of radius with a confirmed total suspended weight of 21,400 lbs. The gross capacity at 40 feet is 24,600 lbs — a lift percentage of 87%. The operator is then directed to raise the boom to increase the angle from 58 degrees to 72 degrees, which will reduce the radius from 40 feet to approximately 30 feet. At 30 feet, the gross capacity is 36,200 lbs. What happens to the lift percentage after the boom-up movement?

A. The lift percentage increases because the boom-up movement is always more dangerous than boom-down

B. Lift percentage after boom-up =  $21,400 \div 36,200 \times 100 = 59.1\%$ ; the lift percentage decreases from 87% to approximately 59% because the shorter radius corresponds to higher rated capacity; the boom-up movement is favorable from a capacity margin perspective

C. The lift percentage remains at 87% since the load weight has not changed

D. The new lift percentage cannot be determined without knowing the actual exact new radius

64. A crane load chart contains a section that shows capacity values only when three specific conditions are all simultaneously satisfied: full outrigger extension, maximum counterweight, and boom length between 80 and 140 feet. The crane is at 100-foot boom, full outrigger extension, and maximum counterweight. During the lift, the boom is accidentally extended to 105 feet without the operator noticing — the automatic extension activated briefly. When the operator notices the boom is now 105 feet, what is the status of the lift?

A. The 105-foot boom is within the 80–140 foot range specified in the section header — the section still applies

B. The 105-foot extension changes the boom length but is within the section's range of 80–140 feet; the operator should update the LMI configuration to 105 feet and continue using the same section

C. Nothing changes — the section covers all boom lengths within the range and 105 feet is within that range

D. The LMI must be updated to reflect the 105-foot boom configuration to ensure it is calculating capacity using the 105-foot column values rather than the 100-foot column — using the wrong column

means the capacity displayed is incorrect for the actual configuration; the operator must confirm the 105-foot capacity at the current radius before proceeding

65. A crane operator is planning a lift using the on-outrigger full extension section. The load chart shows 31,200 lbs at 30 feet and 24,800 lbs at 35 feet. The planned radius is 32 feet. The total suspended weight is 27,400 lbs. After computing the conservative capacity and comparing it to the total suspended weight, what is the final determination, and what is the lift percentage based on the conservative capacity?

A. Conservative capacity at 35 ft = 24,800 lbs; total suspended weight (27,400 lbs) exceeds conservative capacity — the lift cannot proceed as planned in this configuration; if the operator uses the interpolated value of approximately 29,680 lbs, the lift would be within capacity at 92.3%, but the conservative approach does not support the planned lift

B. The lift proceeds — 27,400 lbs is below the 31,200-lb capacity at 30 feet

C. Conservative capacity = 24,800 lbs; lift proceeds since 27,400 is within 10% of the conservative value

D. Conservative capacity = 24,800 lbs; lift percentage = 110.5%; the lift cannot proceed since it exceeds the conservative capacity

## Specialty Exam 7 Answer Key and Full Explanations

1. A — Hydraulic fill — dredged silt and sand placed to extend land area — has notoriously unpredictable and often very low bearing capacity because it was deposited under water without compaction and may contain organic material, soft zones, and variable density throughout. A concrete apron over hydraulic fill hides the fill's condition from visual inspection and does not guarantee structural integrity of the underlying material. Geotechnical evaluation of the hydraulic fill is required before crane outrigger loading.

2. C — OSHA Table A specifies a 20-foot MSAD for power lines with voltage over 200 kV to 350 kV. At 230 kV, the applicable MSAD is 20 feet. The 26-foot clearance exceeds this requirement by 6 feet, satisfying the MSAD. This margin must be maintained by every part of the crane — boom, load line, and load — throughout all phases of operations.

3. B — Scarification mechanically destroys the natural soil structure in the treated layer, breaking up the inter-particle interlocking that provides bearing capacity. The scarified layer has essentially zero structural bearing capacity — the loose particles will not support concentrated loads and an outrigger

pad will sink immediately into the disturbed material. Only the undisturbed native soil below the scarified zone retains its assessed capacity.

4. D — OSHA 1926.1402(b) specifically names the controlling entity as responsible for ensuring ground conditions are firm, drained, and graded for crane operations. When conditions are inadequate, the obligation to prepare the ground rests with the controlling entity — not the crane owner, manufacturer, or operator. This is an affirmative obligation, not just a notification requirement.

5. A — When a pile is driven adjacent to soft soil, the pile penetration densifies the soil around the pile through displacement and soil consolidation. This creates a local zone of increased density and bearing capacity immediately adjacent to the pile. The proximity of the outrigger to a newly driven pile may actually reflect improved ground conditions in the immediate vicinity, not a hazard — though the pile cap area must be confirmed structurally adequate for the outrigger load path.

6. C — Water jetting introduces large volumes of water directly into the soil around the target utility, saturating the immediate area. Saturated cohesive and granular soils can lose dramatic amounts of bearing capacity within hours of saturation. The zone around the jetting location may have much lower actual bearing capacity than the surrounding unaffected soil — assessment of the current conditions in the water-affected zone is required before outrigger loading.

7. B — Clearance = 18 ft (conductor height) – 14 ft (boom height) = 4 feet. OSHA Table A specifies a 15-foot MSAD for lines in the over-50 kV to 200 kV range. At 69 kV, the applicable MSAD is 15 feet. The 4-foot clearance is far below the required 15 feet, meaning this travel route cannot be used as planned. The line must be de-energized, the crane must find an alternate route, or the conductor must be raised before travel can proceed.

8. D — A steel road plate in full contact with the soil distributes the outrigger load over the plate's contact area. Ground bearing pressure =  $96,000 \div 64 \text{ sq ft} = 1,500 \text{ psf}$ . The soil must have at least 1,500 psf confirmed bearing capacity to support this pressure. Both the plate's structural capacity (to carry the outrigger float load across the 64 sq ft area) and the soil's bearing capacity (to support the 1,500 psf distributed load) must be confirmed before use.

9. A — Petroleum contamination in granular soils coats the individual grain surfaces with hydrocarbon films that reduce the inter-particle friction responsible for the soil's shear strength and bearing capacity. The contaminated zone may behave differently from the surrounding clean gravel — potentially flowing or settling under concentrated loads that the clean gravel easily supports. The 4,000 psf assessment from uncontaminated areas should not be assumed valid in the contaminated zone.

10. C — Engineered crane pads are designed to specific loading conditions — a specific crane model's outrigger loads at a specific lift configuration and weight. A pad designed for a 100-ton crane performing a light lift may be inadequate for an 80-ton crane performing a near-capacity lift if the outrigger reaction loads differ significantly. The pad's design parameters must match the planned crane's actual configuration and loading before it can be relied upon.

11. B — Seasonal groundwater rise can bring saturated conditions to near the surface in areas where the seasonal high water table approaches the ground surface. Saturated soil has significantly reduced bearing capacity — the water fills pore spaces that would otherwise contribute to the soil's shear strength through effective stress. The dry-season assessment may overstate current bearing capacity by a substantial margin when the water table has risen.

12. D — A seized hydraulic cylinder is a mechanical deficiency that prevents the outrigger from achieving the rated extension position. ASME B30.5 removal criteria apply to this condition — a mechanical deficiency that prevents the crane from being placed in a rated configuration requires repair before the crane is used. Additionally, a seized cylinder may indicate a more serious internal hydraulic problem that could affect other critical functions.

13. A — Wetland indicator plants — reeds, cattails, and hydrophytic species — require saturated or near-saturated soil conditions throughout their growing season to thrive. Their presence is strong evidence that this zone is a hydric soil area with a seasonally or permanently high water table. Hydric soils typically have very low bearing capacity due to high moisture content and often organic matter accumulation. The controlling entity's report based on drier areas does not cover this zone.

14. B — OSHA 1926.1408 establishes a hierarchy: de-energization is the preferred control and must be evaluated first. Only when de-energization is not feasible may an encroachment prevention plan be used as an alternative. The encroachment prevention plan is not inherently inferior to de-energization for all situations, but the regulation's hierarchy requires that de-energization feasibility be assessed before defaulting to the operational plan approach.

15. A — Compressed air caisson systems inject air pressure into the ground to prevent water intrusion into the working chamber. This creates a zone of pressurized pore air in the soil adjacent to the caisson. Pressurized pore air reduces the effective stress between soil particles — the same mechanism as pore water pressure in saturated soils — potentially causing ground heave or loss of bearing capacity near the pressurized zone. The zone of influence extends beyond the caisson perimeter and must be evaluated for adjacent outrigger support.

16. D — The most common cause of an unexpected RCI alarm at a confirmed load weight is that the actual operating radius is greater than the planned value — either from boom deflection under load or a pre-load radius measurement error. Stopping and verifying the actual radius is the correct first response because it addresses the most likely physical cause. Continuing or recalibrating during the lift risks proceeding at a capacity level that may not match the actual configuration.

17. A — OSHA 1926.1425 is unambiguous — loads may not pass over personnel. Workers in an excavation are personnel regardless of their below-grade position. The trench walls do not provide protection against a load drop — a dropped load will impact the trench floor and potentially the workers with full force. All workers must physically exit the trench and clear the load's swing path before the lift proceeds.

18. C — "Quick" and "small" are not load chart inputs. Every lift requires confirmed load weight, confirmed operating radius, confirmed load chart capacity lookup, and comparison of total suspended weight to gross capacity. An unplanned lift is not exempt from these requirements — it is more vulnerable to planning errors precisely because it was not included in the original shift planning. The operator must perform the full capacity verification before the first hoist input.

19. B — Pick-and-carry ratings specify exact configuration conditions simultaneously: boom length, boom angle, maximum load weight, surface requirements, and maximum travel speed. Meeting the weight limit alone does not authorize travel if any other condition — boom length, boom angle, or surface type — differs from the rated condition. The operator must confirm all listed conditions are met before beginning travel with the load.

20. D — ASME B30.5 and OSHA 1926 both require that hoist brakes hold a suspended load without drift when the controls are in neutral. Any downward movement — regardless of rate — indicates the brake is not developing sufficient holding force to support the load. Progressive brake drift indicates a deteriorating condition that will worsen under subsequent loads. The crane must be removed from service and the brake repaired immediately.

21. A — OSHA 1926.1419 requires that the signal system be established and understood by both the operator and signal person before operations begin. If any signal's meaning is in dispute, it cannot be safely used — acting on a signal interpreted differently by each party creates exactly the miscommunication hazard that signal standardization is designed to prevent. The dispute must be resolved through mutual agreement before the first lift using that signal.

22. C — In a tandem lift, the load is shared between two cranes whose combined forces must remain balanced throughout all movements. Any unilateral action by one crane — hoisting, booming, or

swinging — changes the load distribution on the other crane unpredictably. The lift director must coordinate both cranes simultaneously to safely return the load to the ground under controlled conditions that maintain acceptable load sharing throughout the recovery.

23. B — Pile extraction differs fundamentally from a standard vertical lift because the soil resistance force is unpredictable — it can suddenly release when the pile friction or end bearing is overcome. This sudden release removes the large resistive force from the system, allowing the crane to "spring back" from the stored elastic energy in the boom, rigging, and lifting structure. This sudden unloading can cause violent crane movement, tip-over, or structural overload. Engineered planning specific to the pile extraction force is required.

24. D — OSHA 1926.1431 requires the operator to remain at the controls at all times while personnel are suspended in the platform. There are no exceptions in the standard — not for brief breaks, not when the platform is near a landing, not with signal person monitoring. This absolute requirement exists because any sudden change in crane position, load, or emergency requires immediate operator response that cannot be provided by an absent operator.

25. A — The operator cannot safely direct a crane lift when the load is intermittently invisible — the operator cannot confirm the load's position, detect rigging disengagement, identify obstacles, or respond to load contact with structures. Either a second observer with continuous sight to the load must be established and linked to the operator through a relay system, or operations must wait for visibility to improve. Inferring load position from the signal person's position is not equivalent to confirmed direct observation.

26. C — ASME B30.5 end-of-shift requirements include: lowering all loads, securing all functions with brakes engaged, protecting against unauthorized operation, and maintaining the hook block at a safe working height. Ground-level hook block is not required — maintaining it at a safe height prevents unauthorized attachment and reduces wind-induced boom loading while not leaving loose rope on the drum that could cause spooling problems.

27. B — OSHA 1926.1427 requires that the employer evaluate and document operator competency for each specific crane model at each specific worksite. The NCCCO LBC certification confirms that the operator has the knowledge and skills for lattice boom crawler operation in general — it does not confirm familiarity with this particular crawler crane's controls, configuration, or the specific site's hazards. The employer's competency evaluation is a separate and additional requirement.

28. D — A tag line wrapped around a structural column creates a lateral force on the boom when the swing continues — the load is effectively being pulled sideways toward the column while the crane

pushes the opposite direction. At 88% of rated capacity, the structural members are already under high stress; adding a lateral force from the wrapped tag line can push the combined structural loading beyond the boom's design capacity. All movement must stop immediately.

29. C — Load chart capacity confirmation is required for every lift because any change that affects capacity — radius, configuration, load weight, or site conditions — requires re-verification against the applicable chart values. The requirement is not time-based but event-based; when anything that could affect the applicable capacity changes, the capacity must be re-confirmed. This includes changes during operations, not just between shifts.

30. D — The manufacturer's maximum rated hydraulic operating temperature defines the limit above which the fluid's properties are degraded — reduced viscosity, reduced lubrication effectiveness, and potential seal damage. Operating above the maximum rated temperature in the red zone risks progressive hydraulic system damage and, most critically, potential loss of load-holding capacity from degraded seals or insufficient fluid film thickness. The load must reach the ground before shutdown since a hydraulic failure after shutdown could prevent controlled lowering.

31. A — The convex (outside) face of a hook is the tension face — it experiences the highest tensile stress during loading. Cracks on the tension face are consistent with fatigue crack initiation at stress concentration points. Any crack in a hook is an absolute removal condition under ASME B30.10 — there is no threshold depth, no monitoring period, and no capacity reduction option. High-strength steel hooks can fail catastrophically from crack propagation under subsequent loading.

32. D — ASME B30.9 specifies the same 3/64-inch diameter reduction criterion for wire rope slings as ASME B30.5 specifies for running ropes. This criterion applies regardless of the nominal rope diameter — a 3/4-inch rope and a 1-inch rope both use the same absolute diameter reduction threshold. Diameter reduction indicates material loss from abrasion or corrosion that reduces the rope's tensile capacity below its nominal rated value.

33. A — With six legs at 60 degrees from horizontal: tension per leg = (total load ÷ 6 legs) × (1 ÷ sin 60°) = (84,000 ÷ 6) × (1 ÷ 0.866) = 14,000 × 1.155 = 16,170 lbs. Since 16,170 lbs is below the 18,000-lb WLL per leg, the configuration is adequate with 1,830 lbs of margin per leg. The six-leg bridle divides the total load by six before applying the angle factor, significantly reducing per-leg tension compared to fewer-leg configurations at the same angle.

34. C — A pressurized hydraulic mist from a pinhole leak creates two simultaneous life-threatening hazards. First, hydraulic fluid under pressure (typically 2,000–5,000 psi) can penetrate skin at pinhole leak velocity, causing hydraulic injection injury — an emergency medical condition that requires

immediate treatment. Second, fine hydraulic mist is highly flammable and can ignite from engine heat or electrical sources. Both hazards require immediate crane shutdown.

35. B — ASME B30.9 requires synthetic web slings to be stored away from sunlight, heat sources, sharp objects, and chemical contamination. UV radiation degrades polymer fiber chains continuously and silently — slings left hanging in sunlight lose strength invisibly over time. Heat above the sling's rated temperature permanently alters fiber properties. Chemical contamination may be invisible but can completely destroy the fiber's molecular structure. Proper storage protects the sling's capacity between uses.

36. D — Operating a hydraulic system with fluid 30% below the minimum level risks pump cavitation (fluid level below the pump inlet) and fluid aeration from turbulence at low reservoir levels. Both conditions can cause pump damage and erratic brake performance. Additionally, the source of the 30% fluid loss must be identified — a significant fluid loss indicates a leak that may be in a hose, fitting, or cylinder that could fail during the critical lift. Both the level and the leak source must be addressed.

37. A — ASME B30.5 operator qualification requirements implicitly require that operators know removal-from-service criteria for the crane being operated. An operator who cannot identify a removal-triggering condition cannot perform a meaningful inspection — they may find the condition but not know it requires removal. This knowledge is fundamental to the inspection function that operators perform daily and is part of the competency basis for NCCCO certification.

38. B — Rod wipe with dried residue indicates the cylinder rod seal is allowing hydraulic fluid to escape past its sealing surfaces. While a minimal wipe rate may currently not affect holding capacity, hydraulic seals do not self-repair — the condition is progressive. As the seal deteriorates, the wipe rate increases until the cylinder loses its ability to maintain pressure and consequently loses its load-holding capacity. Evaluation and seal replacement before the condition becomes critical is the appropriate response.

39. B — The cotter pin in a bolt-type shackle prevents the nut from rotating off the pin due to vibration, load oscillation, and incidental contact during rigging operations. Without the cotter pin, the nut can unscrew progressively until it falls off, allowing the pin to back out of the shackle bow and releasing the load. This failure mode can occur without warning and results in complete sudden load drop. The cotter pin is not optional safety hardware — it is a required retention device.

40. B — A wire rope in a sheave groove that is too large for the rope's diameter contacts the groove only at the bottom apex — the groove walls that should be cradling and supporting the rope's sides make no contact. All of the groove's contact force is concentrated at this single bottom point, creating very high

contact stress per unit area. This crushes the rope's crown wires at the contact point, rapidly fatiguing them and causing premature wire breakage.

41. D — OSHA 1926.1401 defines "qualified rigger" using the same performance-based framework as other qualified person definitions: knowledge, training, and experience demonstrated through ability to resolve rigging problems. No specific credential is mandated by OSHA for rigger qualification. The operator cannot assess compliance by checking a certification card — the qualification must be demonstrated through competence in the specific rigging task.

42. C — The manufacturer's maximum allowable deflection specification is the engineering limit beyond which the slewing ring bearing is considered to have worn to the point requiring evaluation or replacement. Exceeding this specification is a non-compliant condition — the inspector's recommendation to continue with monitoring is inappropriate because it authorizes operation of equipment known to be out of specification. The crane must be removed from service for manufacturer or engineering evaluation.

43. A — Conservative Capacity at 35 ft = 28,800 lbs; Total Suspended Weight of 26,860 lbs Exceeds Net Capacity of 25,940 lbs — Lift Cannot Proceed

When the actual radius falls between two chart values, the conservative approach requires using the next greater radius — the one with the lower capacity. At 33 feet, that means applying the 35-foot value of 28,800 lbs. Total rigging weight is  $2,100 + 560 + 200 = 2,860$  lbs. Net capacity =  $28,800 - 2,860 = 25,940$  lbs. Total suspended weight =  $24,000 + 2,860 = 26,860$  lbs. Since 26,860 lbs exceeds the 25,940-lb net capacity, the lift cannot proceed as planned.

44. B — The note is a binding load chart condition establishing an 85% derating factor when the boom transits the rear sector. During the rear sector transit:  $32,000 \times 0.85 = 27,200$  lbs. The total suspended weight must remain within 27,200 lbs during all portions of the swing that pass through the rear sector. This derating likely exists because rear sector stability is lower than other directions for this crane configuration.

45. A — Conservative approach: capacity at the next larger tabulated radius (25 ft) = 50,200 lbs. Total suspended weight = 58,000 lbs. Since 58,000 lbs exceeds 50,200 lbs by 7,800 lbs, the lift cannot proceed at 22 feet using the conservative approach. The stability-limited designation for all cells means this lift is especially sensitive to out-of-level conditions and dynamic loading, reinforcing why the conservative approach's lower bounding value is the appropriate standard.

46. B — Maximum counterweight increases the restoring moment — the force  $\times$  distance product of the counterweight that resists the crane tipping toward the load. At long radii where the load's overturning moment approaches the machine's restoring moment (stability tipping governs), greater counterweight allows rated capacity to extend to a greater radius before reaching the tipping threshold. This is why counterweight configuration directly affects the maximum rated radius for stability-limited configurations.

47. B — The minimum main boom length requirement for a luffing jib configuration is a structural geometry condition — the pendant angles, mast geometry, and load distribution through the boom support system differ significantly between a 100-foot and 120-foot boom. The structural analysis underlying the jib section's capacity values assumed the load path geometry of a 120-foot boom. With a 100-foot boom, the actual structural loading is different from what the capacity values were derived for.

48. B — Using the conservative interpolation approach, the capacity at the next larger tabulated radius (60 feet) = 8,600 lbs. Total suspended weight = 5,900 + 2,200 = 8,100 lbs. Since 8,100 lbs is less than 8,600 lbs, the lift is within conservative capacity with a 500-lb margin. The conservative approach ensures that any small radius measurement error will not push the lift beyond a confirmed tabulated capacity.

49. A — The note states the tabulated values already account for the specified 1,400-lb block. Using the heavier 2,200-lb block means an additional 800 lbs beyond what the table assumed is consuming gross capacity. This 800-lb difference must be deducted from the tabulated gross capacity, reducing the available payload by 800 lbs. The standard practice of deducting all rigging from gross capacity would apply to any remaining rigging beyond the hook block.

50. C — The over-front section applies when the boom is within the stated sector —  $0^\circ$  to  $30^\circ$  each side of front center. At 25 degrees, the boom is within the sector and the over-front section's capacity of 38,400 lbs is the applicable value. The 360-degree section's lower value of 28,600 lbs was derived as a conservative all-positions value — using it when a specific higher-capacity directional section applies understates the available capacity.

51. B — The note's requirement to "re-verify level immediately before each lift" is a binding condition applied to every individual lift in this section — not just the shift start. Progressive settlement between lifts can cause the crane to drift out of the 0.25% tolerance without the operator noticing. At 94% capacity in a section with tight leveling requirements, the operator must confirm the crane is within tolerance before every individual lift.

52. C — When both 4-part and 8-part reeving sections show identical capacity at the same configuration, it confirms that the crane's structural or stability limit governs before the rope's mechanical advantage capacity is reached. The structural limit is independent of how many parts of line are used — increasing parts of line cannot increase capacity above the structural ceiling. Both sections converge at the same structural or stability limit regardless of reeving.

53. A — Minimum cribbing area = outrigger reaction load ÷ soil bearing capacity =  $110,000 \div 4,500 = 24.4$  sq ft, rounded up to 25 square feet. Both the load (from Table C) and the soil capacity are confirmed values that must be used together to calculate the minimum contact area. The operator must confirm the actual cribbing provides at least 25 square feet of contact area against the soil — nominal mat size may not equal effective contact area if the mat is not fully in contact with the ground.

54. D — Conservative approach at pick (43 ft): next larger tabulated radius = 45 ft, capacity = 18,400 lbs. Conservative approach at set (46 ft): the blank at 50 ft defines the maximum rated radius as 45 feet — the set at 46 ft exceeds the maximum rated radius. There is no rated capacity at 46 feet. The set location cannot be reached in this crane configuration; the crane must be repositioned or a longer boom configuration used.

55. A — The note's language is clear and specific: "firm, prepared surfaces" is a condition for using the section's pick-and-carry values. A freshly graded but uncompacted dirt surface does not meet this definition — "prepared" implies intentional surface treatment such as compaction, stabilization, or paving. Without the required surface condition, the section's values cannot legally be applied and the pick-and-carry operation cannot proceed.

56. D — The load chart organizes capacity values by specific boom extension percentage positions: 50%, 75%, and 100%. These represent discrete rated configurations, not a continuous spectrum. The 87% position is not a rated configuration in this chart — it has no associated capacity values. The boom must be moved to one of the three rated positions before a capacity value from this chart can be applied.

57. D — The interpolated value provides a more precise capacity estimate but removes the safety buffer that the conservative approach provides against measurement uncertainty. In field conditions, radius measurements have inherent uncertainty — errors of 0.5 to 1 foot are common. Using the conservative (tabulated 35-foot) value means a 1-foot radius measurement error does not push the lift beyond a confirmed capacity. Using the interpolated value means the same measurement error produces a lower confirmed margin.

58. B — The LMI's climb from 86% to 94% during the swing is a direct measurement of centrifugal load displacement increasing the effective operating radius. The 2.5-foot outward swing of the load corresponds to a radius increase that reduces the rated capacity, making the same weight represent a higher percentage. Reducing swing speed reduces the centrifugal force, brings the effective radius back toward the planned value, and prevents further LMI increase.

59. A — Conservative approach: capacity at the next larger tabulated radius (50 ft) = 9,200 lbs. Total suspended weight = 8,200 + 320 + 480 = 9,000 lbs. Since 9,000 lbs is within the 9,200-lb conservative capacity, the lift proceeds with a 200-lb margin. This extremely narrow margin requires precise radius control — any actual radius increase beyond 47 feet would push the effective radius closer to the 50-foot boundary and further reduce the margin.

60. C — An asymmetric outrigger configuration — one side full extension, the opposite at reduced extension — is not rated in either the full extension or reduced extension section, since both sections assume uniform extension on all four sides. The reduced extension section is the most conservative rated configuration that bounds the actual situation and must be used. The asymmetric geometry itself (unequal spread creating asymmetric stability) may also require engineering review.

61. C — Structure-limited capacities indicate the crane's structural members are at their design stress limit at the tabulated value. At 94% of this limit, only 6% structural reserve remains. Any dynamic loading from abrupt starts, stops, or swing acceleration adds structural stress on top of the near-limit static load. Smooth, controlled movements throughout the lift are the specific operational precaution required — no sudden inputs that add inertial or dynamic loading to the already near-limit structural condition.

62. B — The note's scope explicitly includes "stowed, staged, or active" jib configurations. A fly section stored on the crane carrier is physically present on the crane — exactly what the note addresses. The manufacturer included stowed and staged configurations because the jib's presence even in storage adds weight to the crane's weight distribution that may affect stability calculations. The note must be followed as written.

63. B — After the boom-up movement: new gross capacity at approximately 30 feet = 36,200 lbs. New lift percentage =  $21,400 \div 36,200 \times 100 = 59.1\%$ . The boom-up movement is favorable from a capacity standpoint because the reduced operating radius corresponds to a higher rated capacity. The same load weight now represents a smaller fraction of the higher rated capacity at the shorter radius.

64. D — When the boom length changes during a lift, the LMI must be updated to the new configuration to ensure it is calculating capacity against the correct column values. The section header's 80–140 foot

range means the 105-foot boom is still within the section — the section does apply. However, the LMI that was configured for 100 feet is now computing against the wrong column. The operator must update the LMI to 105 feet and confirm the 105-foot capacity at the current radius before proceeding.

65. A — Conservative capacity at the next larger tabulated radius (35 ft) = 24,800 lbs. Total suspended weight = 27,400 lbs. Since 27,400 lbs exceeds 24,800 lbs, the lift cannot proceed using the conservative approach. The interpolated capacity at 32 feet  $\approx (31,200 - [(32-30) \div (35-30)] \times (31,200-24,800)) = 31,200 - (0.4 \times 6,400) = 31,200 - 2,560 = 28,640$  lbs. Using the interpolated value:  $27,400 \div 28,640 \times 100 = 95.7\%$  — within capacity but only by 1,240 lbs. The conservative approach, however, does not support the lift.