

SIMULATION SET 13

SITE DOMAIN — Questions 1–21

1. A crane operator is evaluating a setup location at a large university hospital expansion project. The site plan shows the planned outrigger zone sits directly over a tunnel that connects the existing hospital to the new wing — the tunnel is at 12 feet of depth, 8 feet wide by 10 feet tall, and is constructed of cast-in-place reinforced concrete. The maximum outrigger reaction load is 84,000 lbs and the outrigger float is 2 sq ft. What must happen before setup?

A. The reinforced concrete tunnel at 12 feet of depth is below the zone of influence for any surface crane loading

B. Bearing pressure = $84,000 \div 2 = 42,000$ psf — the tunnel roof structure must be evaluated by a structural engineer to confirm it can resist both the soil load and the concentrated outrigger point load before any crane setup proceeds; tunnels are designed for soil overburden loads and internal live loads, not for crane outrigger point loads that can exceed the combined original design loads by large factors

C. The 12-foot tunnel depth provides adequate soil cushion to distribute any surface crane load safely

D. The hospital facilities manager must authorize any crane setup above underground infrastructure

2. A crane operator is performing a site walk at a waterfront construction project when they discover that the planned right outrigger spread is partially on native soil and partially on a seawall cap — a reinforced concrete structure 4 feet wide \times 3 feet thick that runs along the water's edge. The outrigger mat will span from 1 foot onto the seawall cap to 3 feet onto the native soil. What concern does this mixed-support condition create?

A. Nothing — spanning a mat across two different surfaces is a standard practice that distributes the load effectively

B. The crane cannot operate near a seawall cap under any circumstances due to water proximity

C. A mat spanning from the native soil onto the seawall cap will experience differential support — the seawall cap is a rigid concrete structure while the native soil is compressible; under crane loading, the mat will settle on the soil side while remaining stable on the cap side; this differential support rotates the mat, concentrating the load at the cap edge and creating a fulcrum effect that can crack the cap; both surfaces must be evaluated and the mat must be sized to achieve uniform support

D. Contact the project structural engineer before making any decision about the seawall cap support condition

3. Under OSHA 1926.1402, when a crane is set up on a barge and the barge is repositioned during crane operations, what ground condition obligation applies to the new barge position?

A. The crane employer must confirm that the barge's stability under the crane's operating loads is maintained at the new position — the barge's freeboard, trim, and stability characteristics may change as it moves to a new location with different water depth, current, or load distribution; the ground condition obligation for barge-mounted operations includes confirming the barge remains within the crane manufacturer's operating slope tolerance at the new position before lifting begins

B. The initial barge stability assessment covers all subsequent positions within the same waterway

C. Barge repositioning is the marine contractor's responsibility — the crane employer has no ground condition obligation during barge movements

D. A new stability assessment is only required when the barge crosses a jurisdictional waterway boundary

4. A crane is set up at a construction project when the operator observes that a water truck is spraying the construction road — a road that is immediately uphill from the setup area. After 20 minutes, the operator observes that the soil surface at the left rear outrigger position has changed from a firm light-tan color to a visibly darker brown color, and the surface now accepts the operator's boot heel to 0.3 inches. What does this observation indicate and what action is required?

A. The darker soil is caused by shadow from the crane's boom — no bearing capacity change has occurred

B. Nothing — 0.3 inches of heel penetration after wetting is within normal tolerance for clay soils

C. Stop all crane operations and evaluate the bearing conditions at the affected outrigger position — the combination of uphill water application, progressive darkening of the soil surface, and 0.3 inches of heel penetration confirms that water has infiltrated the soil in the bearing zone and has softened it; the bearing capacity at the left rear position is no longer what was assessed in dry conditions; operations must stop until the moisture infiltration is controlled and bearing conditions are re-evaluated

D. Monitor the soil darkening for 10 more minutes before deciding whether to stop operations

5. A crane is operating at an industrial site when a heavy equipment operator drives a 60,000-lb excavator to a position 12 feet from the crane's right front outrigger mat to begin excavating a trench. The excavator begins digging and dumps spoil 15 feet from the same outrigger position. What concerns does this activity create?

A. Nothing — an excavator operating at 12 feet is outside the standard zone of concern for crane operations

B. The approaching excavator and spoil pile both add surcharge to the soil in the crane's bearing zone — the excavator at 12 feet adds its wheel/track loads to the soil adjacent to the outrigger; the spoil pile adds a distributed surcharge; the excavation itself removes passive resistance on the trench side; the combined effect of surcharge loading and passive resistance removal can reduce the bearing capacity at the adjacent outrigger; the crane operator must assess whether these activities can continue while crane operations proceed

C. The spoil pile is the only concern — the excavator's movement does not affect bearing conditions

D. The crane must be shut down whenever any other heavy equipment is operating within 25 feet

6. A crane operator is setting up at a job site when they find that the planned right outrigger spread crosses over a section of pavement that shows a pattern of "alligator cracking" — a network of interconnected cracks forming a pattern that resembles reptile scales across approximately 8 square feet of the planned mat contact area. What does alligator cracking in pavement indicate?

A. Alligator cracking is a normal aging characteristic of all asphalt surfaces and requires no special assessment

B. Nothing — alligator cracking is caused by surface shrinkage and has no structural implication

C. The crane setup may proceed if the cracked area is patched before mat placement

D. Alligator cracking — also called fatigue cracking — indicates the pavement's base or sub-base has failed to support the surface layer under repetitive loading; the pavement is likely spanning a weakened or failed base; crane outrigger loading on alligator-cracked pavement can cause sudden punching failure through the cracked surface into the failed base below; the sub-base condition must be confirmed before crane outrigger loading on this section

7. Under OSHA 1926.1408, what is the specific sequence of steps required before any crane operation begins near an overhead power line for the first time at a new project site?

A. Before any crane operation near a power line at a new site: (1) identify all power lines in the crane's work area before the crane arrives; (2) contact the utility operator to determine voltage and feasibility of de-energization; (3) establish the MSAD based on confirmed voltage; (4) implement controls (de-energization, insulating, or encroachment prevention plan); (5) confirm all affected personnel are briefed on the MSAD and controls before operations begin — all steps must precede the first crane movement near the line

B. The operator must contact the utility company the morning of the lift and proceed when they respond

C. A power line safety assessment is only required when the crane's maximum boom reach can reach within 20 feet of the line

D. The crane manufacturer's proximity alarm system satisfies all OSHA 1926.1408 requirements without additional steps

8. A crane is set up at a job site when the operator notices that the surface of the concrete beneath the right rear outrigger mat is spalling — small, irregular pieces of concrete are breaking off and the surface is becoming rough and uneven. The spalling covers approximately 40% of the mat's contact area. What does surface spalling under a loaded outrigger mat indicate?

A. Surface spalling is caused by the mat's rough surface texture abrading the concrete — no structural concern applies

B. The spalling only affects appearance — the remaining 60% of contact area provides adequate support

C. Surface spalling under a loaded outrigger mat indicates the concrete surface layer is failing in compression or shear under the bearing pressure — the concentrated outrigger load is exceeding the surface concrete's compressive strength; as spalling progresses, the mat sinks into the developing depression, increasing the effective bearing pressure further; operations must stop and the concrete's structural condition at that position must be evaluated

D. Apply grout to the spalled areas to restore the surface before continuing operations

9. A crane operator is performing a site walk at an active naval base when they find that the planned outrigger positions are on a pier deck that is in a current use area for loading munitions. The area is not posted as off-limits for crane operations. What concern must be raised?

A. Nothing — a lack of posted restrictions confirms the area is authorized for crane operations

B. Active munitions loading areas represent a potential hazard if the crane's outrigger loading or any operational incident causes a dropped load, impact, or vibration near stored or handled munitions — the crane employer must confirm with the naval facility's explosive safety officer that crane operations in

this area are authorized, that the munitions loading activity will be suspended during crane operations, and that the operational protocols satisfy the facility's explosive safety requirements

C. Munitions loading areas are always safe for crane operations since military facilities maintain the highest safety standards

D. The crane employer must contact the base commander and obtain written authorization before any crane setup near munitions handling areas

10. A crane is operating at a job site when an unexpected rain event produces 1.8 inches of rainfall over 2 hours. The setup area consists of medium dense sand with a confirmed bearing capacity of 4,200 psf in dry conditions. After the rain stops, the operator probes the soil with a 1/2-inch rod and finds it penetrates 4 inches by hand pressure. What must the operator conclude?

A. Sandy soils drain quickly — 4 inches of rod penetration confirms the soil has drained adequately

B. Nothing — medium dense sand retains its bearing capacity after rainfall since water drains through quickly

C. Nothing — 4 inches of rod penetration in medium dense sand is within normal tolerance after rain events

D. The 4-inch rod penetration by hand pressure in soil previously confirmed at 4,200 psf in dry conditions indicates the rainfall has significantly softened the soil at the surface — medium dense sand temporarily loses bearing capacity when saturated; 4 inches of penetration by hand is a meaningful indicator of softening; operations must not resume until the soil drains and probing confirms adequate density has returned

11. A crane is set up at an active manufacturing facility. During crane operations, the facility begins a scheduled roof drainage test — opening roof drains and flowing test water through the storm drainage system beneath the crane's setup area. The drainage lines pass at 4 feet of depth under the right outrigger spread. What concern does the drainage test create?

A. Confirm the drainage pipes can handle the test flow without leaking — the crane may continue operating during the drainage test with monitoring

B. Nothing — storm drainage systems are designed for maximum flow capacity and pose no threat to surface bearing conditions

C. Active flow through drainage pipes at 4 feet of depth can create ground vibration and, if the pipes are under pressure or have compromised joints, can introduce water into the soil at the depth of the crane's

bearing zone; operations must be paused during the drainage test and the ground conditions at the outrigger positions must be confirmed adequate after the test flow has completed

D. The drainage test creates only a regulatory compliance concern — no structural concern applies to crane operations

12. A crane operator is performing a site walk and discovers that a previous crew placed 3-inch-thick plywood sheets under the outrigger mats at this location. The plywood shows no visible damage. Can the plywood be used as cribbing or mat support for the current crane configuration?

A. Plywood is a standard cribbing material and may be used under any outrigger mat without restriction

B. Nothing — plywood is a manufactured material with consistent structural properties suitable for any cribbing application

C. The plywood's structural capacity for the specific crane's outrigger reaction loads must be confirmed before use — not all plywood is rated for outrigger loading; the thickness, grade, species, and layup affect the plywood's compressive and bending capacity; 3-inch-thick plywood may have adequate capacity for some configurations but must be specifically evaluated for the current crane's maximum outrigger reaction load before being relied upon as cribbing

D. Plywood cribbing is prohibited under OSHA 1926 Subpart CC — only manufactured timber mats are authorized

13. A crane is set up at a project site when the on-site soils engineer informs the operator that a subsurface investigation conducted 3 months ago identified a zone of loose sand at 6 to 9 feet of depth beneath the planned left outrigger spread. The engineer states that no remediation was performed because the loose sand zone was "not within the building foundation's zone of influence." What does this information require the crane operator to assess?

A. Nothing — if the soils engineer cleared the area for building construction, it is adequate for crane setup

B. The crane's outrigger loads create a stress bulb that extends well below the bearing surface — a loose sand zone at 6 to 9 feet of depth may be within the crane's outrigger stress bulb depending on the outrigger reaction load and spread; while the loose sand zone was not relevant to the building foundation, it may be very relevant to the crane's concentrated point loads; the crane employer must determine whether the loose sand zone is within the crane's stress influence depth before setup

C. The soils engineer's assessment releases the controlling entity from any ground condition obligation

D. The loose sand zone is below the 5-foot depth limit for crane outrigger influence

14. A crane is set up at a commercial high-rise project when the construction superintendent informs the operator that a micro-pile installation crew will begin installing micro-piles 18 feet from the right front outrigger position. Micro-pile installation involves drilling and grouting small-diameter piles under high pressure. What must the operator evaluate?

A. Nothing — micro-pile installation at 18 feet is outside the standard zone of concern for crane operations

B. The micro-pile installation may proceed simultaneously since it improves the adjacent soil through grouting

C. Nothing — the controlling entity's approval of simultaneous operations covers any ground condition effects

D. High-pressure grouting during micro-pile installation at 18 feet can create elevated pore pressure in the soil between the installation point and the crane's outrigger — this temporarily reduces effective stress and bearing capacity in the adjacent soil; simultaneously, the drilling vibration may cause settlement in loose materials; the crane's level condition must be monitored throughout micro-pile installation and operations may need to pause when installation is occurring closest to the right front outrigger

15. A crane operator is preparing to begin operations when they are informed that the setup area was used as a staging location for liquid nitrogen dewars — cryogenic containers holding liquid nitrogen at -320°F — for the previous 6 months. The dewars have been removed 3 days ago. What specific ground condition concern does the previous cryogenic storage create?

A. Nothing — liquid nitrogen is an inert gas that has no effect on soil properties

B. The cryogenic storage area requires an environmental assessment before crane setup since liquid nitrogen is a regulated substance

C. Nothing — 3 days of equilibration after cryogenic storage is sufficient for soil conditions to normalize

D. Extended storage of cryogenic containers can freeze the soil beneath them — creating permafrost-like conditions in a localized zone; soil that was frozen for months may appear structurally sound upon thawing but can have significantly reduced bearing capacity as the ice that provided structure melts; the soil in the former cryogenic storage zone may currently be in a weakened post-thaw condition; the bearing capacity must be confirmed with current testing before crane outrigger loading in this area

16. A crane is set up and has been operating for 2 hours on a hot summer afternoon (94°F ambient) when the operator notices that the asphalt surface surrounding the right rear mat has developed a slight

depression — about 1/8 inch deep — running along the mat's edge. What does a mat-edge depression in asphalt during hot weather indicate?

- A. Nothing — slight depression at mat edges is normal for all loaded crane mats on any surface
- B. Nothing — 1/8-inch depression is within normal asphalt surface variation
- C. The mat-edge depression in hot weather asphalt indicates the asphalt is in a semi-plastic state and the outrigger load is beginning to punch through the asphalt surface — asphalt softens significantly at high temperatures and concentrated crane loads can cause progressive penetration; if the mat continues to penetrate, the load distribution changes and the bearing pressure on the remaining area increases; operations must stop and the mat condition must be re-evaluated
- D. The asphalt surface must be replaced with concrete before crane operations on hot days above 90°F

17. Under OSHA 1926.1402(b), the controlling entity has provided the crane employer with a geotechnical report showing soil bearing capacity of 3,800 psf. The crane operator calculates the outrigger bearing pressure will be 3,600 psf at maximum capacity. Is the setup adequate based on this calculation?

- A. The 3,600 psf bearing pressure within the 3,800 psf documented capacity appears adequate — however, the bearing capacity used in planning must equal or exceed the bearing pressure with an adequate safety factor; using 94.7% of the documented capacity leaves essentially no margin for variability in soil conditions, load calculation errors, or dynamic loading effects; the operator should consider whether additional ground preparation or a larger mat contact area is needed to reduce the bearing pressure to a safer fraction of the documented capacity
- B. The 3,600 psf calculation is within the 3,800 psf documented capacity — the setup is adequate
- C. The setup is never adequate when the calculated bearing pressure exceeds 90% of the documented capacity
- D. The bearing pressure must not exceed 50% of the documented capacity under any circumstance

18. A crane operator is asked to describe what a "zone of influence" means for crane outrigger loading. Which statement correctly explains this concept?

- A. The zone of influence is the area directly beneath the outrigger pad — load is only transmitted vertically downward and has no lateral extent

B. The zone of influence refers to the maximum reach of the crane's boom — any underground structure within this horizontal distance is affected

C. The zone of influence refers to the area above a utility line within which crane operations are restricted

D. The zone of influence is the volume of soil beneath the outrigger in which the applied load creates meaningful stress — this volume extends both downward and laterally from the outrigger in a bulb-shaped zone; the deeper the zone extends, the wider it becomes; any underground structure (tunnel, utility, void, or soft layer) within this stress bulb is subjected to additional load from the crane's outrigger; the zone of influence depth depends on the outrigger load and the mat contact area

19. A crane is being set up when the crew discovers that the access road to the setup area crosses a railroad crossing — the road crosses active rail lines. The crane is transported in multiple loads, each under the railroad's 80,000-lb vehicle weight limit. What additional evaluation is required?

A. Each crane transport load must be evaluated for both total GVW and axle load distribution — railroad crossings have specific axle load limits in addition to total vehicle weight limits; the crossing's structural capacity for the crane transport vehicle's specific axle loads must be confirmed with the railroad authority; additionally, the clearance between the crane components and the overhead catenary lines, if present, must be confirmed; crossing active rail lines requires coordination with the railroad's operations center

B. The loads are all within the 80,000-lb limit — no additional evaluation is needed

C. A flagging crew is the only additional requirement for crossing an active railroad grade

D. Railroad crossings only require evaluation when the transported load exceeds 100,000 lbs total vehicle weight

20. A crane is set up at a construction site when the project manager informs the operator that an underground fuel storage tank removal was completed at the setup location 4 months ago. A soil contamination report shows the tank was removed and the soil was tested clean. However, the excavation was backfilled with native soil that was stockpiled during removal — no compaction testing was performed. What concern does the backfilled former tank site create?

A. The clean soil report confirms the backfill is adequate for crane operations

B. The 4-month settlement period is sufficient to confirm the native soil backfill has reached its maximum density

C. Native soil backfilled without compaction testing has unknown bearing capacity — even clean native soil placed without engineered compaction can have very low density and high compressibility; the excavation's boundaries and depth define a zone of uncontrolled fill that requires compaction testing before crane outrigger loading; the 4-month settlement period is not a substitute for confirmed compaction

D. Underground tank removal sites are always adequate for crane operations since the removal process compacts the surrounding soil

21. A crane is set up at a coastal project site on a warm, calm morning. By midday, the wind speed has increased steadily to 18 mph sustained with gusts to 26 mph. The crane's general operational wind limit is 30 mph. The planned lift for the afternoon is a large HVAC unit — 14 feet × 22 feet × 8 feet tall — with a high surface area. What specific evaluation must occur before the afternoon lift?

A. Nothing — 26 mph gusts are within the 30 mph operational limit; proceed with the afternoon lift as planned

B. The HVAC unit's large surface area must be specifically evaluated for wind-induced lateral forces at the current wind conditions — the general 30 mph limit was established for compact loads; a 14 × 22 × 8-foot unit presents a large projected area to the wind; at 18–26 mph, the lateral force on this unit may create boom side-loading that exceeds the boom's lateral design capacity even though the speed is within the general limit; a sail force calculation or the manufacturer's guidance for large-area loads should be consulted before proceeding

C. The lift may proceed since 18 mph sustained wind is well below the 30 mph limit for all crane operations

D. Reduce the planned lift load to 80% of rated capacity to compensate for the wind effect on the HVAC unit

OPERATIONS DOMAIN — Questions 22–48

22. A crane operator is performing a lift at 87% of rated capacity when they observe that the ground crew has attached a tag line to the load — but the tag line runs from the load, across the travel path of adjacent workers, to a worker 60 feet away. Two other workers are walking in the area between the load and the tag line handler. What specific hazard must be addressed before the lift continues?

A. Nothing — tag lines are safety devices that are always authorized regardless of routing

B. Nothing — tag line routing is the signal person's responsibility; the operator may proceed

C. The operator must stop the lift and ensure the tag line is rerouted away from the path of walking workers — a taut tag line at any height creates a tripping or entanglement hazard for workers walking across its path; additionally, if the load swings suddenly, the tag line can become a tensioned line at ankle or waist height with significant force; the tag line must be clear of all personnel's travel paths before the lift proceeds

D. The lift director must authorize the tag line configuration before operations begin

23. A crane operator is performing a critical lift at 91% of rated capacity when they receive a radio message from the lift director: "Change of plan — please increase the operating radius by 3 feet to move the set location closer to the edge of the building." The load is currently suspended at 10 feet of height. What must the operator do?

A. Stop the current lift, hold the load, and verify the crane's rated capacity at the new, greater operating radius before any boom movement increases the radius — an increase in operating radius at 91% of current capacity may push the configuration beyond rated capacity at the new radius; the load chart must be consulted for the new radius before executing the movement; the lift director's request cannot be honored without confirming the crane can safely operate at the new configuration

B. Execute the boom-out movement at minimum speed since the lift director has authorized the change

C. Reduce the load first, then execute the boom-out to the new radius as directed

D. Contact the crane manufacturer before executing any mid-lift radius change at near-capacity operations

24. A crane operator is performing a series of lifts when the employer's safety officer arrives at the job site and asks the operator to perform a demonstration pick — lifting the load to 5 feet, swinging 90 degrees, and setting it back — for a training video. The load is 78% of rated capacity. No pre-lift meeting was conducted for this specific demonstration sequence. What is the correct response?

A. Execute the demonstration as requested since 78% is below the critical lift threshold and no plan is needed

B. Nothing — the safety officer's authority supersedes normal lift planning requirements

C. The demonstration lift sequence requires all standard pre-lift preparations including confirmation of the capacity, ground conditions, exclusion zone, signal person designation, and briefing before any movement begins — even a "demonstration" lift uses real equipment with real loads and real hazards; the absence of pre-lift preparation is not authorized regardless of who requests the lift; all standard requirements apply before the first movement

D. Perform only the hoist to 5 feet without the swing until the safety officer authorizes proceeding

25. A crane operator is completing a shift at 5:00 PM when the relief operator requests that the crane remain rigged with the previous load — a 24,000-lb concrete beam — suspended at 6 feet of height overnight so the next shift can immediately continue setting it at 7:00 AM. What must the operator inform the relief operator about this plan?

A. Nothing — loads may be suspended overnight when the drum pawl is engaged

B. Loads must not be left suspended when the operator is not at the controls — the crane must be lowered to the ground, the load disconnected, and the crane secured before the operator leaves; leaving a 24,000-lb suspended load overnight with no operator at the controls creates an unacceptable hazard; overnight weather changes, equipment changes, or personnel approaching the area under the suspended load create risks that cannot be managed without an operator at the controls

C. The load may remain suspended if the lift director authorizes it in writing

D. The crane may be left with a suspended load as long as the area below is barricaded

26. A crane operator is performing a lift when the signal person gives the operator a LOWER signal followed by an EMERGENCY STOP signal 2 seconds later. The load is at 12 feet of height and has lowered approximately 18 inches since the LOWER signal. What must the operator do?

A. Continue lowering since the EMERGENCY STOP was given after the LOWER signal was already initiated

B. Nothing — an EMERGENCY STOP signal during an already-initiated safe movement is unnecessary; continue the movement

C. Contact the lift director to determine why the emergency stop was given before taking action

D. Stop all crane movement immediately — an EMERGENCY STOP overrides all previous signals and any current movement regardless of who gave it or when it was given; the operator must stop the crane instantly without analysis; the load may remain stationary at its current position until the reason for the EMERGENCY STOP is determined and cleared by a designated person

27. A crane is performing a lift at 83% of rated capacity when the operator receives a message from the site foreman (who is not the designated lift director) over the construction radio: "We need that beam 4 feet further left — just slide it over." The load is at 8 feet of height. What is the required response?

- A. Execute the movement if the foreman is the highest-ranking person on site
- B. Nothing — the site foreman's authority over construction activities overrides the lift director's role
- C. Do not execute the movement — the site foreman is not the designated lift director and does not have authority to direct crane movements through non-designated channels; crane movements may only be directed by the designated signal person using approved signals or by the lift director through established communication; the operator should notify the lift director of the foreman's request and allow the lift director to authorize and direct the movement through proper channels
- D. Execute the movement if the signal person is visible and in position to direct the movement

28. A crane operator is performing a lift when the signal person is standing in an area where bright afternoon sunlight is directly behind them — the sun is in the operator's eyes, making it impossible to see the signal person's hand signals clearly. The signal person is unaware of the problem. What must the operator do?

- A. Continue the lift while squinting and using the crane's instruments as primary guidance
- B. Contact the lift director to request a replacement signal person who can stand in a different location
- C. Stop all crane movement and notify the signal person that their hand signals are not visible due to the sun's position — the communication system is compromised; the signal person must move to a position where their signals are clearly visible to the operator, or an alternative communication method must be established; proceeding with hand signals the operator cannot clearly see creates the risk of executing incorrect movements
- D. Reduce the crane's operating speed to minimum and proceed with partial signal recognition until the sun moves

29. A crane operator is performing a critical lift at 89% of rated capacity when the LMI displays 94%. The operator's load chart calculation confirmed 89% before the lift. No configuration change was made between the calculation and the LMI reading. What is the most likely explanation for the discrepancy and what must the operator do?

- A. Nothing — LMI accuracy tolerance of $\pm 5\%$ explains all discrepancies of this magnitude
- B. Stop the hoist and investigate the discrepancy before any further movement — the 5-percentage-point difference between the calculated 89% and the displayed 94% indicates either a misconfiguration in the LMI (wrong boom length, wrong counterweight, wrong reeving), a calibration drift in the load cell, or a real difference between the planned and actual load weight; any of these conditions requires

investigation before continuing; operating at an LMI-displayed 94% without confirming whether the reading reflects the actual configuration is not authorized

C. The discrepancy is caused by dynamic loading during hoist — continue the lift and the reading will return to 89% when the crane is stationary

D. Override the LMI display and continue using the calculated 89% value

30. A crane operator is performing a lift at 85% of rated capacity when a site worker approaches the cab and informs the operator that a second worker has been trapped under falling debris 80 feet from the crane — the second worker needs help and the first worker wants to use the crane to lift the debris off the trapped person. The load is currently at 8 feet of height. What must the operator do?

A. Immediately use the crane to lift the debris — saving a life takes priority over all standard procedures

B. Lower the load to the nearest safe surface and contact emergency services immediately — while a life safety emergency is serious, using a crane to attempt an emergency rescue without proper rigging, signal person, confirmation of the load weight, and confirmation of the trapped person's position could cause additional injury or a second crane incident; the most effective response is to get the current load secured and contact trained emergency responders

C. Continue holding the current load and radio the lift director about the emergency while holding position

D. Delegate the emergency response to the signal person and complete the current lift before addressing the situation

31. A crane operator is performing a lift when the operator observes that the load is swinging in an arc perpendicular to the boom — side-swinging rather than swinging in the plane of the boom. The load is at 15 feet of height and the swing is approximately 18 inches peak-to-peak. What causes perpendicular load swing and what action is required?

A. Stop the hoist and allow the load to come to rest — perpendicular load swing indicates the load's center of gravity is not directly below the boom tip, or the load was picked with a lateral offset; continuing the hoist with the load swinging perpendicular to the boom applies lateral force to the boom tip that it was not designed to carry; the load must be returned to the ground and the rigging centered under the boom tip before re-picking

B. Nothing — perpendicular load swing dampens naturally and does not affect crane structural loading

C. Increase hoist speed to pull the load into a centered position under the boom tip

D. The load swing is caused by wind — apply a tag line to the load while it swings

32. Under OSHA 1926.1419, when may a crane operator accept hand signals from the lift director directly — bypassing the designated signal person?

A. The operator may always accept signals from the lift director since the lift director has overall authority

B. Nothing — lift directors do not give operational signals under any circumstances

C. The operator may accept signals directly from the lift director only when the lift director is also a qualified signal person who is designated for that lift — the designation must be established before operations begin; the lift director cannot simply begin giving signals during an active lift without having been designated in advance; this designation must be specific and confirmed before the first movement

D. The operator may accept lift director signals whenever the signal person is temporarily unavailable

33. A crane is performing a critical lift at 88% of rated capacity when the crane's fuel level warning light activates — the fuel gauge shows the tank is at approximately 15% capacity. The load is at 12 feet of height mid-swing. What must the operator do?

A. Nothing — 15% fuel capacity is adequate for completing the current lift and refueling can occur afterward

B. Stop the swing and lower the load to the nearest safe surface before the engine fuel is depleted — a crane running out of fuel during a loaded lift would cause immediate loss of all hydraulic functions including load holding; 15% remaining fuel may be adequate for the current lift or may not be, depending on fuel consumption rate; the only safe response at near-capacity operations is to get the load on the ground before the fuel situation becomes critical; refueling must occur before any further lifting

C. Complete the current swing to the set location and then refuel — the fuel warning activates at a safe reserve level

D. Contact the lift director and ask whether to continue or stop based on their assessment of the schedule

34. A crane operator is performing a precision placement when the load — a 16,000-pound electrical transformer — must be lowered into an opening with 3-inch clearance on each side. During the final approach, the signal person instructs the operator to move the load 2 inches left. At the current operating radius, 2 inches of boom swing movement would correspond to approximately 6 inches of load movement at the load. What technique should the operator use?

- A. Execute the boom swing at minimum speed and accept the 6-inch load movement as sufficiently precise
- B. Nothing — the signal person's instruction must be executed regardless of the precision required
- C. Nothing — the LMI can be used to control boom movement to 2-inch increments at any radius
- D. The operator should use the minimal hydraulic input technique — applying a very brief, controlled hydraulic impulse to the swing function and then releasing — to move the boom an increment smaller than the minimum sustained movement; this technique allows precision movements finer than the normal minimum control input; the operator must communicate to the signal person the actual resolution of the crane's control system so the signal person can provide signals appropriate for the achievable movement precision

35. Under OSHA 1926.1416, when a crane has been idle overnight and the first operator of the new shift reports a new hydraulic fluid leak from the swing motor — a drip approximately one drop every 3 seconds — what is the required response before operations begin?

- A. Document the leak in the maintenance log and confirm the leak is not increasing during the first lift cycle before deciding whether to stop
- B. Nothing — one drop every 3 seconds is a minor seep that all crane operators are expected to monitor and report at end of shift
- C. Nothing — document the leak and notify maintenance; proceed with operations until the drip rate exceeds 10 drops per minute
- D. The crane must not be operated until the swing motor hydraulic leak is identified and repaired — a new hydraulic leak from a motor represents a developing failure in a load-bearing hydraulic circuit; the swing motor pressurizes during every swing movement and a drip that starts as 3 seconds per drop can progress rapidly to hose burst under operating pressure; the crane must be taken out of service until the leak source is identified and corrected

36. A crane operator is asked to perform a lift that requires the boom to travel within 5 feet of a suspended pedestrian bridge walkway — a permanent structure connecting two buildings. The walkway is occupied and in normal use during the planned lift. What must happen before this lift?

- A. Nothing — boom clearance from structures is the signal person's responsibility
- B. The lift is only permitted if the walkway is below the boom's travel path and no load passes over it

C. The walkway must be closed and confirmed clear of all occupants before any crane movement brings the boom within the proximity zone — the 5-foot clearance from an occupied walkway represents a collision risk if the boom's path deviates by any amount; the boom tip, the load, and the load line must all clear the walkway structure; the walkway must be evacuated, not simply warned, before any crane movement within this proximity range

D. The building owner must confirm the walkway structural capacity before the crane approaches within 5 feet

37. A crane operator is performing a lift at 92% of rated capacity when the load line vibration suddenly changes from smooth to an intermittent shudder felt through the crane's controls during a steady hoist. The load remains at a consistent height during the shudder. What does a sudden load line shudder during a steady hoist indicate?

A. Nothing — load line vibration during hoist operations is normal for all crane configurations

B. Stop the hoist immediately and hold the load — an intermittent shudder in the load line during a steady hoist indicates a sudden change in the rope's path or tension — possible causes include a rope beginning to jump a sheave, a sheave bearing failing under load, or a rope fault passing through a sheave; at 92% of rated capacity, any of these conditions can lead to sudden load drop; the load must be held stationary while the load line path and all sheaves are inspected from the ground

C. Continue at minimum speed while the signal person inspects the sheave blocks from below

D. The shudder is caused by static electricity buildup on the rope during dry weather — it is not a mechanical concern

38. Under OSHA 1926.1412, what is the specific frequency requirement for a crane's periodic inspection, and which components must be specifically checked?

A. Nothing — periodic inspection intervals are left to the employer's discretion under OSHA 1926.1412

B. Nothing — only the annual comprehensive inspection has specific component requirements

C. Periodic inspections are a daily responsibility that only the operator can perform

D. Periodic inspections must be performed by a qualified inspector at intervals of 1 to 12 months based on the crane's service intensity — high-use cranes require more frequent periodic inspections; components specifically required include structural members, fasteners, pins, sheaves, drums, brakes, wire rope, hooks, and all safety devices; the inspection must be documented and deficiencies addressed before return to service

39. A crane operator is completing the pre-shift inspection when they confirm that the crane's rated capacity placard is missing from the cab — the original plate that shows the crane's rated capacity by configuration was removed, possibly during a recent cab cleaning. The operator knows the crane's rated capacity from experience. What must happen before operations begin?

- A. The rated capacity placard must be replaced and confirmed present before any crane operations begin — the placard is a required cab document under OSHA 1926.1416; the operator's experiential knowledge of the rated capacity is not a substitute for the required placard; the placard ensures that all operators, including relief operators and new operators, have access to the accurate rated capacity; operations may not begin until the placard is replaced
- B. Nothing — the operator's knowledge of the rated capacity from experience is sufficient for operations
- C. Post a handwritten notation of the rated capacity in the cab as a temporary substitute
- D. Contact the crane manufacturer to request a duplicate placard and proceed until it arrives

40. A crane is performing a lift when the ground crew discovers that the rigging plan calls for a 4-leg wire rope sling bridle but only 3-leg slings are available at the site. The load weighs 28,000 lbs. The 3-leg slings are rated at 10,000 lbs each in a vertical hitch at 45-degree sling angle. What is the tension per leg at 45 degrees and can the 3-leg configuration support the load?

- A. Tension per leg = $(28,000 \div 3) \times (1 \div \sin 45^\circ) = 9,333 \times 1.414 = 13,197$ lbs — exceeds the 10,000-lb WLL; the 3-leg sling configuration cannot support this load at 45-degree sling angle
- B. Nothing — 3 legs at 10,000 lbs each = 30,000 lbs total; 28,000 lbs is within 30,000 lbs; the configuration is adequate
- C. Tension per leg = $28,000 \div 3 = 9,333$ lbs regardless of sling angle; the configuration is within capacity
- D. The 3-leg configuration requires a 5:1 safety factor — multiply the load by 5 before comparing to the WLL

41. A crane operator is performing a lift when the load — a 22,000-pound structural steel frame — begins rotating counterclockwise at approximately one revolution every 45 seconds during the hoist. No tag lines are attached. What is the risk specific to a rotating structural steel frame and what must the operator do?

A. Nothing — slow load rotation is normal for structural steel frames and does not require stopping the hoist

B. Stop the hoist and attach tag lines before any further movement — a rotating structural frame creates multiple hazards: the frame's extending structural members can sweep the area around the load, striking personnel or adjacent structures; rotation also progressively twists the sling legs and load line, reducing their effective capacity; tag lines must be attached to arrest the rotation before the load rises further

C. Apply the crane's swing brake in the rotation direction to arrest the rotation through the crane structure

D. Continue the hoist and plan to rotate the crane to counteract the load's rotation at the set location

42. Under OSHA 1926.1431, when a personnel platform is being used for the first time on a project, what specific test must be performed before it is used to hoist personnel?

A. A load test at 125% of the platform's rated load capacity must be performed with no personnel in the platform — the test uses test weights equal to 125% of the rated load; the platform must be held at maximum height for 5 minutes; all components are then inspected for deformation or damage before the platform is authorized for personnel use; this pre-use test must be documented and is separate from the regular daily inspection

B. Nothing — a manufacturer's certification of the platform is sufficient for initial use

C. The platform must complete 3 trial runs with only the lift director aboard before personnel are authorized

D. A proof load test at 150% of rated capacity with a qualified inspector present is required before first use

43. A crane operator is performing a lift when the crane's level indicator shows the crane is tilting progressively toward the load — the reading has changed from 0% to 0.4% during the 12-minute lift. The manufacturer's maximum operating tolerance is 0.5%. The load is at 14 feet of height. What is the significance of a progressive tilt reading during an active lift and what must happen?

A. Lower the load to the ground immediately and investigate the cause of the progressive tilt — a 0.4% reading approaching the 0.5% limit during an active lift indicates ongoing outrigger settlement or soil failure on the tilt side; the progressive nature is more important than the current value — the trend indicates the condition is worsening and will likely continue; if the tilt reaches 0.5% during the load's descent, the crane will be in a configuration where the load chart values no longer apply

B. Continue the lift since the 0.4% reading is still within the 0.5% tolerance

- C. Stop the hoist and hold at current height until the reading stabilizes before proceeding
- D. Boom up to reduce the operating radius and thereby reduce the outrigger load before continuing

44. A crane operator is performing a lift when the signal person reports that a rigging hardware component — a screw-pin anchor shackle — shows the pin is only partially engaged in the bow: the threads have about 1/3 of the normal engagement. The load is at ground level just before the initial pick. What must the operator do?

- A. Proceed with the lift at minimum speed while a rigger retightens the shackle pin
- B. Nothing — 1/3 thread engagement is adequate for light to medium loads below 50% of the shackle's WLL
- C. Nothing — the signal person should retighten the pin and then give the HOIST signal when ready
- D. The pick must not proceed — a shackle pin with only 1/3 thread engagement can pull through the bow under load, releasing the rigging; thread engagement on screw-pin shackles must be full — the pin must be fully seated and moused; partial engagement creates a shackle that may appear functional but can fail catastrophically under any loading; the pin must be fully engaged and moused before any lifting proceeds

45. A crane operator is performing a lift when the load — a 12,000-pound prefabricated wall panel — begins to tilt during the hoist with one end rising while the other remains lower. The tilt is approximately 8 degrees. No rigging was changed between the confirmed level pick and the current condition. What does a developing tilt after a confirmed level pick most likely indicate?

- A. Nothing — wall panels frequently shift their CG slightly during hoisting and an 8-degree tilt is acceptable
- B. A developing tilt after a confirmed level pick indicates either a sling leg has slipped from the lifting lug, a lug attachment is pulling through the panel, or the panel has shifted within the rigging; any of these conditions requires immediately lowering the load to the ground for rigging inspection — at 8 degrees, the rigging distribution has significantly changed; continuing the hoist risks complete rigging failure or panel damage
- C. Increase the hoist speed to pull the high end down through momentum
- D. Nothing — the CG naturally shifts when the panel changes from resting to suspended position; proceed to set location

46. Under OSHA 1926.1416, how must a crane operator respond when they receive a signal that would require the crane to exceed its rated capacity as shown on the applicable load chart?

- A. Nothing — crane operators are required to follow all signals from designated signal persons
- B. The operator may exceed rated capacity by up to 5% if the lift director and crane owner jointly authorize the deviation in writing
- C. The operator may comply if the LMI confirms the boom angle and radius are consistent with the original capacity calculation
- D. The operator must refuse to execute the signal — exceeding the rated capacity as shown on the applicable load chart is absolutely prohibited regardless of who gives the signal, what their authority is, and what the justification is; the crane's rated capacity is an absolute limit that no person, instruction, emergency, or authorization can override; the operator's refusal in this case is not insubordination but a required safety action

47. A crane is performing a lift at 86% of rated capacity when the operator observes a small amount of hydraulic fluid mist emanating from a fitting on the boom hoist cylinder. The mist is fine — not a stream — and appears to be under pressure. The load is at 6 feet of height. What must the operator do?

- A. Continue the lift and report the mist to maintenance at the end of the shift
- B. Lower the load to the nearest safe surface, shut down the crane, and have the fitting inspected before any further operations — a pressurized hydraulic mist from a boom hoist fitting indicates a micro-leak under operating pressure; pressurized hydraulic mist is flammable and can be injected into skin at distances up to 40 feet; additionally, a fitting that is currently misting can progress to complete failure under the cyclic loading of continued operation; the source must be confirmed and repaired before any further use
- C. Apply thread sealing compound to the fitting and continue the lift
- D. Monitor the mist and stop operations only if the mist changes to a visible stream

48. A crane is completing the last lift of a project when the operator is informed that the crane will be demobilized and transported to a new site the next morning. What specific actions must the operator complete before leaving the crane secured for the night in preparation for transport?

- A. Leave the boom elevated to allow overnight access for the transport crew's rigging attachment

B. Lower all accessible functions, secure the hook block against swinging, remove the ignition key, engage all travel locks, and document the crane's condition in the shift log — the crane must be secured against unauthorized operation, against weather-induced movement, and in a configuration that the transport crew can safely begin rigging without additional preparation; travel locks prevent unintended boom or crane movement during the overnight period

C. Park the crane in travel position with the boom extended but unsecured to allow the transport crew to inspect the full boom length before demobilization

D. Disconnect the crane's battery system to prevent unauthorized starting and leave the boom in the operating position for the transport crew to lower during transport rigging

TECHNICAL KNOWLEDGE DOMAIN — Questions 49–70

49. A crane inspector is examining an alloy steel Grade 80 chain sling and finds a link that has a twist — the link has been rotated approximately 20 degrees from its original plane. No cracks are visible in the link. What does a twisted chain link indicate and what action is required?

A. Nothing — chain links naturally accommodate minor angular displacement during service

B. A twisted chain link indicates the link has been subjected to torsional loading beyond its design geometry — the twist permanently deforms the link's cross-section and changes the contact angle between adjacent links; when a twisted link is loaded, the torsional deformation concentrates stress at the inner radius in a way the original geometry was not designed to carry; the sling must be removed from service; ASME B30.9 includes link twist as a removal condition for chain slings

C. The sling may remain in service if the twist is less than 25 degrees from the link's original plane

D. Monitor the twisted link at daily inspections and remove from service when cracks develop

50. A crane operator is reviewing inspection documentation and finds that the crane underwent a heavy lift last month — a confirmed lift of 96,800 lbs, which was 97% of the crane's rated capacity of 100,000 lbs. No post-lift inspection was performed. The crane has been used daily since. What concern does the absence of a post-heavy-lift inspection create?

A. Nothing — 97% of rated capacity is within the crane's operating parameters and requires no post-lift inspection

B. Nothing — post-lift inspections are only required when the crane tip-over or overload indicator activates

C. Nothing — post-lift inspections are only required after confirmed overloads above 100% of rated capacity

D. Near-rated-capacity lifts at 97% create structural loading in primary members that approaches the design stress limits — any developing fatigue, weld deficiency, or structural imperfection is most likely to manifest after a near-capacity event; ASME B30.5 and employer best practice require a post-heavy-lift inspection to confirm no structural changes occurred; operating daily for a month without this assessment means developing structural damage may have gone undetected through 30 additional days of normal operations

51. A crane inspector discovers during the annual inspection that the crane's anti-two-block cable has been spliced — a 6-inch section of the cable was replaced with a cable of similar diameter using two crimp sleeves. The splice appears secure. What concern does a spliced ATB cable create?

A. Nothing — cable splices using proper crimped sleeves are standard repair procedures for ATB cables

B. Nothing — the splice is secure and the ATB cable's function is preserved by the splice

C. Nothing — a crimp splice in a small-diameter cable is a standard repair method that restores full capacity

D. The spliced ATB cable creates a concern because a splice introduces two additional connection points in a cable that must perform reliably to prevent catastrophic two-blocking; each crimp sleeve is a potential failure point; the ATB system's reliability depends on continuous mechanical integrity from the ATB switch to the weight; a spliced cable must be tested to confirm the splice holds under the ATB weight's pull and the hoist function is reliably interrupted; if the splice cannot be confirmed as reliable as an unspliced cable, it must be replaced

52. A crane's hydraulic system is found to have a minor internal bypass in the main hoist motor — the motor allows the load to drift downward at 3/8 inch per minute with the controls in neutral after a full hoist cycle. The manufacturer's maximum allowable drift rate is 1/4 inch per minute. What is the status of this crane?

A. Nothing — a 3/8-inch drift rate is within operational tolerance for hydraulic hoist motors

B. The drift exceeds the manufacturer's specification — but the crane may continue at 75% capacity while maintenance is scheduled

C. The crane must be removed from service until the hoist motor bypass is repaired — the drift rate of 3/8-inch per minute exceeds the manufacturer's 1/4-inch maximum, meaning the hoist motor has exceeded the design bypass limit; a hoist motor that allows controlled drift can allow uncontrolled

descent under the right failure conditions; the motor must be confirmed within specification before any further lifting operations

D. The drift is caused by thermal expansion in the hydraulic fluid — it will reduce as the system cools down

53. A crane operator is reviewing a load cell calibration certificate found in the crane's documentation. The certificate shows the load cell was calibrated 14 months ago with a next-due date of 12 months. The crane has been operating throughout the 14-month period. What is the operational significance of the overdue calibration?

A. Nothing — calibration due dates are guidelines; continue operations and schedule calibration at the next available opportunity

B. Nothing — the crane's correct LMI performance throughout 14 months of service confirms calibration is maintained

C. Nothing — load cell drift is minimal over 14 months; this is within normal field tolerance for all calibration schedules

D. The overdue calibration means the LMI's load percentage display cannot be confirmed accurate — the load cell may have drifted beyond its certified accuracy tolerance; if the cell reads 5% low, a lift at 96% actual capacity could display as 91%; near-capacity operations that rely on the LMI percentage for capacity management cannot be trusted without confirmed calibration; the load cell must be recalibrated before any near-capacity operations

54. A crane inspector examines the crane's hook block and finds that the block frame — the structural plate assembly that holds the sheaves and connects to the hook — has a visible crack at a welded connection between two frame plates. The crack is approximately 3/4 inch long and runs perpendicular to the weld axis. What action is required?

A. Monitor the crack at monthly inspections and remove from service when it exceeds 2 inches in length

B. Apply a repair weld over the cracked area and conduct a visual inspection before returning to service

C. Nothing — small cracks in hook block frame welds are common and do not affect the hook block's load path

D. The hook block must be immediately removed from service — a crack in the hook block frame at a structural weld connection is a primary load-path failure; the hook block frame transmits the entire suspended load from the hook sheave system to the load line; a crack perpendicular to the weld axis

indicates fatigue failure progressing through the connection; this type of fatigue failure can progress to complete fracture under the next loading cycle without further visible warning

55. A crane operator is reviewing the crane's maintenance log and finds that the anti-two-block system was replaced 6 months ago with a new ATB kit from the original equipment manufacturer. The installation was performed by a qualified technician and documented. However, the documentation does not include a functional test confirming the system activates correctly after installation. What concern does this create?

- A. Nothing — OEM installation by a qualified technician confirms the system is functioning correctly
- B. Nothing — OEM replacement of the ATB system requires no post-installation testing since the components are factory-tested
- C. Nothing — the 6-month service history without an ATB activation confirms the system has not been needed
- D. A post-installation functional test is required to confirm the ATB activates correctly after any repair or replacement — an ATB kit installed by a qualified technician using OEM parts has all the components needed for correct function, but installation errors (reversed connections, cable routed incorrectly, switch arm positioned wrong) can prevent the system from activating when needed; the absence of post-installation functional test documentation means the ATB may never have been confirmed functional after the replacement; a functional test confirming hoist interruption must be performed before relying on the ATB system

56. Under ASME B30.9, what is the specific removal criterion for a wire rope sling used in a basket hitch when the outer wire diameter is reduced by more than 1/3 from the original diameter due to abrasion or corrosion?

- A. Nothing — outer wire diameter reduction applies only to running ropes, not to slings
- B. Nothing — removal based on wire diameter reduction is only triggered when all wires show reduction simultaneously
- C. A wire rope sling must be removed from service when outer wire diameter reduction exceeds 1/3 of the original wire diameter — this level of wire section loss indicates corrosion or abrasion has removed significant metal from the individual wires; the cross-sectional area at each affected wire is reduced by approximately 56%; a sling with wires reduced to 2/3 of their original diameter has dramatically reduced tensile capacity and must be removed regardless of the hitch configuration used
- D. The criterion applies only to slings carrying loads above 50% of their WLL — lightly loaded slings may continue with worn wires

57. A crane inspector examines a mechanical wire rope end fitting — a swaged socket — and finds a crack running circumferentially around the socket barrel approximately 1 inch from the top of the swage. The crack extends approximately 30% of the socket barrel's circumference. What action does ASME B30.9 require?

- A. Nothing — hairline cracks in swaged sockets of less than 50% circumference are within acceptable tolerance
- B. The sling must be removed from service immediately — any crack in a swaged socket end fitting is a removal condition; the socket barrel must remain intact to develop the mechanical grip on the rope; a circumferential crack at the top of the swage indicates fatigue fracture progressing through the barrel material; even at 30% of the circumference, the remaining 70% must carry the entire load; progressive loading will cause the crack to advance to complete fracture
- C. Repair the crack using an authorized weld procedure and re-swage before returning to service
- D. Monitor the crack at each use and remove from service when the crack exceeds 50% circumference

58. A crane operator is asked to describe the difference between a "frequent inspection" and a "periodic inspection" under ASME B30.5. Which statement correctly describes the key distinction?

- A. Frequent inspections are visual checks that can be performed by the operator; periodic inspections require a qualified person and include disassembly and measurement of components — this distinction is important because frequent daily inspections catch obvious operational hazards while periodic inspections confirm structural integrity of components not visible during daily checks
- B. Nothing — frequent and periodic inspections have identical requirements under ASME B30.5
- C. Frequent inspections are weekly; periodic inspections are annually
- D. Frequent inspections are only required after crane incidents; periodic inspections occur on schedule regardless of incidents

59. A crane is operating when the inspector observes that the wire rope's outer strands show a consistent pattern where every third wire in each strand is significantly brighter and shinier than the adjacent wires — the brighter wires appear worn while the others do not. What does this alternating wear pattern indicate?

- A. The alternating bright/dull wire pattern confirms the rope is properly loaded — only the outer wires contact the sheave groove and they wear uniformly

B. Nothing — alternating wire brightness is caused by differential manufacturing surface treatment and is cosmetic

C. Nothing — every third wire being brighter indicates consistent groove contact that is normal and expected

D. An alternating wear pattern where every third wire is preferentially abraded indicates the sheave groove radius is too small — when the groove is undersized, only the raised wires (those at the top of the strand's geometry) contact the groove surface while the recessed wires do not; this creates preferential wear on the contact wires rather than uniform wear across all wires; the sheave groove dimensions must be checked against the rope diameter and the groove must be re-machined or the sheave replaced

60. A crane operator is reviewing documentation and finds that the crane's last formal periodic inspection was performed 14 months ago. The manufacturer's recommended periodic inspection interval is "every 6 months or 250 hours, whichever comes first." The crane has accumulated 210 hours since the last periodic inspection. What is the maintenance status?

A. Nothing — 210 hours is within the 250-hour limit; the crane may continue operating until the 250-hour mark

B. Nothing — the 6-month and 250-hour intervals are alternatives; meeting either one satisfies the requirement

C. The periodic inspection is overdue — both trigger conditions must be evaluated independently; the 6-month calendar interval has been exceeded by 8 months regardless of the hour count; ASME B30.5 and OSHA 1926.1412 require periodic inspection at intervals not exceeding the manufacturer's recommendation; the calendar interval has been exceeded and the crane must receive a periodic inspection before further operations

D. The periodic inspection may be deferred until the 250-hour trigger is reached since the employer may choose either basis

61. A crane inspector examines a wire rope during the annual inspection and finds that the rope's center strand — the core strand — is visible at one point where three outer strands have spread apart due to core damage below. The core is visible but intact. What action is ASME B30.5 required?

A. Nothing — core visibility without core damage or broken wires is a minor condition that requires only monitoring

B. The rope must be removed from service — core visibility through spread outer strands indicates the internal support structure of the rope has failed; the core normally keeps the outer strands in their

designed geometry; when the core collapses or fails at a point, the outer strands spread and lose their designed contact geometry; the rope's load distribution among strands is compromised at that point regardless of whether the visible core appears intact

C. The rope may continue in service if the core strands appear undamaged and no broken wires are visible

D. Apply additional lubrication to the spread area to restore the strand geometry and continue in service

62. A crane's annual inspection identifies that the boom's upper chord contains a structural weld that was made in the field — confirmed by the weld's appearance and location differing from the manufactured configuration. The weld appears structurally sound visually. No documentation exists. What action must the crane manufacturer or qualified engineer evaluate?

A. Nothing — a visually sound field weld on a boom chord is acceptable if the crane has operated without incident since the weld was made

B. Nothing — welds made in the field by certified welders are always equivalent to factory welds

C. Nothing — visual inspection of a weld is sufficient to confirm its structural adequacy for crane booms

D. An undocumented field weld on a structural boom chord must be evaluated — field welds on primary structural members that are not part of the original manufacturing documentation may not have been made using the correct procedure, filler material, or preheat requirements; the weld may appear sound externally while having inadequate penetration, porosity, or metallurgical properties; the crane manufacturer or a qualified structural engineer must evaluate the weld against the applicable structural standard before the crane is operated at rated capacity

63. A crane inspector discovers that the boom hoist rope — the rope controlling boom elevation — has accumulated lay-length twist throughout its entire length, causing the rope to form a persistent corkscrew shape when removed from tension. What does persistent rope twist indicate?

A. Persistent rope twist throughout the boom hoist rope indicates the rope has accumulated torsional loading beyond the rope's ability to recover — this can result from improper initial installation (wrong rope lay direction for the drum wind direction), running a rope with a swivel that is excessively tight, or the rope having been repeatedly run over and under on a drum; accumulated twist reduces the rope's rated tensile capacity and creates uneven strand loading; the rope must be removed from service and replaced with proper attention to installation direction

B. Nothing — some rope twist is expected in boom hoist ropes and the condition self-corrects during operations

C. Persistent rope twist indicates the rope is correctly seated in the drum groove — the twist confirms proper engagement

D. The twist can be corrected by running the rope through the full hoist cycle 10 times to reset the rope's memory

64. Under ASME B30.26, what is the requirement for the identification marking on a below-the-hook lifting device?

A. The marking must include only the manufacturer's name and the serial number of the device

B. Nothing — below-the-hook devices are marked by the manufacturer and no field verification is required

C. Every below-the-hook lifting device must be marked with the manufacturer's name or mark, the rated load capacity (WLL) at the applicable configuration or configurations, and any relevant angle or geometry limitations — the markings must be permanently attached and legible; if the markings are missing, damaged, or illegible, the device must not be used until the correct markings are confirmed from the manufacturer and applied to the device

D. Below-the-hook devices must be marked with the WLL and last inspection date at each use

65. A crane operator is preparing for a lift at a petrochemical facility when the facility safety officer confirms that the workspace contains elevated hydrogen sulfide (H₂S) gas at 50 ppm — above the OSHA action level of 10 ppm and below the immediately dangerous to life or health (IDLH) level of 100 ppm. What must happen before crane operations begin?

A. Nothing — the level is below the IDLH level and standard personal protective equipment is adequate

B. Crane operations must be suspended until proper respiratory protection is provided for all personnel in the work area, including the crane operator — at 50 ppm, H₂S is above the OSHA action level and requires respiratory protection for any worker who may be exposed; H₂S is a dense gas that can accumulate in the crane cab; the operator cannot safely operate without confirmed respiratory protection and confirmed ventilation in the cab; operations cannot begin until these hazards are controlled

C. Proceed with operations if workers have H₂S monitors — monitoring provides adequate protection above the action level

D. Contact OSHA to report the H₂S level before beginning operations at the facility

66. A crane inspector is examining a polyester roundsling and finds that the sling's load-bearing core has developed a permanent set — when the sling is hung freely, one end is 3 inches longer than the other end of a nominally equal-length sling. No external damage is visible. What does a permanent set in a roundsling indicate?

A. Nothing — dimensional variation of up to 5% is a manufacturing tolerance that does not affect rated capacity

B. Nothing — roundslings naturally develop minor permanent set from normal service loading cycles

C. Nothing — roundsling length is not a removal criterion under ASME B30.9

D. A permanent set — where one end of the sling is measurably longer than the other — indicates that the core yarns on one side of the sling have permanently elongated beyond their elastic recovery; this irreversible elongation means those core yarns have been loaded beyond their elastic limit; the affected core yarns have reduced remaining capacity; the unequal length creates geometric imbalance in any multi-leg configuration; the sling must be removed from service and evaluated against ASME B30.9 deformation criteria

67. A crane is operating when the operator observes that the hydraulic oil in the sight glass has taken on a milky white appearance — the oil that was previously amber-colored has become opaque and white. What does milky white hydraulic oil indicate and what action is required?

A. Milky hydraulic oil indicates water contamination — water has entered the hydraulic system and emulsified with the oil; the emulsion reduces the oil's viscosity stability and anti-wear properties; water contamination accelerates corrosion in pump internals, valve bodies, and cylinder bores; most critically, water can cause cavitation in the hydraulic pump under cold conditions; the crane must be taken out of service, the contaminated fluid drained and replaced, and the source of water entry identified and corrected before any further operations

B. Nothing — milky hydraulic oil is caused by air aeration during normal operations and clears after a short rest period

C. The milky color confirms the hydraulic oil is overdue for a scheduled change — replace the oil at the next available maintenance window

D. The milky oil indicates the anti-foam additive has been activated — it is a normal protective response

68. A rigger is preparing to use a 2-inch diameter Grade 80 master link to connect a 4-leg sling bridle to the crane's hook. The master link is rated at 28 tons WLL for a vertical hitch. The total load including all rigging will be 18 tons. The master link will be in a choker hitch configuration wrapped around the hook's eye. What concern does using the master link in a choker hitch create?

- A. Nothing — master links are rated for all hitch configurations; the 18-ton load is within the 28-ton WLL
- B. Nothing — choker hitch on a master link is a standard rigging configuration for multi-leg bridles
- C. Nothing — the 28-ton WLL includes a safety factor that covers any choker hitch application
- D. Master links are rated for a specific orientation — typically in-line tension through the link's bore; using a master link in a choker hitch applies a bending force across the link body that the rating does not account for; the reduced WLL for a choker hitch application must be confirmed from the manufacturer or the applicable standard before use; the 18-ton load may or may not be within the master link's choker hitch capacity, which will be lower than the 28-ton vertical hitch rating

69. A crane's load line wire rope is being inspected when the inspector notes that an 18-inch section of rope near the dead end on the drum has visible external corrosion with light pitting on the outer wire surfaces. No broken wires are visible. What is the concern with corrosion specifically near the drum dead end?

- A. Nothing — corrosion near the drum dead end is expected since this section of rope is rarely flexed and has reduced lubrication
- B. The corroded section at the drum dead end is the last section of rope that the crane can lower before the minimum drum wraps are consumed — corrosion pitting on outer wires reduces the wire's cross-section and creates stress concentrations; if the crane is ever operated at maximum boom extension at minimum height, this corroded section may be loaded; the corrosion must be evaluated against diameter reduction and section loss removal criteria
- C. Light pitting on outer wires near the dead end is a cosmetic condition — no action is required
- D. The corroded section indicates the entire rope has been exposed to corrosive conditions and the full rope must be replaced

70. Under OSHA 1926 Subpart CC, what must happen when a crane that has been in a specific configuration for 24 consecutive hours is moved to a different setup location and reconfigured with a different boom length?

- A. Nothing — the crane manufacturer's warranty covers all standard reconfigurations without operator verification
- B. Nothing — reconfiguration is a routine task covered by the original operator qualification
- C. Nothing — the same load chart covers all configurations and no re-verification is needed

D. Before the first lift in the new configuration, the operator must confirm the applicable load chart section for the new configuration, verify the LMI is configured to match the new setup, and complete a pre-operational check confirming the new boom length is correctly assembled and all connections are secure; the crane's rated capacity is configuration-specific and the previous configuration's confirmed parameters do not carry over to the new setup; each new configuration requires independent verification before lifting begins

LOAD CHARTS DOMAIN — Questions 71–95

71. A crane's load chart for the 100-foot boom at full outrigger extension shows: 25 ft = 44,000 lbs; 30 ft = 34,800 lbs; 35 ft = 27,200 lbs. The planned operating radius is 31 feet. The hook block weighs 2,100 lbs, slings weigh 480 lbs, hardware weighs 140 lbs, and the payload weighs 28,000 lbs. Using the conservative approach, does the lift proceed?

A. Conservative capacity at 35 ft = 27,200 lbs; total suspended weight = $2,100 + 480 + 140 + 28,000 = 30,720$ lbs; 30,720 lbs exceeds 27,200 lbs — the lift cannot proceed using the conservative approach

B. Conservative capacity at 35 ft = 27,200 lbs; 30,720 lbs exceeds this value; the lift cannot proceed; the operator must either reduce the total suspended weight or reposition the crane to bring the operating radius to 30 feet or less

C. Conservative capacity at 30 ft = 34,800 lbs; total suspended weight = 30,720 lbs; 30,720 lbs is within 34,800 lbs — the lift proceeds using the conservative approach.

D. Nothing — the interpolated capacity at 31 ft = 34,220 lbs; 30,720 lbs is within this value; the lift proceeds

72. A crane load chart contains the following note: "For all capacity values in this section, the hook block weight has been pre-deducted. Hook block weight = 1,800 lbs. If using a hook block that weighs more or less than 1,800 lbs, adjust all capacity values accordingly." The crane is using an 1,800-lb hook block. The tabulated net capacity at the planned configuration is 26,400 lbs. The total rigging (slings + hardware, not including the hook block) weighs 1,200 lbs and the payload weighs 23,600 lbs. Is the lift within capacity?

A. Nothing — the hook block is pre-deducted; available capacity for rigging and payload = 26,400 lbs; total $(1,200 + 23,600) = 24,800$ lbs; 24,800 lbs is within 26,400 lbs — lift proceeds

B. Nothing — since the block is pre-deducted, only the payload weight counts: 23,600 lbs is within 26,400 lbs

C. The total must include the hook block: $1,800 + 1,200 + 23,600 = 26,600$ lbs; this exceeds 26,400 lbs — lift cannot proceed

D. Nothing — the tabulated net capacity covers all suspended weight including the block; total = 26,600 lbs; $26,600 \text{ lbs} > 26,400 \text{ lbs}$; the lift cannot proceed

73. A crane load chart shows the following for the on-outrigger full extension, all-directions section: all cells from 15 to 25 feet are stability-limited; all cells from 30 feet and beyond are structural-limited. A lift is planned at 28 feet — in the transition zone. Using the conservative approach, the governing capacity comes from the 30-foot structural-limited cell. What is the governing limit type and what operational precautions apply?

A. Nothing — the transition zone defaults to the stability-limited precautions since the actual lift position is in the stability zone

B. The governing capacity from the 30-foot structural-limited cell means structural-limited operational precautions apply — all crane movements must be exceptionally smooth; no rapid acceleration, deceleration, or simultaneous multi-function operation; no abrupt swing direction changes; any dynamic loading from hoist or swing adds to the already near-structural-limit static stress at the governing conservative radius

C. The transition zone requires manufacturer authorization before any lift proceeds

D. Nothing — no special operational precautions are required for structural-limited cells regardless of percentage

74. A crane load chart shows: "ON OUTRIGGERS — FULL EXTENSION — 100-FT BOOM — WITH SUPERLIFT AT 30-FT POSITION — MAXIMUM COUNTERWEIGHT." At 35 ft = 42,800 lbs; 40 ft = 34,600 lbs; 45 ft = 27,400 lbs. A critical lift at 38 feet has a total suspended weight of 38,000 lbs. Using the conservative approach, does the lift proceed?

A. Nothing — conservative capacity at 40 ft = 34,600 lbs; 38,000 lbs exceeds 34,600 lbs; the lift cannot proceed in this configuration using the conservative approach

B. Nothing — conservative capacity at 35 ft = 42,800 lbs; 38,000 lbs is within this — incorrect direction: 38 ft is beyond 35 ft, so the next larger tabulated value is 40 ft

C. Nothing — conservative capacity at 40 ft = 34,600 lbs; 38,000 lbs exceeds 34,600 lbs; lift cannot proceed; operator must reduce the total suspended weight or reposition to 35 feet or less

D. Conservative capacity at 40 ft = 34,600 lbs; 38,000 lbs exceeds this by 3,400 lbs — the lift cannot proceed; the operator must reduce total suspended weight to below 34,600 lbs or reposition to bring the radius to 35 feet or less where the 42,800-lb conservative capacity directly supports the load

75. A crane load chart section shows a note: "Operating radius measurements must be made from the crane's center of rotation to the center of the suspended load. Measurements from any other reference point void the applicable capacity values." An operator plans the lift using the distance from the front of the crane's carrier to the set location — which is 12 feet less than the actual operating radius from center of rotation. What must the operator correct?

A. The operating radius must be re-measured from the crane's center of rotation to the load's center — the 12-foot discrepancy means the operator's planned radius of, for example, 28 feet was actually a 40-foot operating radius; capacity at 40 feet is substantially lower than at 28 feet; using the incorrect reference point has likely resulted in using a capacity value that is significantly higher than what the actual operating radius supports; all capacity calculations must be corrected using the actual operating radius from center of rotation

B. Nothing — using the front of the carrier as the reference point is a common industry practice

C. The 12-foot discrepancy can be accommodated by adding 12 feet to the tabulated radius for the lift

D. The note is informational — operators may use any consistent reference point as long as they use it throughout

76. A crane load chart shows: "ON OUTRIGGERS — FULL EXTENSION — 80-FT BOOM — ALL DIRECTIONS": 30 ft = 34,400 lbs; 35 ft = 27,200 lbs; 40 ft = 21,200 lbs. A planned lift at 37 feet uses linear interpolation. The total suspended weight is 24,600 lbs. What is the interpolated capacity at 37 feet and the resulting lift percentage?

A. Nothing — the conservative approach must be used; 37 ft uses the 40-ft value = 21,200 lbs; 24,600 lbs exceeds this

B. Nothing — interpolation is not authorized for any lift above 75% of rated capacity

C. Interpolated capacity at 37 ft = $27,200 - [(2/5) \times (27,200 - 21,200)] = 27,200 - (0.4 \times 6,000) = 27,200 - 2,400 = 24,800$ lbs; lift percentage = $24,600 \div 24,800 \times 100 = 99.2\%$ — the lift is within the interpolated capacity but leaves only 200 lbs of margin; the operator must note that a critical lift plan is required and that the conservative approach at 40 ft (21,200 lbs) would not support this load

D. Interpolated capacity at 37 ft = 24,800 lbs; lift percentage = 99.2%; the lift proceeds — but the 200-lb margin is extremely tight; even a small radius increase from boom deflection or centrifugal displacement could push the effective radius beyond the interpolated envelope

77. A crane load chart shows: "TELESCOPING BOOM — ALL BOOM LENGTHS — ON OUTRIGGERS — FULL EXTENSION — 360° ALL DIRECTIONS." The section applies to boom lengths from 40 to 120 feet with a single set of capacity values. The crane is at 85-foot boom length. The LMI shows the capacity at the current configuration. What must the operator understand about using a single-table section that covers multiple boom lengths?

- A. Nothing — a single-table section covering multiple boom lengths confirms all lengths have the same capacity
- B. A single table covering 40 to 120 feet with one set of values was derived for the worst-case boom length in that range — typically the longest boom; using these values for an 85-foot boom is conservative relative to the worst case but may not reflect the actual maximum capacity available for the 85-foot configuration; the operator should confirm from the section's notes whether the values represent the minimum across all lengths or the specific worst case, and whether additional capacity is available at 85 feet from a boom-specific section
- C. Nothing — the LMI automatically selects the correct column for 85 feet from the table
- D. The table is invalid — all telescoping boom charts must have separate sections for each boom length increment

78. A crane's load chart for the on-outrigger full extension, all-directions section shows: 100-ft boom at 40 ft = 22,800 lbs; 45 ft = 17,800 lbs; 50 ft = blank. A planned critical lift at 43 feet has a total suspended weight of 19,200 lbs. Using the conservative approach, the governing capacity is 17,800 lbs at 45 feet. The lift percentage = $19,200 \div 17,800 \times 100 = 107.9\%$. What must the operator conclude?

- A. Nothing — the interpolated capacity at 43 ft (21,240 lbs) clearly supports the 19,200-lb load; the lift proceeds
- B. Nothing — the lift director may authorize the 7.9% excess for critical lifts when no alternative crane is available
- C. Nothing — the crane's rated capacity is the tabulated value (22,800 lbs at 40 ft) which supports the 19,200-lb load
- D. The conservative capacity at 45 feet (17,800 lbs) governs for the 43-foot operating radius — 19,200 lbs exceeds 17,800 lbs; the lift cannot proceed using the conservative approach; the operator must either reduce the total suspended weight to below 17,800 lbs, or reposition the crane to reduce the operating radius to 40 feet or less where the 22,800-lb tabulated capacity directly supports the load

79. A crane load chart section note reads: "When the ambient temperature falls below 0°F (-18°C), contact the manufacturer before operating in this section." The current temperature is -8°F (-22°C). What must happen before the first lift of the day?

A. Apply the standard 15% cold weather derating and proceed with operations using the reduced capacity

B. Nothing — cold weather operation is a standard crane operational condition covered by the operator's certification

C. Nothing — the note's 0°F threshold represents guidance rather than a binding requirement

D. Nothing — the manufacturer is not available on weekends; proceed using the values and apply additional care during operations

C. Wait — rereading the question: the correct answer is assigned to Q79 = A. The manufacturer must be contacted before operations in this section at temperatures below 0°F — the note establishes this as a binding condition; the capacity values in this section were derived under specific temperature conditions; at -8°F, the hydraulic system performance, seal integrity, and potentially the steel's impact toughness differ from standard conditions; the manufacturer's guidance for sub-zero operation of this specific crane is required before using this section's values

80. A crane load chart shows: "ON OUTRIGGERS — FULL EXTENSION — 100-FT BOOM — OVER FRONT (0° TO 20° EACH SIDE)": 25 ft = 48,200 lbs. "360° ALL DIRECTIONS": 25 ft = 36,400 lbs. A critical lift requires the boom to pick at 8 degrees right of front center and set at 22 degrees right of front center. What capacity governs?

A. Nothing — the pick at 8 degrees is within the over-front sector (0°–20°); the set at 22 degrees is 2 degrees outside the over-front sector; the all-directions capacity of 36,400 lbs governs the entire lift since the load must be swung into and set in the all-directions zone; the over-front capacity cannot be used for a lift that requires the load to pass into the all-directions zone

B. Nothing — the set at 22 degrees is only 2 degrees outside the over-front sector; the over-front capacity applies with a 5% derating for the minor sector exceedance

C. The over-front capacity governs at the pick and all-directions governs only at the 22-degree set position

D. Nothing — both the pick and set positions are essentially at the sector boundary; average the two capacities for lift planning

81. A crane load chart note reads: "The capacities in this section include all dynamic effects for hoisting speeds up to 80 fpm. For hoisting above 80 fpm, apply a 7% dynamic load increase to the total suspended weight before comparing to the tabulated values." The total suspended weight is 26,000 lbs and the hoist speed will be 110 fpm. What effective total suspended weight must be compared to the tabulated capacity?

- A. Nothing — 110 fpm is the maximum rated hoist speed and no factor applies above the rated speed
- B. Effective weight = $26,000 \times 1.07 = 27,820$ lbs; the 7% dynamic factor must be applied since 110 fpm exceeds the 80 fpm threshold; the tabulated capacity must exceed 27,820 lbs, not just 26,000 lbs; operating above the threshold speed without applying the factor means using capacity values that do not account for the actual dynamic loading during the hoist
- C. Effective weight = $26,000 + 7\%$ of $(26,000 \div 80 \times 110) =$ not the correct approach
- D. Nothing — dynamic load factors are built into all load chart values for all hoisting speeds

82. A crane load chart shows a section titled "JIBBED CONFIGURATIONS — SEE APPLICABLE JIB SECTION." The crane operator confirms the crane is not configured with a jib — only the main boom is installed. Which section applies?

- A. The "JIBBED CONFIGURATIONS" section applies since it shows the crane's maximum capacity
- B. Nothing — the jibbed section header means the operator must consult the jib section regardless of actual configuration
- C. The main boom section (not the jibbed section) applies — the load chart section used must match the actual physical configuration; using jib section values when no jib is installed applies values from a different structural geometry; the jib section may show different values because the jib changes the boom tip load and suspension geometry; the operator must use the section matching the actual installed configuration
- D. The jib section provides more conservative values — using it for a non-jib configuration provides additional safety margin

83. A crane load chart for a 100-foot boom at full outrigger extension shows: 30 ft = 36,800 lbs; 35 ft = 29,000 lbs; 40 ft = 22,600 lbs. The rate of capacity decrease per foot: 30–35 ft = 1,560 lbs/ft; 35–40 ft = 1,280 lbs/ft. A lift at 38 feet uses linear interpolation between 35 and 40 feet. What is the interpolated capacity and does 25,400 lbs of total suspended weight proceed?

- A. Interpolated capacity at 38 ft = $29,000 - (3 \times 1,560)$ = not correct — this uses the wrong interval rate
- B. Nothing — 38 ft is 3 ft beyond 35 ft; interpolated capacity = $29,000 - (3 \times 1,280)$ = $29,000 - 3,840$ = 25,160 lbs; 25,400 lbs exceeds 25,160 lbs — the lift does not proceed using interpolated capacity; the conservative capacity at 40 ft (22,600 lbs) also does not support 25,400 lbs
- C. Interpolated capacity at 38 ft = $29,000 - (3 \times 1,280)$ = $29,000 - 3,840$ = 25,160 lbs; 25,400 lbs exceeds 25,160 lbs — the lift cannot proceed using either interpolated or conservative capacity in this configuration; the operator must reduce the total suspended weight or reposition to 35 feet or less
- D. Nothing — 38 ft interpolated capacity = $29,000 - (3 \times 1,280)$ = 25,160 lbs; 25,400 is 240 lbs above the interpolated value; at 95%+ this is within LMI accuracy tolerance; proceed

84. A crane load chart shows two adjacent capacity cells at the same configuration and radius that show different values in two different printings of the same manual — the shop copy shows 24,400 lbs and the cab copy shows 22,800 lbs. Which value should be used and what action is required?

- A. Nothing — use the lower value (22,800 lbs) from the cab copy as the more conservative value
- B. Nothing — use the higher value (24,400 lbs) since the shop copy is the master document
- C. The discrepancy must be resolved with the manufacturer before using either value — two different printings of the same load chart showing different capacities at the same configuration creates an uncertainty that cannot be resolved by choosing the lower value; even the lower value may be incorrect; the manufacturer must confirm the correct value for the specific configuration; using any unconfirmed capacity value from a document with a known discrepancy is not authorized
- D. The older document must be discarded and only the current document used — confirm with the manufacturer which document is current

85. A crane load chart section note reads: "For lifts in this section, the crane must be on firm, level ground with a minimum 12-inch-thick concrete pad or equivalent engineered surface. Operations on soil alone — even with mats — void this section." The crane is set up on 4-inch-thick timber mats on firm native soil. Can this section be used?

- A. Nothing — the section requires either a 12-inch concrete pad or an equivalent engineered surface; timber mats on native soil do not satisfy "equivalent engineered surface" without specific engineering confirmation; the note explicitly states that mats on soil alone void this section; the crane must either be positioned on a qualifying concrete pad or the operator must obtain confirmation that the timber mat system is an approved equivalent for this specific note before these values can be used

B. Nothing — the timber mats on firm native soil satisfy the "equivalent engineered surface" requirement

C. The 4-inch timber mats are an industry-standard equivalent to 12-inch concrete — the note's condition is satisfied

D. The note only applies when the soil bearing capacity is below 3,000 psf; confirmed firm native soil satisfies the note

86. A crane load chart shows: "MAXIMUM RATED CAPACITY AT ANY CONFIGURATION — 120,000 LBS." A planned lift has a total suspended weight of 118,400 lbs. Using the applicable load chart section, the tabulated capacity at the planned configuration is 124,000 lbs. What governs — the section-specific tabulated value or the maximum rated capacity note?

A. Nothing — the tabulated capacity at the specific configuration (124,000 lbs) governs since it is derived for the exact setup

B. Nothing — maximum rated capacity notes are general guidelines that are superseded by configuration-specific values

C. Nothing — the note's maximum capacity and the tabulated value can both be used depending on the operator's choice

D. The 120,000-lb maximum rated capacity governs and supersedes the higher tabulated value — the maximum rated capacity note establishes an absolute ceiling that applies regardless of what any individual configuration section shows; the structural analysis of the crane as a whole may support more than 124,000 lbs in that specific configuration, but the maximum rated capacity creates an absolute limit; the planned 118,400-lb load is within the 120,000-lb maximum but the operator cannot exceed 120,000 lbs regardless of what the section tabulates

87. A crane's load chart for on-outrigger full extension shows: 80-ft boom at 20 ft = 56,000 lbs; 25 ft = 44,400 lbs; 30 ft = 34,800 lbs; 35 ft = 27,200 lbs. All cells are stability-limited. A planned critical lift at 22 feet has a total suspended weight of 52,000 lbs. Using the conservative approach, what capacity governs and does the lift proceed?

A. Conservative capacity at 25 ft = 44,400 lbs; total suspended weight (52,000 lbs) exceeds 44,400 lbs — the lift cannot proceed using the conservative approach; the operator must reduce the total suspended weight to below 44,400 lbs or reposition to 20 feet or less where the 56,000-lb capacity directly supports the load

B. Conservative capacity at 20 ft = 56,000 lbs — the 20-foot value is the lower adjacent tabulated value; 52,000 lbs is within this capacity; the lift proceeds

C. Nothing — 22 feet is closer to 20 feet than to 25 feet; use the 20-foot value as the conservative governing entry

D. Nothing — the stability-limited cells always have a 25% margin from tipping built in; 52,000 lbs at 25 ft = 117% of the stability limited value; this exceeds the threshold

88. A crane load chart section note states: "These capacity values were calculated for standard atmospheric pressure at sea level. For operations at elevations above 5,000 feet, contact the manufacturer for altitude derating." The crane is operating at 5,800 feet above sea level. What must happen?

A. Apply a standard 5% derating for altitudes above 5,000 feet and proceed with operations

B. Nothing — altitude derating only applies to hydraulic pressure, not load chart capacity values

C. The manufacturer must be contacted for the specific altitude derating before any lifts at this elevation — the note establishes a binding condition requiring manufacturer guidance above 5,000 feet; the capacity values at sea level reflect engine performance and hydraulic output that are affected by reduced atmospheric pressure at altitude; the manufacturer's altitude-specific guidance may change both the available hoist force and the stability analysis; proceeding without this guidance means using capacity values that may not apply at 5,800 feet

D. Nothing — load chart capacity values are engineering limits that do not change with altitude

89. A crane load chart shows two counterweight sections for the same boom and outrigger configuration: 14,000-lb counterweight at 30 ft = 22,400 lbs; 18,000-lb counterweight at 30 ft = 28,600 lbs. Both cells are stability-limited. A planned lift at 30 feet requires 26,000 lbs of total suspended weight. The crane has 14,000 lbs of counterweight installed. What must the operator do?

A. Nothing — 22,400 lbs does not support 26,000 lbs; the crane must either reconfigure with 18,000-lb counterweight to access the 28,600-lb capacity, or reduce the total suspended weight to below 22,400 lbs for the lift to proceed with existing counterweight

B. Nothing — the 22,400-lb capacity supports 22,400 lbs; adding counterweight during an active lift resolves the shortfall

C. Reduce the total suspended weight to 22,400 lbs and proceed — partial load completion is acceptable for a critical lift

D. Nothing — both counterweight sections apply simultaneously; add 22,400 + 28,600 = 51,000 lbs total available

90. A crane load chart for a crawler crane shows: "ON CRAWLERS — OVER SIDE — STANDARD COUNTERWEIGHT — 120-FT BOOM": 40 ft = 82,000 lbs; 45 ft = 66,400 lbs; 50 ft = 52,800 lbs. A critical lift at 43 feet has a total suspended weight of 72,000 lbs. Using the conservative approach, the governing capacity at 45 feet is 66,400 lbs. The lift percentage = $72,000 \div 66,400 \times 100 = 108.4\%$. What must the operator conclude?

A. Nothing — the interpolated capacity at 43 feet (74,320 lbs) supports the 72,000-lb load; the lift proceeds

B. Nothing — for crawler cranes, the conservative approach uses the preceding tabulated value (82,000 lbs) which supports the load

C. Nothing — the lift percentage based on interpolated capacity = $72,000 \div 74,320 = 96.9\%$; the lift proceeds within the interpolated envelope

D. The conservative capacity at 45 feet (66,400 lbs) governs for the 43-foot operating radius — 72,000 lbs exceeds 66,400 lbs by 5,600 lbs; the lift cannot proceed using the conservative approach; the operator must reduce the total suspended weight to below 66,400 lbs or reposition the crane to 40 feet or less where the 82,000-lb capacity directly supports the load

91. A crane load chart section note reads: "The boom length used in selecting this section must match the actual installed boom length within ± 1 foot. Using this section for a boom length outside this tolerance voids its applicability." The crane's actual boom length is confirmed at 98 feet. The operator uses the 100-foot boom section. Is the 2-foot discrepancy within the ± 1 foot tolerance?

A. The 2-foot discrepancy exceeds the note's ± 1 -foot tolerance — the 100-foot section cannot be used for a 98-foot boom; the operator must either use a 98-foot or 99-foot boom section (if available), adjust the boom to exactly 100 feet, or contact the manufacturer for guidance on the applicable section for a 98-foot boom

B. A 2-foot boom length discrepancy is within standard industry measurement tolerance regardless of the note's stated tolerance

C. Nothing — the ± 1 -foot tolerance note is advisory; operators routinely use sections that do not exactly match the installed boom length

D. The note only applies to the boom tip section — the base boom length may vary by more than ± 1 foot

92. A crane load chart shows: "ON OUTRIGGERS — FULL EXTENSION — 100-FT BOOM — ALL DIRECTIONS": 35 ft = 27,800 lbs; 40 ft = 22,000 lbs; 45 ft = 17,200 lbs. The rate of capacity decrease per foot: 35–40 ft = 1,160 lbs/ft; 40–45 ft = 960 lbs/ft. The capacity curve is concave upward. A lift at

43 feet uses linear interpolation between 40 and 45 feet. What is the interpolated capacity and what does the concave upward shape mean for accuracy?

A. Nothing — the concave upward shape means the actual capacity is slightly lower than interpolated — the interpolated value is non-conservative

B. Nothing — linear interpolation is exact regardless of curve shape

C. Interpolated capacity at 43 ft = $22,000 - (3 \times 960) = 22,000 - 2,880 = 19,120$ lbs; the concave upward shape means the actual capacity curve lies above the straight interpolation line, making linear interpolation slightly conservative; the actual capacity at 43 feet is slightly higher than 19,120 lbs; however, the operator must use the interpolated value of 19,120 lbs as the working capacity since the actual curve value is not directly available

D. Interpolated capacity = $22,000 - (3 \times 1,160) = 18,520$ lbs — using the wrong interval rate

93. A crane load chart shows a section for "ON OUTRIGGERS — PARTIAL EXTENSION — OVER REAR SECTOR (10° EACH SIDE)." A planned lift requires the boom to swing through the rear sector but not stop there — the load will be set 40 degrees outside the rear sector. The total suspended weight is 86% of the over-rear section's capacity and 112% of the all-directions section capacity at the same radius. What must the operator conclude?

A. Nothing — the over-rear section capacity governs for any lift that passes through the rear sector

B. Nothing — since the load is set outside the rear sector, the over-rear section capacity governs only during transit

C. The total suspended weight exceeds the all-directions capacity — the lift cannot proceed in this configuration; the load must swing through the all-directions zone to reach the set location; the all-directions capacity applies in that zone; at 112% of the all-directions capacity, the crane will exceed its rated capacity during the swing to the set location; the load must be reduced below the all-directions capacity or the lift must be redesigned to avoid the all-directions zone

D. Nothing — the 86% over-rear capacity for transit through the rear sector confirms the load is within capacity for the swing

94. A crane load chart shows: "TELESCOPING BOOM — ON OUTRIGGERS — FULL EXTENSION": at boom length 80 ft at 35 ft radius = 26,800 lbs; at boom length 100 ft at 35 ft radius = 23,200 lbs. Both are structural-limited. A planned lift at 35-foot radius uses the 80-foot boom with a total suspended weight of 24,800 lbs. Using the 80-foot boom configuration: what is the lift percentage and what type of lift is this?

- A. Nothing — lift percentage = $24,800 \div 26,800 = 92.5\%$; this is a critical lift requiring a written plan and pre-lift meeting; additionally, the structural-limited classification means smooth operation protocols are required — no rapid acceleration, simultaneous multi-function operation, or dynamic loading
- B. Nothing — lift percentage = $24,800 \div 26,800 = 92.5\%$; the structural limit means the crane should boom up to reduce the radius before proceeding
- C. Nothing — the 100-foot boom section's 23,200-lb capacity governs since it is lower than the 80-foot boom section
- D. Lift percentage = $24,800 \div 26,800 = 92.5\%$; using the 100-foot boom section (23,200 lbs) would not support 24,800 lbs; the 80-foot boom section (26,800 lbs) is the applicable section since the 80-foot boom is installed; the 100-foot section does not govern a lift using the 80-foot boom regardless of the capacity comparison

95. A crane load chart shows: 100-foot boom at full outrigger extension, all-directions, maximum counterweight section: 30 ft = 38,200 lbs; 35 ft = 30,400 lbs; 40 ft = 23,800 lbs. A series of 10 identical critical lifts is planned at 32 feet of operating radius with a total suspended weight of 34,400 lbs. Using the conservative approach, the governing capacity at 35 feet is 30,400 lbs. The lift percentage = $34,400 \div 30,400 \times 100 = 113.2\%$. What must the operator conclude?

- A. The conservative capacity at 35 ft governs — 34,400 lbs exceeds 30,400 lbs; the series of lifts cannot proceed at 32 feet using the conservative approach; the operator must either reduce the total suspended weight to below 30,400 lbs, or reposition the crane to bring the operating radius to 30 feet or less where the 38,200-lb conservative capacity directly supports the load
- B. Nothing — the interpolated capacity at 32 ft (36,480 lbs) supports the 34,400-lb load; the lift series proceeds
- C. Nothing — for a series of identical lifts, the critical lift plan from the first lift covers all subsequent lifts
- D. Nothing — 113.2% exceeds the rated capacity; contact the manufacturer for a temporary capacity waiver

Core Exam 13 Answer Key and Full Explanations

1. B — Bearing pressure = $84,000 \div 2 = 42,000$ psf — far exceeding any tunnel roof's designed soil overburden plus live load capacity. Tunnels are designed for distributed soil pressure and internal live loads, not for concentrated point loads applied through only 2 square feet of contact area. A structural engineer must evaluate whether the tunnel roof can resist both the existing soil load and the additional concentrated crane outrigger load before any setup proceeds.

2. C — A mat spanning between rigid concrete and compressible native soil creates differential support — the soil side settles under load while the concrete cap side does not. This differential rotation concentrates the outrigger load at the cap's edge, creating a fulcrum effect that applies bending and shear to the cap at the mat's contact point. The cap was designed for its own structural loads, not for crane outrigger edge loading, and can crack under this concentrated force.

3. A — OSHA 1926.1402 requires ground condition confirmation at each setup location before operations begin, and for barge-mounted cranes, this includes confirming the barge's stability throughout all planned operating positions. When a barge repositions, its trim, freeboard, and list may change based on water depth, current loading distribution, and ballast — all of which affect whether the crane remains within its operating slope tolerance. The stability must be confirmed at the new position before lifting.

4. C — The combination of uphill water application, progressive soil darkening reaching the outrigger position, and 0.3 inches of boot heel penetration together confirm water has infiltrated the bearing zone and significantly softened the soil. Bearing capacity in fine-grained soils decreases dramatically with increased moisture content. Operations must stop until the water source is controlled and the bearing capacity at the affected position is re-evaluated under current moisture conditions.

5. B — Three simultaneous adverse effects are created: the excavator adds surcharge loads to the bearing zone, the spoil pile adds additional surcharge, and the excavation removes passive resistance on the trench side. Any one of these individually would require assessment — the combination requires a thorough evaluation of whether the soil supporting the right front outrigger can resist the combined loads. The operator must confirm the soil's capacity under the combined loading before operations continue.

6. D — Alligator cracking is the terminal fatigue failure pattern in flexible pavement — it confirms the base or sub-base has failed to support the surface under repetitive loading. The cracked surface is no longer structurally supported by the base beneath it and is effectively spanning a failed sub-base. Crane outrigger loading on this surface can cause sudden punching failure through the cracked surface into the void or failed material below, with no warning before collapse.

7. A — OSHA 1926.1408 establishes a mandatory pre-operation sequence for power line proximity: identify lines before crane arrival, determine voltage and de-energization feasibility, establish the MSAD, implement all required controls, and brief all affected personnel. All steps must be completed before the first crane movement near the line. Skipping or reordering any step leaves personnel without confirmed protection during the period before all controls are established.

8. C — Surface concrete spalling under a loaded outrigger mat indicates the surface concrete is failing in compression or bearing shear under the concentrated contact pressure. As spalling removes material, the remaining concrete must carry the same total load over a progressively smaller effective area, increasing the bearing pressure further. This positive feedback loop accelerates failure — each spalled piece increases the pressure on the remaining concrete, accelerating further spalling toward punching failure.

9. B — Active munitions loading areas require coordination with explosive safety authorities before any adjacent operations — crane operational incidents (dropped loads, equipment contact, vibration) near handled or stored munitions create detonation hazards. The absence of posted restrictions does not confirm operational authorization — it simply means no one posted a sign. The crane employer must positively confirm authorization with the facility's explosive safety officer before setup.

10. D — Medium dense sand can temporarily lose significant bearing capacity when saturated — the water fills void spaces and creates positive pore pressure that reduces effective stress between particles. A rod penetrating 4 inches by hand pressure in soil previously confirmed at 4,200 psf indicates the soil's current density is much lower than the dry-condition assessment. Operations must not resume until the soil drains, the probe resistance returns to pre-rain levels, and the bearing capacity is confirmed re-established.

11. C — Active drainage system testing creates water flow through pipes at 4 feet of depth — below the surface but within the crane's stress influence zone. If any pipe joints are compromised under test flow pressure, water exits directly into the soil at depth, creating a saturated zone in the bearing soil without any surface indication. Pausing crane operations during the drainage test eliminates the risk of outrigger loading on soil that may be becoming saturated at depth during the flow test.

12. C — Plywood is not a one-size-fits-all cribbing material — its structural capacity varies significantly with thickness, grade, species, and layup. Three-inch plywood may have adequate compressive strength for some outrigger loads but may be inadequate for higher-reaction cranes. Using plywood as cribbing without confirming its specific capacity for the actual outrigger reaction load creates an unknown-capacity condition in a critical load path component.

13. B — The crane's outrigger load creates a stress bulb that extends downward and outward from the contact area. The depth of significant stress influence depends on the contact pressure and the spread area — for concentrated crane loads, significant stress can extend 6 to 10 or more feet below the surface. A loose sand zone at 6 to 9 feet may fall within this influence depth and could consolidate or shear under the increased stress even though it was not relevant to the building's spread foundation loads.

14. D — High-pressure grouting during micro-pile installation creates elevated pore pressure in the soil surrounding the installation point. This pore pressure increase propagates laterally through the soil, temporarily reducing effective stress and bearing capacity in the adjacent zone that includes the crane's outrigger. Simultaneous crane operations add outrigger loading to soil whose capacity is being temporarily reduced by adjacent grouting — level monitoring and readiness to pause are essential.

15. D — Extended cryogenic storage can freeze the underlying soil, creating localized permafrost conditions beneath the container footprint. When the containers are removed and the frozen soil begins to thaw, the ice that provided structural support melts and the soil loses significant bearing capacity during the thaw transition period. Three days after removal may be early in the thaw process — the bearing capacity in the formerly frozen zone may currently be at its lowest point as the ice melts.

16. C — Hot weather asphalt becomes semi-plastic and flows under sustained concentrated loads. A mat-edge depression indicates the asphalt is yielding under the outrigger load — the mat is beginning to penetrate through the softened surface. As penetration deepens, the load is redistributed to a smaller effective contact area, increasing bearing pressure and accelerating further penetration. This progressive failure requires stopping operations and re-evaluating the surface conditions.

17. A — Using 94.7% of the documented bearing capacity leaves essentially no margin for the inevitable variability in soil conditions, load calculation uncertainties, or dynamic loading effects from crane operations. Bearing capacity values themselves have inherent uncertainty — the test result represents a point sample, not a guarantee that every square foot of the mat contact area meets exactly that value. Reducing bearing pressure to a safer fraction of documented capacity through a larger mat area provides meaningful safety margin.

18. D — The zone of influence is the volume of soil that experiences meaningful additional stress from the outrigger's applied load. This stress bulb extends both downward and laterally — not just vertically. A buried utility, soft layer, or tunnel anywhere within this zone is subjected to the crane's added load. The zone's extent depends on the contact pressure and the mat size — larger mats spread load over wider areas but the stress still extends to meaningful depth below the mat.

19. A — Railroad crossings have two independent load limits: total gross vehicle weight and axle load ratings. A vehicle within the total GVW limit can still exceed the axle load limit if the weight is concentrated on few axles. Crane transport vehicles commonly have this characteristic. Additionally, overhead catenary lines, if present, require confirmed clearance for all crane components during transport. Coordination with the railroad's operations center is required before crossing active tracks.

20. C — Backfill placed without compaction testing may have been dumped rather than compacted — visual inspection of a backfilled site cannot distinguish adequately compacted fill from loosely placed fill. The excavation boundaries define a known zone of uncontrolled fill. Four months of self-weight consolidation does not substitute for engineered compaction — loose backfill can consolidate dramatically under concentrated crane loads with no warning. Current compaction testing is required.

21. B — The general wind limit was established for compact loads where wind force is proportional to load weight and a small projected area. A 14 × 22 × 8-foot HVAC unit presents up to 308 square feet of projected area to the wind, generating lateral forces many times greater than a compact load of equivalent weight at the same speed. These forces create boom side-loading that may exceed the boom's lateral structural capacity well below the general wind limit. A sail force calculation specific to this load is required.

22. C — A tag line routed across the walking path of personnel creates a tensioned line obstacle at unpredictable heights when the load swings. Workers absorbed in their tasks may walk into the line at ankle, knee, or waist height, causing trips or entanglement. If the load swings suddenly, the tag line becomes a dynamic tensioned element capable of knocking workers off their feet or pulling them toward the load. The tag line must be clear of all personnel travel paths before any lifting proceeds.

23. A — A 3-foot radius increase from an existing 91% configuration may push the crane beyond rated capacity at the new radius — capacity decreases with increasing radius and the rate of decrease near the load chart's outer boundaries can be substantial. The load chart must be consulted for the new radius before executing the movement. The lift director's request does not authorize movement to an unconfirmed configuration — operator must hold and verify.

24. C — A demonstration lift uses real equipment, real loads, and real hazards — calling it a "demonstration" changes nothing about the physical risks involved. OSHA 1926.1416 requires pre-lift preparation regardless of the lift's purpose. The absence of a capacity verification, signal person designation, exclusion zone establishment, and crew briefing creates the same hazards for a demonstration lift as for any other lift. All standard requirements apply before the first movement.

25. B — ASME B30.5 and OSHA 1926.1416 both require the operator to remain at the controls at all times while a load is suspended. Leaving a 24,000-lb load suspended overnight with no operator creates multiple unmanaged hazards: weather changes, equipment condition changes, and the potential for personnel to approach the area under the load without a competent person present. The load must be on the ground before the operator leaves.

26. D — An EMERGENCY STOP signal is an unconditional stop command that overrides all other signals and all current crane movements, regardless of who gave the previous signal or how long ago. The emergency stop exists precisely for situations where movement that appears safe suddenly becomes dangerous. The operator must stop instantly and hold position until a designated person confirms the reason for the stop and clears further movement.

27. C — OSHA 1926.1419 establishes that crane movements may only be directed by the designated signal person using approved signals or by the lift director through established communication channels. The site foreman is neither the signal person nor the lift director for this lift. Accepting movement instructions through undesignated channels bypasses the planned communication system and creates confusion about who has authority over the crane's movements at any given moment.

28. C — Hand signal communication requires the operator to clearly see the signal person's gestures. Sun glare directly in the operator's eyes prevents reliable signal recognition — the operator may misidentify a LOWER as a HOIST or a STOP as a SWING. Any signal the operator cannot see clearly is a failed communication that must be resolved before any crane movement. The signal person must relocate or an alternative communication method must be established.

29. B — A 5-percentage-point discrepancy between a calculated 89% and a displayed 94% is beyond normal LMI tolerance and indicates either a configuration error in the LMI or a real difference in the actual versus planned load. If the LMI is configured for a shorter boom or smaller counterweight, it displays higher percentages than the actual configuration warrants. If the load is actually heavier than planned, the 94% is real. Either possibility requires investigation before continuing.

30. B — Using an unrigged crane to attempt emergency rescue without confirmation of the debris weight, proper rigging, signal coordination, and confirmed trapped person's exact position creates a high risk of a second incident — potentially injuring the trapped person further or causing a crane incident. Emergency services personnel have the training and equipment for this situation. Getting the current load secured immediately allows full attention to the emergency while keeping the crane safe.

31. A — Perpendicular load swing — side-swinging rather than in-plane — indicates the load's CG was not centered directly below the boom tip at the moment of pick, or the load was picked with a lateral offset. A load swinging perpendicular to the boom applies lateral force to the boom tip on every swing cycle. Crane booms are designed for in-plane loading — lateral tip loading can exceed the boom's lateral structural capacity and must be resolved before the load rises further.

32. C — OSHA 1926.1419 allows the lift director to give signals directly to the operator only when the lift director is also a qualified signal person who has been designated for that specific lift before operations begin. Designation must precede operations — a lift director cannot begin giving signals mid-lift without prior designation. This requirement prevents ambiguous signal authority situations where both the signal person and lift director are giving potentially conflicting signals.

33. B — A crane that runs out of fuel during a loaded lift experiences complete loss of all hydraulic functions — hoist brakes, boom control, and load holding all depend on hydraulic pressure. At 15% remaining fuel, the exact remaining runtime depends on consumption rate and cannot be predicted with confidence during operations. Lowering the load before fuel depletion ensures the load is on the ground while full hydraulic control is available.

34. D — Precision placement within 3-inch clearances requires load movements in the 1-2 inch range — finer than what normal sustained hydraulic inputs deliver. Brief controlled hydraulic impulses — tap-and-release technique — allow boom movements smaller than the minimum sustained travel. The operator must also communicate the achievable movement resolution to the signal person so commands are given at a scale the crane can execute, preventing multiple overcorrection cycles.

35. D — A new hydraulic leak from a swing motor fitting indicates a developing failure in a pressurized circuit. The swing motor operates at hundreds to thousands of psi during every swing movement. A drip at one drop per 3 seconds at atmospheric state can become a pressurized stream when the motor is loaded during operation. Additionally, the leak's location in the swing circuit means any failure affects swing control — a critical function during loaded lifts. The source must be identified and corrected before any operations.

36. C — Operating the boom within 5 feet of an occupied walkway creates a collision hazard if the boom's path deviates by any amount — from wind loading on the boom, from control input error, or from load-induced boom deflection. The walkway occupants cannot observe or avoid the approaching boom from inside the structure. The walkway must be evacuated — not just warned — before any crane movement brings the boom within this proximity range.

37. B — An intermittent shudder in the load line during a steady hoist indicates a sudden change in the rope's path or tension — consistent with a rope beginning to jump a sheave, a sheave bearing failing, or a rope fault passing through a contact point. At 92% of rated capacity, any of these conditions can progress to sudden rope departure from a sheave or complete rope failure. The shudder must be investigated from the ground before any further hoist movement.

38. D — OSHA 1926.1412(f) requires periodic inspections by a qualified person at intervals of 1 to 12 months, with frequency based on service intensity. The specific components required include all structural members, fasteners, pins, sheaves, drums, brakes, wire rope, hooks, and all safety devices. Documentation of the inspection and correction of all deficiencies before return to service are both required elements that distinguish periodic inspections from the operator's daily pre-shift checks.

39. A — OSHA 1926.1416(e) specifically requires the crane's rated capacity placard to be present in the cab. The placard ensures that every operator — including relief operators, temporary operators, and operators unfamiliar with this specific crane — has access to the accurate rated capacity information. The experienced operator's memory is not a substitute because it cannot be verified by others and creates a single point of knowledge failure if that operator is absent.

40. C — Tension per leg in a 3-leg bridle at 45 degrees from horizontal = $(\text{total load} \div \text{legs}) \times (1 \div \sin \text{angle}) = (28,000 \div 3) \times (1 \div \sin 45^\circ) = 9,333 \times 1.414 = 13,197 \text{ lbs.}$ Since 13,197 lbs exceeds the 10,000-lb WLL per leg, the 3-leg configuration at 45 degrees cannot support this load. Either the sling angle must be increased (to reduce the tension per leg) or higher-capacity slings must be used.

41. B — A rotating structural steel frame presents sweeping structural members that can strike personnel or adjacent equipment in a large radius around the load. As the frame rotates, its extending members travel through the exclusion zone without warning. Simultaneously, sling leg twisting progressively reduces effective WLL. Tag lines must be attached to arrest and control rotation before the frame rises further — after hoisting, arresting rotation becomes more difficult and the sweeping hazard area increases.

42. A — OSHA 1926.1431 requires a proof test at 125% of the platform's rated load capacity before the first use on a project. The test uses test weights equal to 125% of rated capacity, the platform is held at maximum intended height for 5 minutes, and all components are inspected for deformation or damage before personnel are authorized. This test is separate from daily pre-lift inspections and is specifically required as a one-time pre-use certification for each project.

43. A — A 0.4% reading during an active lift that started at 0% means the soil is continuing to consolidate under the outrigger loads — elastic deflection would have occurred instantly during loading, not progressively over 12 minutes. A progressive tilt reading indicates ongoing soil movement, not a one-time deflection event. With the reading at 80% of the tolerance limit and trending toward it, continued operations risk reaching or exceeding the tolerance before the load is safely down.

44. D — Full thread engagement is required for screw-pin shackles — the pin must fully thread through the bow with all threads engaged and the pin must be moused to prevent backing out. At one-third engagement, only a small fraction of the shackle's designed holding threads are engaged. The shackle can pull through the bow at any load level — not just near WLL. Partial thread engagement is a condition that can cause catastrophic rigging failure at any point during the lift.

45. B — A tilt that develops after a confirmed level pick indicates the load distribution in the rigging changed during hoisting. A slipping sling leg, a pulling lug, or a shifting panel within the rigging are the most common causes. At 8 degrees of tilt, the load moment on the individual rigging components has changed significantly from the planned distribution. Continuing the hoist with unknown rigging geometry risks catastrophic rigging failure or panel damage at height.

46. D — OSHA 1926.1416 and ASME B30.5 both establish rated capacity as an absolute limit that no person, signal, instruction, or authorization can override. The crane operator bears personal responsibility for not exceeding rated capacity — even if instructed to by the signal person, lift director, employer, or project owner. Refusal is the only compliant response. Operating beyond rated capacity creates structural loading that the crane was not designed to safely carry.

47. B — A pressurized hydraulic mist is a high-velocity stream of fine droplets that can be injected into skin at distances up to 40 feet — a medical emergency that may not be immediately apparent to the victim. Pressurized hydraulic fluid is also flammable when it contacts hot engine or exhaust surfaces. A fitting currently misting will progressively fail under the cyclic loading of continued crane operation. The source must be confirmed and repaired before any further use.

48. B — Leaving the boom elevated overnight creates wind loading hazards and prevents safe rigging by the transport crew. The overnight configuration must prevent unauthorized operation (key removal), prevent weather-induced structural movement (travel locks), and allow the transport crew to begin their work safely the next morning. Documenting the crane's condition in the shift log ensures the transport crew has accurate information about the crane's status at demobilization.

49. B — A twisted chain link has been subjected to torsional forces that permanently deformed it beyond its design geometry. When a twisted link is placed in tension, the twist angle concentrates stress at the inner bend radius in a manner the link was not designed to carry. This stress concentration can cause crack initiation at the inner radius under normal working loads. ASME B30.9 lists link twist as a removal condition because the link's actual capacity with a twist cannot be confirmed from the rated WLL.

50. D — Near-rated-capacity lifts stress primary structural members to near-design-limit stress levels — the conditions most likely to reveal developing fatigue cracks, weld deficiencies, or structural imperfections. Post-heavy-lift inspections exist to catch structural changes that occurred during the high-stress event. Thirty days of continued daily operations with undetected structural damage from the heavy lift compounds the risk — the damage continues to develop without inspection or documentation.

51. D — The ATB cable must function reliably as a continuous mechanical circuit from the ATB switch through the cable to the weight. Each crimp sleeve in a splice represents a mechanical connection that the original unspliced cable does not have. A splice that appears secure under manual testing may fail under the dynamic conditions of an actual two-blocking event. Post-splice functional testing confirming hoist interruption under the ATB weight's actual load is required to confirm the repair is reliable.

52. C — The manufacturer's 1/4-inch per minute maximum drift rate is the threshold at which the hoist motor bypass is considered to have exceeded acceptable limits. At 3/8-inch per minute, the motor has exceeded this limit — meaning it has bypassed beyond the design maximum. A motor at or above its bypass limit can progress to higher drift rates under continued operations. The crane must be removed from service and the motor repaired before any further lifting.

53. D — A load cell's calibrated accuracy is valid only within the period of the calibration certificate. At 14 months overdue on a 12-month interval, the cell may have drifted beyond its certified accuracy. Load cell drift is cumulative and invisible — the displayed percentage appears normal while the underlying measurement deviates from reality. At 5% drift, a 96% actual lift appears as 91% — well within the comfort zone but actually at near-capacity. Near-capacity operations require confirmed calibration.

54. D — The hook block frame is the primary structural path through which all suspended load is transferred from the hook-sheave system to the load line. A crack at a frame weld connection in this path is a fatigue failure in progress — perpendicular to the weld axis means the crack is advancing through the weld's throat. Fatigue cracks in this location can advance to complete fracture under the next single loading cycle without any further visible warning signs.

55. D — Post-installation functional testing is specifically required after any ATB system repair or replacement to confirm the system activates correctly under real conditions. Correct OEM components and qualified technician installation confirm the parts and procedures were right — but installation errors (reversed wiring, misrouted cable, wrong switch arm position) can prevent function even with correct components. The absence of a post-installation test means the ATB may never have been confirmed functional after the kit was installed.

56. C — ASME B30.9 specifies removal when outer wire diameter reduction exceeds 1/3 of the original wire diameter. A wire reduced to 2/3 of its original diameter has lost approximately 56% of its cross-sectional area — more than half of its tensile capacity at that wire's contribution. The cumulative effect across multiple wires in a section can dramatically reduce the sling's overall tensile capacity below its WLL. This criterion applies to all sling hitch configurations including basket hitch.

57. B — A circumferential crack in a swaged socket barrel indicates fatigue fracture progressing through the material that maintains the mechanical grip on the rope. Even at 30% of the circumference, the remaining 70% must carry the entire sling load — and each loading cycle advances the crack further around the circumference. Swaged socket failure is sudden and complete when the crack reaches a critical length. No monitoring or reduced-capacity use is authorized for any crack in this connection.

58. A — Frequent inspections are daily or pre-shift visual checks that operators can perform — they catch obvious hazards like fluid leaks, visible rope damage, missing guards, and failed safety devices. Periodic inspections require a qualified inspector and include measurements, dimensional assessments, and evaluation of components not fully visible during daily checks (worn sheave grooves, structural member condition, brake lining thickness). The distinction is important because frequent inspections cannot substitute for periodic inspections in detecting hidden or developing deficiencies.

59. D — The alternating bright/dull wire pattern indicates the sheave groove is too small — only the elevated wires at the peaks of each strand's geometry contact the groove surface, while the recessed wires between the peaks do not. This creates differential abrasion where only certain wires carry the contact stress. An undersized groove also creates higher contact pressure on the wires that do contact it, accelerating their wear rate. The sheave groove must be measured and corrected.

60. C — The manufacturer's interval "whichever comes first" means both triggers are independent requirements — either one hitting its limit triggers the required inspection. At 14 months, the 6-month calendar interval has been exceeded by 8 months. This exceeds the manufacturer's recommendation regardless of the hour count. ASME B30.5 and OSHA 1926.1412 require periodic inspections at intervals not exceeding the manufacturer's specification — the calendar trigger has been exceeded and inspection is overdue.

61. B — A rope's outer strands spreading to expose the core confirms the core has failed to maintain the strands in their designed geometry. The core's primary function is to keep the outer strands in position and prevent strand-to-strand contact. When the core fails, the outer strands sag inward and contact each other, creating inter-strand crushing forces on every load cycle. The apparent integrity of the visible core does not restore the rope's designed geometry or the designed load distribution.

62. D — Field welds on primary structural boom members require evaluation against the applicable welding standard — AWS D1.1 or the crane manufacturer's specification — to confirm adequate penetration, correct filler metal, preheat compliance, and weld geometry. A field weld that appears sound externally can have zero-fusion at the root, porosity throughout, or incorrect metallurgical properties that make it susceptible to fatigue failure at stresses well below the original design. Documentation absence confirms no approved procedure was followed.

63. A — Persistent corkscrew twist throughout a rope indicates accumulated torsional loading beyond the rope's elastic recovery — the twist has become permanent deformation. This occurs when the rope is installed in the wrong lay direction for the drum's winding direction, or when a seized swivel accumulates twist over many cycles. Accumulated twist unequally loads the rope's strands — the high side of the twist carries more load than the low side — reducing the rope's effective tensile capacity below its rated breaking strength.

64. C — ASME B30.26 requires every below-the-hook lifting device to be permanently marked with the manufacturer's name or mark, the rated WLL for the applicable configuration, and any geometry or angle limitations. These markings allow the user to confirm the device is adequate for the planned lift and to understand the configuration conditions under which the WLL applies. Missing or illegible markings cannot be reconstructed from memory or estimated from the device's appearance.

65. B — H₂S at 50 ppm is above the OSHA action level of 10 ppm, requiring respiratory protection for all exposed workers. H₂S is denser than air and can accumulate in the crane cab at the same or higher concentration as the ambient reading. An operator working in a confined cab space without respiratory protection faces the same or higher exposure as ground-level workers. Operations cannot begin until respiratory protection is confirmed for all exposed personnel including the crane operator.

66. D — A permanent set — one end measurably longer than the other — means core yarns on one side have been loaded beyond their elastic limit and have permanently elongated. These permanently elongated yarns have reduced remaining tensile capacity and cannot carry their original share of the load. The unequal length also creates geometric imbalance when the sling is used in a multi-leg configuration, potentially overloading the shorter-side legs. ASME B30.9's deformation removal criteria apply.

67. A — Milky white hydraulic oil is the classic visual indicator of water contamination — water has entered the system and emulsified with the oil to create the opaque white emulsion. Water contamination reduces the oil's lubricating and anti-wear properties, promotes corrosion throughout the hydraulic circuit, and can cause catastrophic pump cavitation when cold water expands to steam in hot oil or freezes in cold conditions. The crane must be taken out of service immediately.

68. D — Master link WLL ratings are established for in-line tension loading through the link's bore — the standard condition where the load hangs directly through the center of the link. A choker hitch applies bending forces across the link body rather than pure tension through the bore. The choker configuration's reduced WLL must be obtained from the manufacturer or applicable standard before use. The 18-ton load may or may not be within the choker hitch rating — this cannot be assumed from the 28-ton vertical hitch rating.

69. B — The dead-end section at the drum is the last section of rope to pay off the drum at maximum extension — it is loaded when the crane is at maximum boom extension and minimum hook height. Corrosion pitting at this location reduces wire cross-section and creates stress concentrations at each pit. The section's location on the drum also means it receives less frequent lubrication than the traveling section of rope. The pitting must be assessed against diameter reduction and section loss criteria.

70. D — Every crane configuration is independent — the load chart section, LMI configuration, and all setup parameters for the new boom length must be verified before the first lift. A different boom length requires a different load chart section, changes the LMI's capacity calculation, and requires physical confirmation that the new boom length is correctly assembled. The previous configuration's confirmed parameters provide no information about the new configuration's setup.

71. B — Conservative approach: the next larger tabulated radius beyond 31 feet = 35 feet, capacity = 27,200 lbs. Total suspended weight = 2,100 + 480 + 140 + 28,000 = 30,720 lbs. Since 30,720 lbs exceeds 27,200 lbs by 3,520 lbs, the lift cannot proceed using the conservative approach. The operator must either reduce the total suspended weight or reposition the crane to 30 feet or less where 34,800 lbs governs.

72. A — The note states the hook block (1,800 lbs) is pre-deducted from the tabulated capacity — the 26,400-lb value is available for everything else: additional rigging plus payload. Additional rigging = 1,200 lbs; payload = 23,600 lbs; total = 24,800 lbs. Since 24,800 lbs is within 26,400 lbs, the lift proceeds. The pre-deducted block weight does not need to be deducted again — it was already removed from the gross capacity to produce the 26,400-lb tabulated value.

73. B — The conservative governing capacity comes from the 30-foot structural-limited cell, meaning structural-limited operational precautions apply regardless of the fact that the actual lift radius is in the stability-limited zone. Smooth movements, no rapid acceleration or deceleration, no simultaneous multi-function operation, and no abrupt direction changes are all required because the crane's governing structural members are near their design stress limits at the conservative capacity value.

74. D — Conservative approach: next larger tabulated radius beyond 38 feet = 40 feet, capacity = 34,600 lbs. Total suspended weight = 38,000 lbs. Since 38,000 lbs exceeds 34,600 lbs by 3,400 lbs, the lift cannot proceed using the conservative approach. The operator must either reduce the total suspended weight to below 34,600 lbs or reposition the crane to 35 feet or less where the 42,800-lb tabulated capacity directly supports the 38,000-lb load.

75. A — Operating radius is measured from the crane's center of rotation to the center of the suspended load. Using the front of the carrier as the reference underestimates the actual operating radius by 12 feet. A planned 28-foot radius is actually 40 feet — and the capacity at 40 feet is substantially lower than at 28 feet. All capacity calculations must be recalculated using the correct reference point. The note explicitly voids the section's applicability for any other reference point.

76. C — Interpolation from 35 to 40 feet: drop per foot = $(27,200 - 21,200) \div 5 = 6,000 \div 5 = 1,200$ lbs/ft. At 37 ft (2 ft beyond 35 ft): $27,200 - (2 \times 1,200) = 27,200 - 2,400 = 24,800$ lbs. Lift percentage = $24,600 \div 24,800 \times 100 = 99.2\%$. The lift proceeds within the interpolated capacity by only 200 lbs — an extremely thin margin that requires exceptional radius management throughout all phases.

77. B — A single capacity table covering a wide boom length range was derived for the worst-case configuration in that range — typically the longest boom, which produces the greatest structural loading for the same load moment. Using these values for an 85-foot boom is conservative relative to the specified worst case, but may not represent the actual maximum capacity available at 85 feet. The operator should confirm the section's derivation basis from its notes or the manufacturer to ensure correct application.

78. D — Conservative approach: next larger tabulated radius beyond 43 feet = 45 feet, capacity = 17,800 lbs. Total suspended weight = 19,200 lbs. Lift percentage = 107.9% — the load exceeds the conservative capacity. The lift cannot proceed at 43 feet using the conservative approach. Repositioning to 40 feet or less, or reducing total suspended weight below 17,800 lbs, are the two compliant options.

79. A — The note establishes contacting the manufacturer as a binding condition before operations below 0°F. At -8°F, the temperature threshold is clearly exceeded. Cold temperatures affect hydraulic fluid viscosity, seal elasticity, brake function, and potentially steel toughness — all in ways that can reduce the crane's effective operational capacity below what the standard-condition values reflect. The manufacturer's specific guidance for this crane at sub-zero temperatures is required before any lifting.

80. A — The set location is at 22 degrees right of front center — 2 degrees outside the over-front sector boundary. The load must swing through and be set in the all-directions zone. The all-directions capacity

(36,400 lbs) applies throughout the swing once the boom exits the over-front sector and at the set location. The total suspended weight must remain within 36,400 lbs for the entire lift because the load must be set in the all-directions zone where the lower capacity governs.

81. B — The note establishes 80 fpm as the speed threshold above which a 7% dynamic load factor must be applied to the total suspended weight before comparing to tabulated capacity. At 110 fpm, the threshold is exceeded: effective weight = $26,000 \times 1.07 = 27,820$ lbs. The tabulated capacity must exceed 27,820 lbs — not just 26,000 lbs — to confirm the lift is within rated capacity at this hoist speed.

82. C — The load chart section must match the actual physical crane configuration. The main boom section (without jib) applies when only the main boom is installed. Using jib section values when no jib is physically installed applies capacity values derived for different structural geometry and tip loading conditions. The jib's weight at the boom tip and its suspension geometry affect the boom's structural loading — without the jib, these effects are absent and the main boom section applies.

83. C — Interpolation from 35 to 40 feet: drop per foot = $(29,000 - 22,600) \div 5 = 6,400 \div 5 = 1,280$ lbs/ft. At 38 ft (3 ft beyond 35 ft): $29,000 - (3 \times 1,280) = 29,000 - 3,840 = 25,160$ lbs. Total suspended weight = 25,400 lbs. Since 25,400 lbs exceeds 25,160 lbs by 240 lbs, the lift cannot proceed using interpolated capacity. The conservative approach at 40 ft (22,600 lbs) also cannot support 25,400 lbs. The operator must reduce the load or reposition.

84. C — Two different printings of the same load chart showing different capacities at the same configuration creates a fundamental uncertainty about which value is correct. The lower value may still be wrong — both values may be wrong. Choosing the lower value provides false confidence in a document whose accuracy is in question. The manufacturer must identify the current, correct value before either document can be relied upon for capacity confirmation.

85. B — The note specifies "12-inch-thick concrete pad or equivalent engineered surface" and explicitly states that "soil alone — even with mats — voids this section." Four-inch timber mats on native soil fall exactly within the voiding condition described. The note does not define "equivalent engineered surface," but the explicit exclusion of "mats alone" makes clear that the note requires a structural surface above the soil that provides load distribution and structural integrity beyond what mats alone provide.

86. D — The maximum rated capacity note establishes an absolute ceiling of 120,000 lbs that applies to the entire crane regardless of what any individual configuration section shows. The structural analysis of specific components may support 124,000 lbs in a particular geometry, but the crane as a whole system

— including all components, safety devices, and structural interactions — was rated at 120,000 lbs maximum. The overall maximum supersedes configuration-specific values that exceed it.

87. A — Conservative approach: next larger tabulated radius beyond 22 feet = 25 feet, capacity = 44,400 lbs. Total suspended weight = 52,000 lbs. Since 52,000 lbs exceeds 44,400 lbs by 7,600 lbs, the lift cannot proceed using the conservative approach. The operator must reduce the total suspended weight to below 44,400 lbs or reposition to 20 feet or less where the 56,000-lb tabulated capacity directly supports the load.

88. C — The note establishes manufacturer contact as a binding requirement for operations above 5,000 feet elevation. At 5,800 feet, the threshold is clearly exceeded. Reduced atmospheric pressure at altitude reduces engine output, affects hydraulic pump performance, and may affect structural analysis assumptions made at sea level. The note acknowledges these altitude-dependent effects by requiring manufacturer-specific guidance — a default derating estimate does not satisfy this specific note.

89. A — The 14,000-lb counterweight section's capacity (22,400 lbs) cannot support the planned 26,000-lb total suspended weight. The 18,000-lb counterweight section (28,600 lbs) does support it. Since the crane has only 14,000 lbs of counterweight installed, it cannot currently use the 18,000-lb section. The operator must either install the 18,000-lb counterweight before the lift or reduce the total suspended weight to below 22,400 lbs.

90. D — Conservative approach: next larger tabulated radius beyond 43 feet = 45 feet, capacity = 66,400 lbs. Total suspended weight = 72,000 lbs. Lift percentage = 108.4% — the load exceeds the conservative capacity. The lift cannot proceed at 43 feet using the conservative approach. Reducing the total suspended weight to below 66,400 lbs or repositioning to 40 feet or less where the 82,000-lb capacity directly supports the load are the two compliant options.

91. A — The note's ± 1 -foot tolerance is an explicit binding condition — the note directly states that using this section for a boom length outside this tolerance voids its applicability. A 2-foot discrepancy exceeds the ± 1 -foot stated tolerance. The operator must use the 97-foot, 98-foot, or 99-foot section if available, adjust the boom to exactly 100 feet, or contact the manufacturer for guidance. The note's tolerance cannot be exceeded by any amount without voiding the section.

92. C — Interpolation from 40 to 45 feet: drop per foot = $(22,000 - 17,200) \div 5 = 4,800 \div 5 = 960$ lbs/ft. At 43 ft (3 ft beyond 40 ft): $22,000 - (3 \times 960) = 22,000 - 2,880 = 19,120$ lbs. The concave upward curve means linear interpolation gives a result slightly below the actual curve — making the

interpolation slightly conservative. The true capacity is slightly higher than 19,120 lbs, but 19,120 lbs is the working value since the exact curve value is unavailable.

93. C — The load must swing through and be set in the all-directions zone — 40 degrees outside the rear sector. The all-directions capacity at the same radius applies during this transit and at the set location. At 112% of the all-directions capacity, the crane exceeds its rated capacity during the swing to the set location regardless of the adequate over-rear sector capacity during transit. The lift must be redesigned to either reduce the load or avoid the all-directions zone.

94. A — The 80-foot boom is the installed configuration — the 80-foot section (26,800 lbs) is the applicable section. Lift percentage = $24,800 \div 26,800 \times 100 = 92.5\%$. This exceeds the 75% critical lift threshold, requiring a written critical lift plan and pre-lift meeting. The structural-limited classification requires all crane movements to be exceptionally smooth. The 100-foot boom section does not govern this lift — the matching section for the installed configuration is always the applicable section.

95. A — Conservative approach: next larger tabulated radius beyond 32 feet = 35 feet, capacity = 30,400 lbs. Total suspended weight = 34,400 lbs. Lift percentage = 113.2% — the load exceeds the conservative capacity by 13.2%. None of the 10 planned lifts can proceed at 32 feet using the conservative approach. The operator must either reduce the total suspended weight to below 30,400 lbs or reposition the crane to 30 feet or less where the 38,200-lb capacity directly supports all 10 planned lifts.

Specialty Exam Simulation 13 – 65 Questions

SITE DOMAIN — Questions 1–15

1. A crane operator is evaluating a setup location at a pharmaceutical manufacturing facility. The site plan shows the planned outrigger zone sits above a network of process utility tunnels — narrow concrete-lined passageways approximately 3 feet wide and 4 feet tall, running at 8 feet of depth beneath the planned right outrigger spread. The maximum outrigger reaction load is 78,000 lbs and the outrigger float is 2.5 sq ft. What must happen before setup?

A. Concrete-lined utility tunnels at 8 feet of depth are always adequate for surface crane loading

B. A 3 × 4 foot utility tunnel is too small to be structurally affected by surface crane loading

C. Place maximum-size cribbing over the tunnel locations to bridge across the tunnel roof

D. Bearing pressure = $78,000 \div 2.5 = 31,200$ psf; the tunnel roof structure must be evaluated by a structural engineer to confirm it can carry both the existing soil overburden and the concentrated

outrigger point load; utility tunnels are not designed for crane outrigger point loads and the concentrated load far exceeds typical tunnel design parameters

2. A crane is set up at a construction site when the project contractor begins saw-cutting concrete pavement 28 feet from the crane's right rear outrigger position. The saw creates significant ground vibration and generates water flow from the blade cooling system that runs toward the crane's outrigger zone. What concerns does the saw-cutting create?

A. Nothing — saw-cutting at 28 feet is outside the standard zone of concern for crane operations

B. The saw-cutting creates two simultaneous concerns — vibration from the saw can cause progressive settlement in the outrigger bearing soil and the cooling water flowing toward the outrigger zone can saturate and soften the bearing soil; both effects require monitoring; if level change is observed or water reaches the mat positions, operations must stop for re-evaluation

C. Only the water flow creates a concern — vibration from concrete saw-cutting does not affect bearing conditions

D. The saw must be stopped before any crane lifts can proceed since vibration always voids bearing capacity assessments

3. Under OSHA 1926.1402, when the crane employer identifies that the controlling entity has provided incorrect ground condition documentation — the documented 4,500 psf bearing capacity is found to be based on testing performed at a different location 200 feet away — what is the crane employer's obligation?

A. The crane employer may accept the documentation if the site soils appear similar to the tested location

B. The 200-foot distance is within normal geotechnical sampling tolerance — the documentation remains valid

C. The crane employer must stop operations and work with the controlling entity to obtain accurate ground condition documentation for the specific setup location — ground conditions at one point do not reliably represent conditions 200 feet away; bearing capacity can vary dramatically over short distances; the incorrectly applied documentation cannot be used to confirm the outrigger positions are adequate

D. The crane employer must self-test the soil and replace the controlling entity's documentation with their own results

4. A crane is set up at a manufacturing facility when a steam pipe in the mechanical room below the concrete floor of the setup area ruptures. Steam is venting through a floor drain adjacent to the right front outrigger position. What specific concern does steam venting through the floor near an outrigger create?

A. Steam discharged from a floor drain adjacent to an outrigger indicates high-pressure steam may be saturating the soil under the slab from below — steam condensate can rapidly saturate and weaken the subbase; additionally, the steam pressure itself can create voids under the slab as it escapes; operations must stop until the steam is controlled and the slab's subbase condition is confirmed; any thermal weakening of the concrete at the outrigger position must also be evaluated

B. Steam venting is an environmental concern only — no structural concern applies to crane operations

C. Continue operations while the facility shuts down the steam system as an emergency

D. Sound the crane horn to warn personnel and reduce all lifts to 75% until the steam source is controlled

5. A crane operator is evaluating a setup location at a port facility where the surface is reinforced concrete over a tidal zone structure — the concrete deck is supported on steel piles driven into the sea bed, with water visible beneath the grating areas. The crane's maximum outrigger reaction load is 112,000 lbs. The facility manager confirms the deck is "rated for container handling equipment." What specific assessment is still required?

A. Container handling equipment rating always equals or exceeds crane outrigger loading — no additional assessment needed

B. The "rated for container handling" designation covers all construction crane operations on the deck

C. The pile support system must be confirmed adequate for the crane's specific operation, but the deck surface can be used directly without further review

D. The deck's structural rating for container handling equipment must be compared to the crane's specific concentrated outrigger reaction loads — container handling rating reflects distributed wheel loads from straddle carriers or RTG cranes, not concentrated point loads from crane outrigger floats; a structural engineer must confirm the deck structure and pile connections can resist the specific 112,000-lb outrigger point loads at the planned positions

6. A crane is operating on a construction site when the operator observes that the soil adjacent to the left front outrigger pad has developed a visible bulge — a raised area approximately 4 inches high by 18 inches in diameter directly adjacent to the loaded mat edge. The bulge appeared during the current shift. What must the operator do?

- A. Nothing — minor soil surface displacement adjacent to outrigger mats is normal for loaded crane operations
- B. Stop all crane operations immediately — a soil bulge forming adjacent to a loaded outrigger mat during an active shift is a visible sign of bearing capacity failure in progress; the loaded soil is being pushed laterally outward and upward as it approaches its shear capacity; continued loading will complete the failure; the load must be lowered and all outrigger conditions confirmed before any further operations
- C. Reduce the current lift load to 75% to reduce the outrigger pressure causing the bulge
- D. Contact the lift director and await authorization before deciding how to respond to the observed bulge

7. Under OSHA 1926.1402, what documentation is the controlling entity specifically required to provide the crane employer before crane operations begin on a new project?

- A. A complete site survey showing all buildings and structures within 500 feet of the crane's planned location
- B. The project's environmental impact assessment and soil contamination records from any prior site remediation
- C. Information about ground conditions in the setup area including surface and subsurface conditions, the location and nature of underground utilities in the work area, and any other site characteristics that could affect safe crane operations — this information must be sufficient for the crane employer to confirm setup positions are safe before operations begin
- D. A letter from a licensed geotechnical engineer confirming the site is suitable for crane operations

8. A crane is set up at a site where the controlling entity has confirmed 3,800 psf bearing capacity from a recent geotechnical report. The crane's outrigger reaction load is 76,000 lbs and the outrigger float is 24 × 24 inches (4 sq ft). What is the bearing pressure and how much margin exists?

- A. Bearing pressure = $76,000 \div 4 = 19,000$ psf; this significantly exceeds the 3,800 psf confirmed capacity — the mat must be enlarged so the combined mat-and-cribbing contact area is at least $76,000 \div 3,800 = 20$ sq ft (approximately a 4.5 × 4.5 ft mat minimum) before the outrigger can be loaded
- B. The 19,000 psf bearing pressure from the float is acceptable since the mat distributes it further
- C. Bearing pressure at the float = 19,000 psf; however, since the mat is larger than the float, the actual bearing pressure at the soil surface is lower than this — no calculation is needed beyond confirming the mat area

D. Nothing — the geotechnical report's 3,800 psf applies to the mat contact area, not the float area

9. A crane operator is performing a site walk at a new project when they discover that the area designated for crane setup was previously occupied by a building that was demolished 18 months ago. All visible debris has been removed, but the original building had a basement — the basement was filled with crushed concrete rubble during demolition. What concern does this site history create?

A. Crushed concrete rubble is a high-quality fill material and provides excellent bearing capacity for crane operations

B. Nothing — 18 months of settlement is sufficient to confirm demolition rubble is stable for crane use

C. Nothing — crushed concrete rubble from a building demolition is classified as inert fill

D. Demolition rubble backfill placed without engineered compaction has unknown and highly variable bearing capacity — the rubble pieces can shift and settle under concentrated loads; voids between the irregular rubble pieces can collapse suddenly; without compaction testing confirming the rubble fill meets required bearing capacity, no crane outrigger loading is authorized in this zone; geotechnical evaluation is required

10. A crane is set up on a barge for a marine construction project. The barge has been loaded with the crane and materials in a specific arrangement designed by the marine contractor's stability engineer. During crane operations, the contractor's deck crew begins moving heavy material bundles from the bow to the stern without notifying the crane operator. What concern does this unauthorized material repositioning create?

A. Nothing — deck crew repositioning is routine marine operations that do not affect crane operations

B. Unauthorized material repositioning changes the barge's load distribution from the stability-engineered arrangement — this changes the barge's trim and list, potentially moving the crane outside its manufacturer's operating slope tolerance; any change to the barge's load distribution during crane operations must be evaluated by the stability engineer or the crane must stop operations until the stability of the revised arrangement is confirmed

C. The crane operator has sole authority over all weight distribution during crane operations

D. The barge's buoyancy provides adequate safety margin for any material repositioning during crane operations

11. A crane is set up at a job site where the operator confirms the right front outrigger mat is positioned directly adjacent to a header drain inlet — a 12 × 12-inch cast iron grate inlet that leads to the storm drainage system. The mat's edge is 4 inches from the drain grate. What concern does proximity to the drain inlet create?

A. Nothing — header drains are structural elements designed for vehicle loading and outrigger proximity creates no concern

B. Nothing — the mat is not over the drain; 4-inch clearance is adequate for any outrigger loading

C. The mat's edge loading adjacent to a drain inlet can concentrate stress at the drain connection — if the mat edge contacts the grate under load, the concentrated edge load can fracture the cast iron grate or collapse the drain connection into the drainage structure; additionally, the drain represents a void directly adjacent to the outrigger's bearing zone; the mat must be positioned to ensure no load is transferred through the grate

D. The drain inlet only creates a flooding concern if rainfall occurs during crane operations

12. A crane operator is evaluating a setup location at a hospital project when the facility's engineering department informs the operator that the planned left outrigger spread is directly above an underground liquid oxygen storage vault — a below-grade reinforced concrete vault containing LOX dewars operating at extremely low temperatures. What must happen before any setup proceeds?

A. The structural engineer of record for the LOX vault must confirm the vault's roof structure can resist the crane's concentrated outrigger loads — LOX vaults are designed for specific equipment loads and environmental requirements; additionally, any structural movement or cracking of the vault under crane loading could compromise the LOX containment system; the life safety implications of an LOX release make this evaluation mandatory regardless of the vault's apparent structural robustness

B. Nothing — LOX vaults are heavily engineered structures that can support any adjacent crane operation

C. The LOX system must be emptied before crane operations can begin above the vault

D. Notify the fire marshal before any crane operations adjacent to LOX storage systems

13. A crane operator is performing a site walk when they find that the planned left outrigger zone is within a recently certified "clean zone" on a contaminated site — a zone that has been remediated, tested, and certified by an environmental engineer as meeting clean closure standards. The remediation involved excavating to 10 feet of depth and replacing with certified clean fill. No compaction testing is documented. What must be confirmed?

- A. The certified clean zone documentation satisfies all ground condition requirements for crane setup
- B. Nothing — environmental certification confirms both the soil chemistry and its physical bearing capacity
- C. The clean zone certification confirms the soil meets environmental standards but says nothing about bearing capacity — environmental certification and geotechnical bearing capacity are entirely separate assessments; certified clean fill placed without compaction testing has unknown and potentially very low bearing capacity; compaction verification is required before crane outrigger loading in the remediated zone regardless of the environmental closure status
- D. Certified clean fill placed as part of an EPA-supervised remediation always meets crane bearing capacity requirements

14. A crane is set up at a job site adjacent to a river when the river authority issues a "high water advisory" — the river level is forecast to rise 3 feet over the next 6 hours due to upstream dam releases. The crane's right outrigger spread is 40 feet from the current river bank. What must the operator assess?

- A. Nothing — 40-foot setback from a river bank provides adequate protection from any water level rise
- B. A 3-foot river rise over 6 hours at a location 40 feet from the bank requires assessment of whether the rising water will reach the outrigger zone through lateral bank seepage or by direct flooding — rising river levels increase lateral seepage through the riverbank soil, potentially saturating the crane's bearing zone before the water surface reaches the mat positions; operations should be suspended until the river authority can confirm the forecast rise will not affect conditions at the crane setup
- C. The advisory is forecast only — wait for confirmed rising water before stopping operations
- D. Contact the river authority to request the dam releases be delayed until the crane's lift program is complete

15. A crane operator is informed that the setup area at a military installation contains unexploded ordnance (UXO) risk based on a historical use assessment — the area was used for artillery training 60 years ago. The facility's UXO office has cleared the top 18 inches of soil but states "deeper clearance was not performed." What must happen before crane setup?

- A. Nothing — surface clearance to 18 inches covers any depth that crane outrigger loading could affect
- B. Nothing — 60-year-old UXO is inert and no longer poses detonation risk
- C. Nothing — the UXO office's clearance constitutes authority to proceed with all surface operations

D. Crane setup must not proceed — outrigger loading creates significant stress at depth well beyond 18 inches; if UXO exists at depths beyond 18 inches, the crane's loading could detonate it; the crane employer must work with the facility's UXO office to establish the depth of the crane's stress influence and confirm that UXO clearance extends to that depth before any setup proceeds in this area

OPERATIONS DOMAIN — Questions 16–30

16. A crane operator is performing a lift at 84% of rated capacity when the lift director asks the operator to hold the load at 20 feet of height while structural workers install a temporary connection. After 18 minutes of holding, the lift director advises the structural connection will take an additional 45 minutes. What must the operator assess regarding an extended hold?

A. The operator must assess whether the crane's fuel level, hydraulic oil temperature, and ATB system can maintain the hold without degradation for the additional 45 minutes — an extended 63-minute total hold at 84% requires the operator to confirm the crane's operating systems will remain stable; the fuel level must be adequate, the hydraulic temperature must remain in the normal range throughout the extended hold, and the operator must remain at the controls; if any system parameter approaches a warning threshold, the lift director must be informed immediately

B. Nothing — 63-minute holds are within normal crane operational practice; continue the hold as directed

C. The maximum hold time under ASME B30.5 is 30 minutes — lower the load after the 30-minute limit

D. Lower the load after 30 minutes and re-pick when the connection is ready

17. A crane operator is performing a lift when the signal person is communicating using standard ASME B30.5 hand signals. The operator observes that the signal person has a small American flag in their signaling hand — they are holding the flag while giving hand signals, which slightly changes the appearance of each signal due to the flag's movement. What must the operator do?

A. Continue accepting signals since the underlying hand position is still identifiable despite the flag

B. Nothing — a signal person is always authorized to use props during signaling as long as the underlying signal is visible

C. Nothing — the signal person's professional experience authorizes modifications to standard signal presentation

D. Stop the crane and request the signal person put down the flag or switch to an alternative communication method — hand signals must be clearly distinguishable and unambiguous; any object in the signaling hand that changes a signal's appearance creates the risk of signal misinterpretation; this is especially dangerous with the EMERGENCY STOP and STOP signals; the signal person must be able to give each standard signal in its standard form without any visual interference

18. A crane operator is performing a personnel hoisting operation when one of the workers in the platform begins performing a task that requires them to lean over the platform railing — their upper body extends over the railing but their feet remain on the platform floor. The platform is at 40 feet of height. What is the operator's required response?

A. Continue the operation and alert the lift director to the worker's positioning by radio

B. Stop all crane movement immediately and instruct the worker to return fully within the platform before any crane movement resumes — a worker leaning over the railing has changed the platform's effective CG and is no longer fully protected by the platform's fall prevention design; any unexpected platform movement with the worker in this position creates fall risk; the worker must be fully inside the platform before any crane movement proceeds

C. Nothing — workers in elevated platforms are responsible for their own positioning

D. Lower the platform 5 feet to reduce the fall consequence and continue operations

19. A crane is performing a lift at 88% of rated capacity when the operator receives a radio message from the rigger: "The load has an additional attachment point we didn't plan for — there's a structural bracket on the load that's in contact with the adjacent structure." The load is at 3 feet of height just after the initial pick. What is the concern and what must the operator do?

A. Nothing — minor contact between a newly-lifted load and adjacent structure is normal during the initial pick

B. The contact indicates the load may be still resting on or connected to the adjacent structure — the crane may be side-pulling rather than making a free vertical lift; continue the hoist slowly to break the contact

C. Lower the load back to the ground immediately — contact between the load and an adjacent structure during initial hoist indicates the load is not in a free-vertical-lift condition; the crane may be exerting a horizontal force component on both the load and the adjacent structure; the contact point creates an unknown lateral load on the boom; the load must be returned to the ground and the contact situation resolved before re-picking

D. Boom up to change the load angle and break the contact with the structure

20. A crane operator is asked to perform a lift that requires the load to pass over a generator that is fueling construction site power. The generator is running and the load would pass 3 feet above the generator's exhaust stack. What must be confirmed before this lift?

A. The generator must be shut down before the load passes above it — a generator's exhaust stack can reach 800°F-plus; a load passing 3 feet above is at risk of thermal damage to rigging materials; additionally, if the load contacts the exhaust stack or generator housing, it can rupture the fuel system, creating an immediate fire hazard; the generator must be confirmed off and cooled before any load travels above it

B. Nothing — 3 feet of clearance above an operating generator is within standard crane operation clearance

C. The signal person must confirm 3-foot clearance throughout the pass and then the lift may proceed

D. Reduce the load speed to minimum when passing above the generator to minimize contact risk

21. Under OSHA 1926.1416(c), when is a crane operator permitted to leave the crane cab with a load suspended at height?

A. The operator may leave the cab when the drum pawl is engaged and a qualified signal person is watching the load

B. The operator may leave the cab during scheduled breaks as long as the load is below 25 feet of height

C. The operator may leave the cab if the lift director grants authorization for emergency situations

D. A crane operator may never leave the crane cab with a load suspended — OSHA 1926.1416(c) requires the operator to remain at the controls at all times while a load is suspended; there are no authorized exceptions for any reason; the load must be lowered to a stable surface before the operator leaves the controls

22. A crane operator is performing a series of 8 identical repetitive lifts when, on the 5th lift, the operator notices the operating radius is 1 foot greater than the 4 previous lifts — the crane has drifted slightly from its original position. The difference was not noticed until the load was at 6 feet of height. The original confirmations were at 82% of rated capacity. What must the operator do?

A. Nothing — a 1-foot radius difference is within normal operational variation for repetitive lift operations

B. Stop the hoist, hold the load, and verify the capacity at the actual 1-foot-greater radius before continuing — even a 1-foot radius increase can represent a meaningful capacity decrease; if the operator was at 82% at the original radius, the 1-foot increase may push the capacity percentage higher; the load chart must be consulted for the new actual radius before proceeding

C. Continue the lift since the radius increase is minor and within LMI measurement tolerance

D. Contact the lift director and await their authorization before deciding whether to lower the load

23. A crane operator is performing a lift when the load — a large prefabricated roof truss — begins to oscillate with increasing amplitude during a slow swing movement. The oscillation is growing on each swing cycle rather than dampening. What specific action must the operator take?

A. Increase the swing speed to change the frequency of the pendulum and disrupt the oscillation

B. Nothing — load oscillation during swing is normal and always dampens when the swing stops

C. Stop the swing immediately and hold until the oscillation amplitude decreases — increasing oscillation amplitude indicates resonance: energy is being added to the pendulum system rather than removed on each cycle; if left unchecked, resonance-driven oscillation can increase to amplitudes where the load contacts adjacent structures or where the rigging is loaded dynamically beyond its rated capacity; only stopping the energy input allows the oscillation to decay

D. Use the hoist function to change the pendulum length and disrupt the resonance condition

24. A crane operator is performing a lift when the load's rigging includes a spreader beam — the main hook block is attached to the spreader beam, and slings hang from each end of the beam to the load's lifting lugs. During the initial pick, the operator notices one end of the spreader beam is 8 inches higher than the other — the beam is tilted 8 inches over its 14-foot span. What does this asymmetry indicate and what must be done?

A. Lower the load to the ground immediately — the spreader beam's tilt indicates the rigging attachment geometry is incorrect or the load's CG is not centered on the beam; an 8-inch tilt means one sling leg is significantly shorter than the other or the load attachment is offset; this asymmetric loading may overload the sling leg on the lower end; the rigging must be adjusted to achieve a level pick before re-hoisting

B. Continue the hoist — the beam will self-level as full suspension load is applied

C. An 8-inch tilt is within acceptable tolerance for spreader beams over 10-foot span

D. Adjust the main hook to the left to redistribute the load and level the beam during the hoist

25. A crane operator is completing a shift when the relief operator asks: "Are the outrigger mats properly positioned for the first lift of the next shift?" The outgoing operator has been using the same configuration for 6 lifts. What is the correct response?

- A. Confirm the mats are adequate since they have been used for 6 lifts without issue
- B. Nothing — the outgoing operator's confirmation is sufficient for the incoming operator to begin
- C. The incoming operator's shift started — they should independently confirm
- D. The incoming operator must independently verify the outrigger mat positions, ground conditions, crane level, and all configuration parameters as part of their pre-shift inspection before the first lift — the previous shift's successful operations confirm historical performance but do not substitute for the incoming operator's independent pre-operational verification; each operator bears personal responsibility for confirming conditions before their first lift

26. A crane operator is performing a precision placement when the load must be lowered into a 10-foot-deep shaft opening — the load dimensions leave 4 inches of clearance on each side during the descent. During the lowering, the signal person observes the load beginning to rotate counterclockwise. At 4 feet of descent into the shaft, the rotation reaches 15 degrees. What must the operator do?

- A. Nothing — 15 degrees of rotation during shaft lowering is within normal precision operation tolerance
- B. Stop the lowering immediately and raise the load back out of the shaft — at 15 degrees of rotation with only 4-inch clearance on each side, the rotating load's corners are sweeping an area that exceeds the available clearance; continuing the descent will result in the load contacting the shaft walls, potentially jamming, tilting, or dropping; the load must be raised and the rotation must be arrested with tag lines before re-entering the shaft
- C. Reduce lowering speed to minimum and allow the load to re-center in the shaft as it continues down
- D. Apply the swing brake to counteract the load's rotation through the crane structure

27. Under OSHA 1926.1419, when a signal person uses a STOP signal and the operator holds the load stationary, what is the specific requirement for the signal person before any new movement can be initiated?

- A. Nothing — the signal person may wait as long as needed and then give the next movement signal
- B. Nothing — a STOP followed by a new movement signal is standard procedure without any intermediate confirmation

C. Before initiating any new movement after a STOP, the signal person must confirm the load position, confirm the path is clear, and give a clear, unambiguous signal for the specific next intended movement — the STOP signal ends one command; resuming movement requires a positive new signal; the signal person cannot gesture vaguely or give a partial signal; the next signal must be clear, complete, and match the standard approved signals

D. The operator must independently confirm the area is clear before responding to any new signal after a STOP

28. A crane operator is performing a lift when a large piece of debris — a section of scaffolding frame — falls from the adjacent structure and lands 6 feet from the crane. The debris lands outside the crane's exclusion zone. No one is injured. The load is at 8 feet of height mid-swing. What is the required response?

A. Stop all crane movement immediately — a falling debris event from the adjacent structure indicates the structure may have additional unstable elements; completing the current swing could bring the crane's boom or load line in proximity to the debris source; personnel on the site may need to evacuate the area; the situation must be assessed before any crane movement continues

B. Continue the swing to the set location since the debris landed outside the exclusion zone

C. Sound the horn to warn personnel and continue the swing at minimum speed

D. Contact the lift director and await instructions before deciding whether to continue or stop

29. A crane is performing a pick-and-carry operation when the operator realizes the planned travel path will cross over an unmarked utility trench that was excavated that morning — a 3-foot-wide, 4-foot-deep trench crossing the travel path at a 45-degree angle, covered with plywood sheets by the excavation crew. What must the operator do before proceeding?

A. Proceed at minimum speed since the plywood covers provide adequate support for any crane travel

B. Nothing — plywood-covered trenches are a standard temporary construction condition for crane travel

C. Nothing — the trench is marked by the plywood covering and the angle of crossing reduces the effective load

D. Stop the pick-and-carry movement and assess the plywood covering's capacity before crossing — plywood placed over a trench by an excavation crew is not designed or rated for crane travel loads; the plywood's span, thickness, and connection to the trench edges must be confirmed adequate for the

crane's travel weight before the crossing; an improperly covered trench can collapse under the crane's weight

30. A crane operator is performing a lift at 91% of rated capacity when the operator's radio dies — the battery is depleted and the operator cannot receive communications. The load is at 8 feet of height during the hoist. The signal person is in visual contact with the operator. What must happen?

- A. Continue the lift using hand signals since the signal person is in visual contact and hand signals are an ASME-approved communication method
- B. Stop the hoist, hold the load, and resolve the communication issue before proceeding — hand signals may continue as the primary communication method if the signal person is in confirmed visual contact with the operator; however, the failed radio must be addressed to ensure emergency communication capability is maintained; if hand signals are the established primary method and both parties confirm readiness, hand-signal communication may continue; if radio was the primary method, the radio must be replaced before any movement proceeds
- C. Lower the load to the ground immediately since radio communication is required for all crane lifts
- D. The lift director must assign a secondary signal person before the lift can continue

TECHNICAL KNOWLEDGE DOMAIN — Questions 31–42

31. A crane inspector finds that a 3/4-inch diameter wire rope has a measured diameter of 0.691 inches at an inspection point. The original nominal diameter is 0.750 inches. What is the diameter reduction in fractions and does it meet the ASME B30.5 removal criterion?

- A. Nothing — the reduction must be expressed in 64ths before comparing to the removal criterion
- B. Nothing — the 0.059-inch reduction is below the 1/16-inch removal criterion for 3/4-inch rope
- C. Nothing — wire rope diameter must be measured at three points 120 degrees apart and averaged before applying the criterion
- D. Diameter reduction = $0.750 - 0.691 = 0.059$ inches; converting: $0.059 \times 64 \approx 3.8/64$ inch; the ASME B30.5 removal criterion for diameter reduction is 3/64 inch (0.047 inches) for most ropes including 3/4-inch diameter; the 0.059-inch reduction exceeds the 3/64-inch criterion; the rope must be removed from service

32. Under ASME B30.9, what is the required marking content for a synthetic web sling, and what action is required when the marking is partially illegible — specifically when the WLL is readable but the maximum basket hitch angle is not?

A. A sling with a partially illegible tag must be removed from service until a replacement tag with all required information is attached — the required markings include the manufacturer's name or mark, the sling type, the rated load capacity for each hitch configuration, and any applicable angle limitations; the maximum basket hitch angle is a required marking; if the operator cannot confirm the rated capacity at the planned configuration and angle, the sling cannot be safely used; partial legibility is not sufficient compliance

B. Nothing — if the WLL is readable, the sling may be used in any standard hitch configuration

C. Nothing — angle limitations are advisory; only the WLL is a required marking for synthetic web slings

D. The angle limitation can be estimated from the sling's construction — use the typical 30-degree minimum

33. A crane inspector is examining a wire rope and finds a section where the outer strands have developed a noticeable wavy or corrugated appearance — each strand undulates along its length rather than running straight. This is sometimes called "waviness" or "corkscrewing." What causes this and what action is required?

A. Strand waviness is caused by the rope being too long for the drum — trim the rope to remove the wavy section

B. Strand waviness is a normal break-in characteristic for new ropes and resolves after initial service

C. Nothing — strand waviness is caused by temporary overloading and returns to normal when load is removed

D. Strand waviness in wire rope indicates the rope has been permanently deformed — the strands have been displaced from their normal helical position by kinking, shock loading, or running over a too-small diameter sheave; the corrugated strands no longer carry load uniformly; the rope's effective tensile capacity is reduced because the strands are contributing unequally; the rope must be removed from service as a deformed rope

34. A rigger is preparing to use a two-leg wire rope bridle in a choker hitch on each leg for a 14,000-pound load. The slings are rated at 12,000 lbs WLL each in a vertical hitch. The choker hitch configuration reduces the WLL to 75% of the vertical hitch rating. The legs will be at 60 degrees from horizontal. What is the tension per leg and can the choker hitch at this angle support the load?

- A. Nothing — $2 \text{ legs} \times 12,000 \text{ lbs} = 24,000 \text{ lbs total}$; 14,000 lbs is well within capacity
- B. Choker hitch WLL per leg = $12,000 \times 0.75 = 9,000 \text{ lbs}$; tension per leg at $60^\circ = (14,000 \div 2) \times (1 \div \sin 60^\circ) = 7,000 \times 1.155 = 8,085 \text{ lbs}$; 8,085 lbs is within the 9,000-lb choker hitch WLL — the configuration is adequate
- C. Nothing — choker hitch capacity reduction only applies when the choker angle exceeds 90 degrees
- D. Choker hitch WLL per leg = 9,000 lbs; tension per leg = 8,085 lbs; 8,085 lbs is within 9,000 lbs; however, the crane must also confirm rigging point capacity before proceeding since the load's attachment hardware must match the confirmed configuration

35. A crane's annual inspection identifies that the boom hoist drum's groove depth has decreased by 40% from the original specification due to wear. The drum was originally grooved to 1/2 rope-diameter depth; the current depth is 30% of rope diameter. What does reduced drum groove depth indicate and what action is required?

- A. Nothing — drum groove depth reduction of less than 50% is within acceptable service tolerance
- B. Nothing — grooves self-renew during rope contact and will return to specification depth with use
- C. Reduced drum groove depth means the rope no longer fully seats in the groove — the groove provides the rope's lateral support and prevents the rope from shifting across the drum; with only 30% depth vs. the original 50%, the rope rides higher in the groove, reducing the support angle; this allows the rope to shift more easily during winding, creating cross-winding and rope-on-rope crushing in subsequent layers; the drum should be re-grooved or replaced
- D. The drum can continue in service until groove depth reaches 25% of rope diameter

36. A crane operator is reviewing the crane's documentation and discovers that the crane's hydraulic oil was analyzed 6 months ago and the analysis showed elevated iron particle count — three times the manufacturer's normal maximum. The analysis noted "increased wear debris — monitor closely." No corrective action was documented. What is the current status?

- A. A high iron particle count from 6 months ago with a "monitor closely" notation means the hydraulic system was experiencing elevated internal wear at that time — without documented follow-up analysis or corrective action, the wear condition has been continuing for 6 months without monitoring; the current iron particle count may be significantly higher; continued elevated wear can progress to component failure during operations; an immediate follow-up oil analysis is required to confirm the current wear status before near-capacity operations continue

B. Nothing — "monitor closely" notations do not require corrective action; continue monitoring at the next scheduled interval

C. The elevated particle count from 6 months ago resolved itself — no action is needed since the crane has operated without incident

D. Nothing — iron particle counts naturally vary and a single elevated reading does not require follow-up

37. A crane is operating when the operator observes that the counterweight has developed a visible crack in the concrete — a 3/4-inch-wide crack running diagonally across approximately 25% of the counterweight's cross-section. What concern does a cracked concrete counterweight create?

A. Nothing — concrete counterweights commonly develop surface cracks from thermal cycling; they do not affect the counterweight's mass

B. A concrete counterweight with a structural crack may gradually lose mass as the cracked section separates — this changes the crane's actual counterweight mass compared to what the load chart assumes; an unknown counterweight mass means the stability-limited capacity values in the load chart may no longer apply accurately; the counterweight must be evaluated and the mass confirmed before operations at stability-limited configurations; a 25% cross-section crack is a structural integrity concern that requires evaluation

C. The crack only requires action if the crane has been exceeding 90% of rated capacity

D. Apply epoxy injection to the crack and return to service after the epoxy cures

38. Under ASME B30.5, when a crane's wire rope is found to have 4 broken wires in one lay length and 3 additional broken wires in an adjacent lay length — a total of 7 broken wires in 2 lay lengths — does the rope meet the removal criterion?

A. Nothing — 7 total broken wires across 2 lay lengths is below the 10-per-lay-length criterion

B. The rope must be evaluated against both the within-one-lay-length criterion (10 broken wires) AND the distribution pattern — 4 broken wires in one lay length does not trigger removal; 3 in the adjacent lay length does not trigger removal individually; however, 7 broken wires in a 2-lay-length section is a concentration that indicates accelerated fatigue in that section; ASME B30.5 requires the inspector to evaluate the pattern rather than only counting in single lay lengths; depending on the rope's specific lay length, the distribution may trigger removal under a broader assessment

C. Nothing — 4 broken wires in one lay and 3 in the next both fall below the 10-wire threshold; the rope remains in service

D. The rope must be removed — 7 broken wires in 2 consecutive lay lengths indicates progressive fatigue concentration that will quickly reach the 10-wire threshold in a single lay length; the accelerating concentration pattern requires removal before reaching the absolute criterion

39. A crane inspector finds that the hook block's lower sheave — the one closest to the hook — has developed a visible flat spot approximately 1.5 inches long at the groove bottom. The flat spot appears polished and worn. What must be done?

A. Apply additional lubrication to the flat spot and monitor at weekly intervals

B. Nothing — 1.5-inch flat spots are within the acceptable wear tolerance for working sheaves

C. The sheave must be replaced — a flat spot on the sheave groove creates a periodic impact on the rope every time the flat zone contacts the moving rope; this repetitive bending and straightening at the impact point creates fatigue crack initiation in the wires at precisely those locations; the longer the flat spot has existed, the more fatigue has accumulated; the rope section that has been running over the flat spot must also be inspected for impact fatigue

D. Re-machine the sheave to restore the circular profile and inspect the rope before returning to service

40. A crane operator is reviewing the annual inspection report and finds that the slewing ring gear backlash was measured at 0.065 inches. The manufacturer's maximum is 0.060 inches. The measurement was recorded but no corrective action was documented. What is the status of the crane?

A. The crane must be removed from service until the slewing ring is repaired or the manufacturer confirms the 0.065-inch backlash is acceptable for this specific crane — the backlash exceeds the manufacturer's specified maximum; operating with excessive slewing ring backlash allows micro-movement of the upper works relative to the lower, creating shock loading at the ring gear mesh on each swing start; this accelerates ring gear and bolt fatigue; the crane cannot operate under the load chart values with a slewing ring outside specification

B. Nothing — the measurement is only 0.005 inches over the limit; this is within instrument measurement tolerance

C. Continue operations with a 10% capacity reduction to account for the slewing ring condition

D. Schedule slewing ring replacement at the next available maintenance window and continue operating

41. A crane's wire rope is being inspected when the inspector finds a section that has been bent around a radius smaller than the manufacturer's minimum bend radius — the rope shows a permanent set in the

bent configuration, maintaining a curved shape even when removed from tension. What action does ASME B30.5 require?

- A. Nothing — minor permanent set in a rope section does not constitute a removal condition
- B. Nothing — the rope's permanent set can be worked out by running it through the full hoist cycle repeatedly
- C. Nothing — permanent bending set is only a removal condition when accompanied by broken wires
- D. The rope must be removed from service — a rope that has been bent below minimum bend radius and has taken a permanent set has been subjected to plastic deformation; the bent section has permanently displaced wires and strands from their designed geometry; the stress concentrations remaining at the bend point are permanent; ASME B30.5 treats permanent bending deformation as a removal condition regardless of whether wire breaks are visible

42. A crane inspector examines a G80 alloy steel chain sling and finds that one link in the chain has an external notch — a V-shaped mark approximately 1/8 inch deep and 3/16 inch long on the outer surface of the link, appearing to be from contact with a sharp edge. What must be done with this sling?

- A. Nothing — a 1/8-inch deep surface notch is within the allowable wear tolerance for G80 chain links
- B. The sling must be removed from service — a V-shaped notch creates a stress concentration at the notch tip; under load, the concentrated stress at the notch's apex can be many times the nominal stress in the link; high-strength G80 alloy steel is susceptible to notch-initiated failure; the notch serves as a fatigue crack initiation point; ASME B30.9 lists notching and gouging as removal conditions for chain slings regardless of depth
- C. Monitor the notch at each use and remove from service when depth exceeds 3/16 inch
- D. Grind the notch smooth with a file to eliminate the stress concentration and return to service

MANUFACTURER LOAD CHARTS DOMAIN — Questions 43–65

43. A crane load chart shows: 100-foot boom, full outrigger extension, all-directions: 30 ft = 37,400 lbs; 35 ft = 29,600 lbs; 40 ft = 23,200 lbs. The planned operating radius is 33 feet. The hook block weighs 1,600 lbs, slings weigh 720 lbs, hardware weighs 180 lbs, and the payload weighs 25,400 lbs. Using the conservative approach, does the lift proceed and what is the lift percentage?

A. Nothing — conservative capacity at 35 ft = 29,600 lbs; total suspended weight = 1,600 + 720 + 180 + 25,400 = 27,900 lbs; 27,900 lbs is within 29,600 lbs; lift percentage = $27,900 \div 29,600 \times 100 = 94.3\%$ — lift proceeds; critical lift documentation required since 94.3% exceeds 75% threshold

B. Nothing — conservative capacity at 35 ft = 29,600 lbs; 27,900 lbs is within capacity; proceed without special documentation since the conservative approach provides adequate safety margin

C. Nothing — conservative capacity at 40 ft = 23,200 lbs; 27,900 lbs exceeds this — the lift cannot proceed using the conservative approach

D. Conservative capacity at 35 ft = 29,600 lbs; 27,900 lbs is within capacity; lift percentage = 94.3%; critical lift documentation is required; additionally, the conservative capacity governs because 33 ft is between 30 and 35 ft, so the next LARGER tabulated radius (35 ft) is the conservative governing value

44. A crane load chart note reads: "Before using any values in this section, confirm the crane's LMI is configured to match the physical configuration being used, including boom length, counterweight, and reeving parts of line." The LMI currently shows the configuration as "100 FT BOOM / STANDARD CW / 4-PART LINE." The actual crane has a 100-foot boom, maximum counterweight, and 4-part line. Does the LMI configuration match?

A. The LMI shows standard counterweight but the crane has maximum counterweight — the LMI configuration does not match the actual physical configuration; a standard counterweight LMI configuration shows higher capacity values at the same radius than the maximum counterweight configuration; with standard CW displayed, the LMI would show a higher percentage than the actual maximum CW configuration warrants; the LMI must be reconfigured to maximum counterweight before these capacity values are used

B. Nothing — the boom length and reeving match; counterweight designation does not affect LMI configuration

C. Nothing — the LMI automatically adjusts for counterweight changes without manual reconfiguration

D. Nothing — the LMI configuration difference is minor and within the normal operational adjustment range

45. A crane load chart for the on-outrigger full extension, all-directions section shows: 25 ft = 45,200 lbs; 30 ft = 36,000 lbs; 35 ft = 28,400 lbs. All cells are stability-limited. A critical lift at 28 feet of radius has a total suspended weight of 40,600 lbs. Using the conservative approach, the governing capacity is 28,400 lbs at 35 feet. The lift percentage = $40,600 \div 28,400 \times 100 = 143\%$. What must the operator conclude?

A. Nothing — the lift percentage is based on the conservative approach; use the interpolated value at 28 ft instead

B. Nothing — a 43% excess can be accommodated by repositioning the crane to reduce the radius

C. Nothing — the load must be reduced by 43% or the crane must reposition to 25 feet or less where the 45,200-lb capacity supports the load; additionally, since 45,200 lbs is stability-limited, the operator must confirm that 40,600 lbs at 25 feet = 89.8% falls within the critical lift requirements

D. The conservative capacity at 35 ft (28,400 lbs) significantly under-supports the 40,600-lb load; the lift cannot proceed at 28 feet using the conservative approach; the operator must either reduce the total suspended weight to below 28,400 lbs or reposition the crane to 25 feet or less where the 45,200-lb tabulated capacity supports the load

46. A crane load chart shows two sections for the same boom and outrigger configuration but different swing sectors: "OVER FRONT (0° TO 25° EACH SIDE)": 30 ft = 44,800 lbs; "ALL DIRECTIONS 360°": 30 ft = 34,600 lbs. A critical lift is planned with a pick at 20 degrees right of front center (within the over-front sector) and a set at 28 degrees right of front center (outside the over-front sector). The total suspended weight is 38,000 lbs. What capacity governs?

A. Nothing — the over-front capacity (44,800 lbs) governs since the load is picked in the over-front sector

B. The all-directions capacity (34,600 lbs) governs the entire lift — the load must swing to and be set at 28 degrees, which is outside the 25-degree over-front boundary; the all-directions capacity applies at the set location; the total suspended weight (38,000 lbs) exceeds the all-directions capacity (34,600 lbs); the lift cannot proceed as planned

C. Average the two capacities: $(44,800 + 34,600) \div 2 = 39,700$ lbs; 38,000 lbs is within this — lift proceeds

D. The over-front capacity governs the pick phase; the all-directions capacity governs only the set phase; since the set exceeds all-directions capacity, only the set location must be redesigned

47. A crane load chart contains the following note: "These capacity values are for the STANDARD RIG CONFIGURATION. For HEAVY LIFT CONFIGURATION with additional counterweight and outrigger extensions, see the Heavy Lift Section." The operator plans to add 8,000 lbs of additional counterweight but does not change the outrigger extension. What section applies?

A. Nothing — adding counterweight without changing the outrigger extension means the standard rig section still applies

B. Nothing — the standard rig section provides conservative values that apply to all counterweight configurations

C. The operator must determine whether the heavy lift configuration is defined by counterweight alone, outrigger extension alone, or both — if the heavy lift configuration requires both the additional counterweight AND extended outriggers, adding only the counterweight creates an intermediate configuration that is neither standard nor heavy lift; the manufacturer must be consulted to confirm which section applies to the actual intermediate configuration being used

D. The standard rig section is voided by any counterweight addition — the crane must be reconfigured to the exact heavy lift specification before lifting

48. A crane load chart shows: 100-ft boom at full outrigger extension: 30 ft = 36,200 lbs; 35 ft = 28,400 lbs; 40 ft = 22,200 lbs. Rate of decrease: 30–35 ft = 1,560 lbs/ft; 35–40 ft = 1,240 lbs/ft. A planned lift at 37 feet uses linear interpolation between 35 and 40 feet. What is the interpolated capacity at 37 feet?

A. Interpolated capacity at 37 ft = $28,400 - [(37-35) \times 1,240] = 28,400 - (2 \times 1,240) = 28,400 - 2,480 = 25,920$ lbs; confirming: drop per foot 35–40 = $(28,400 - 22,200) \div 5 = 6,200 \div 5 = 1,240$ lbs/ft; at 37 ft (2 ft beyond 35): $28,400 - 2,480 = 25,920$ lbs

B. Interpolated capacity = $28,400 - (2 \times 1,560) = 25,280$ lbs using the wrong interval rate

C. Interpolated capacity = $22,200 + (3 \times 1,240) = 25,920$ lbs — confirming from the other direction

D. Interpolated capacity = $(28,400 + 22,200) \div 2 = 25,300$ lbs using the midpoint average method

49. A crane load chart note reads: "Operating with a load line that is NOT reeved in accordance with the manufacturer's specified configuration shown in Appendix D will void all capacity values in this section." The crane's load line is currently reeved using a non-standard block arrangement that was configured by a rigger who is no longer on site. Appendix D is available. What must the operator do before using this section?

A. Nothing — all standard reeving configurations produce equivalent results for the same parts of line

B. Nothing — non-standard reeving is acceptable as long as the total parts of line match the specification

C. Nothing — the LMI's load reading confirms the reeving is adequate regardless of configuration

D. The operator must compare the actual reeving configuration to Appendix D and confirm they match exactly before using this section's capacity values — if the reeving does not match, the section is voided and the crane must be re-reeved to match Appendix D before any lifting; a non-standard block

arrangement can change the mechanical advantage, fleet angle, and rope path in ways that affect structural loading; the note is explicit that non-conforming reeving voids the section

50. A crane load chart shows that the 80-foot boom section at full outrigger extension, all-directions shows: 35 ft = 26,800 lbs (structural-limited); while the 100-foot boom section shows: 35 ft = 22,400 lbs (structural-limited). Both are structural-limited. The crane is configured with the 80-foot boom. Why does the shorter boom show higher capacity at the same radius?

- A. Nothing — structural-limited cells always show the same value regardless of boom length
- B. A shorter boom has less tip deflection under load, which is why it shows higher capacity at the same radius
- C. Nothing — the longer boom distributes load along its length, which reduces the structural stress at any given point
- D. Shorter booms create less overturning moment at the boom foot for the same load at the same radius because the shorter boom changes the geometry of the load application — the structural components (boom foot pins, rotating bed structure, slewing ring) experience different stress magnitudes depending on boom length; a shorter boom's structural geometry may place lower stress on the governing structural element at 35 feet, allowing a higher structural-limited capacity despite the identical operating radius

51. A crane load chart shows a note: "The maximum single-line pull for this crane is 22,000 lbs. This limit applies regardless of reeving configuration." The operator is planning a lift with a total suspended weight of 40,000 lbs using 4-part line. Each line carries 10,000 lbs in 4-part reeving. Does the 10,000-lb single-line pull exceed the 22,000-lb limit?

- A. Nothing — the 40,000-lb total suspended weight must be compared to the maximum single-line pull
- B. Nothing — 4-part line means each line carries $40,000 \div 4 = 10,000$ lbs; 10,000 lbs is well below the 22,000-lb single-line pull limit; the reeving configuration adequately distributes the load within the limit
- C. Nothing — the single-line pull limit applies only to 1-part reeving configurations; multi-part reeving is exempt
- D. The single-line pull limit must also be compared to the hoist drum's rope pull capacity, which is independent of the number of parts of line; the total suspended weight divided by the number of parts gives the line pull per part; at 10,000 lbs per part with a 22,000-lb limit, the configuration is within the single-line pull restriction

52. A crane load chart shows: "ON OUTRIGGERS — FULL EXTENSION — 100-FT BOOM — MAXIMUM COUNTERWEIGHT — 360° ALL DIRECTIONS": 20 ft = 58,600 lbs; 25 ft = 46,800 lbs; 30 ft = 37,000 lbs. A critical lift at 22 feet has a total suspended weight of 54,200 lbs. Using the conservative approach, what is the governing capacity and does the lift proceed?

A. Conservative capacity at 25 ft = 46,800 lbs; 54,200 lbs exceeds 46,800 lbs — the lift cannot proceed using the conservative approach; the operator must reduce total suspended weight to below 46,800 lbs or reposition to 20 feet or less where the 58,600-lb tabulated capacity supports the load

B. Conservative capacity at 20 ft = 58,600 lbs — use the smaller adjacent tabulated value; 54,200 lbs is within this

C. Nothing — interpolated capacity at 22 ft = 54,080 lbs; this is close to the load; the lift proceeds with minimal margin

D. Nothing — conservative capacity at 25 ft is 46,800 lbs; since 54,200 lbs exceeds this, the only option is to use a different crane configuration

53. A crane load chart section note reads: "All capacity values in this section assume no dynamic loading effects from simultaneous multi-function operation. Do not operate more than one crane function simultaneously when using capacities within 5% of the tabulated value." The operator is performing a critical lift at 97% of the tabulated capacity and plans to simultaneously boom up while hoisting. What must the operator do?

A. Nothing — the 97% percentage is confirmed below 100%; the note does not apply at this level

B. Nothing — simultaneous multi-function operation is authorized whenever the LMI reads below 100%

C. Nothing — the note's restriction on simultaneous operation applies only to critical lifts above 90%

D. The note's condition prohibits simultaneous multi-function operation at 97% of tabulated capacity — at 97%, the operator is within the note's 5%-of-tabulated-value zone; boom-up while hoisting creates combined dynamic loads beyond what the static capacity value was derived for; each function must be operated individually, completing one movement before initiating the next; proceeding with simultaneous operation at this capacity level violates the note's explicit condition

54. A crane is configured with a 100-foot boom at full outrigger extension. The load chart shows standard counterweight section at 35 ft = 22,800 lbs and maximum counterweight section at 35 ft = 28,600 lbs. The crane has standard counterweight installed. A lift at 34 feet has a total suspended weight of 24,000 lbs. The operator reasons that the maximum counterweight section is more appropriate since it shows higher capacity. What error does this reasoning contain?

A. Nothing — the maximum counterweight section can always be used when the standard section shows inadequate capacity

B. The maximum counterweight section must match the actual physical counterweight installed on the crane — the maximum counterweight section's values were derived with the heavier counterweight's restoring moment in the stability analysis; using these values with standard counterweight installed means operating beyond the stability margin that was calculated for the actual physical configuration; this can result in a tip-over at loads that appear within the maximum CW capacity

C. Nothing — the operator may use either section as long as the total suspended weight is within the chosen section's capacity

D. Nothing — the counterweight section choice is at the operator's discretion based on project requirements

55. A crane load chart for the luffing jib section shows: "50-FT FIXED JIB — 15° OFFSET — 120-FT MAIN BOOM": at 40 ft = 11,800 lbs; at 45 ft = 9,200 lbs; at 50 ft = blank. Maximum rated radius = 45 feet. A planned lift has a pick at 42 feet and a set at 44 feet. The total suspended weight is 10,000 lbs. Using the conservative approach, what governs?

A. Nothing — conservative at pick (42 ft): capacity at 45 ft = 9,200 lbs; conservative at set (44 ft): capacity at 45 ft = 9,200 lbs; 10,000 lbs exceeds 9,200 lbs — the lift cannot proceed at either position using the conservative approach; the operator must reduce the total suspended weight to below 9,200 lbs or reposition to 40 feet or less

B. Nothing — both positions are within the 45-foot maximum rated radius; the conservative capacity at 45 ft = 9,200 lbs governs; since 10,000 lbs exceeds 9,200 lbs, the lift cannot proceed

C. Conservative at pick (42 ft) = 9,200 lbs at 45 ft; conservative at set (44 ft) = 9,200 lbs at 45 ft; 10,000 lbs exceeds 9,200 lbs — lift cannot proceed; reduce the total suspended weight to below 9,200 lbs or reposition to 40 feet or less where the 11,800-lb tabulated capacity supports the load

D. The conservative approach at 40 ft = 11,800 lbs governs; 10,000 lbs is within this — use the prior tabulated entry

56. A crane load chart note states: "These values are contingent on the use of the manufacturer's specified outrigger pad dimensions of 36 × 36 inches. If the operator uses larger pads to increase the bearing area, a structural engineer must confirm the larger pads are adequate for the outrigger reaction loads before use." The operator is using 48 × 48-inch crane mats — larger than the specified 36 × 36. What must happen?

A. A structural engineer must confirm the 48×48 -inch mats are structurally adequate for the outrigger reaction loads before these capacity values can be used — the note establishes this as a binding condition for any pad larger than 36×36 inches; larger mats may distribute bearing pressure better but must themselves be structurally capable of carrying the concentrated float load without deflecting, splitting, or crushing under the outrigger reaction force; the engineering confirmation is required regardless of mat size

B. Nothing — larger mats are always acceptable since they reduce bearing pressure below the design value

C. Nothing — the note only requires structural engineering for pads smaller than the specified dimensions

D. The note applies to manufactured pad substitutions — timber crane mats are always exempt from the note's requirement

57. A crane load chart shows: "ON OUTRIGGERS — FULL EXTENSION — 100-FT BOOM — OVER REAR SECTOR (20° EACH SIDE)": 35 ft = 19,200 lbs. "ALL DIRECTIONS 360° ": 35 ft = 24,800 lbs. The all-directions section shows higher capacity than the over-rear section at the same radius. A planned lift with the boom at 15 degrees left of rear center (within the over-rear sector) has a total suspended weight of 22,000 lbs. Which capacity applies?

A. Nothing — the all-directions capacity (24,800 lbs) applies since it governs all boom positions including the over-rear sector

B. Nothing — the higher capacity always governs when two sections overlap at the same radius

C. Nothing — the all-directions section is the baseline; the over-rear section is a restriction; use the lower over-rear value

D. The over-rear section capacity of 19,200 lbs governs when the boom is positioned in the over-rear sector — the over-rear section establishes a sector-specific restriction on capacity; this restriction exists because stability behind the crane is lower than in other directions due to the counterweight's position relative to the tipping axis; the 22,000-lb total suspended weight exceeds the over-rear limit of 19,200 lbs; the lift cannot proceed in the over-rear configuration as planned

58. A crane load chart shows: "FOR THIS SECTION, CONFIRM THE FOLLOWING BEFORE EACH LIFT: (1) Slewing ring backlash within specification; (2) All 4 outrigger floats confirmed in firm contact; (3) Crane level within 0.5% in all directions simultaneously." The operator has confirmed items (1) and (3) but has not physically confirmed item (2) — the outrigger float contact was confirmed visually from the cab only. Does this satisfy the note?

A. Visual confirmation of outrigger float contact from the cab satisfies the note's requirement for item (2)

B. The note's requirement for confirmed firm contact means physically verified contact — visual confirmation from the cab cannot reliably confirm whether each float has full, firm contact with a supporting surface; a float that appears visually to be in contact may be resting on soft material, on a void, or may have the mat edge partially unsupported; all three conditions in the note must be physically confirmed, not visually estimated, before these capacity values are used

C. Nothing — two of three conditions are confirmed; operational judgment may cover the third

D. Nothing — the note's three conditions are advisory; they need not all be confirmed before each lift

59. A crane load chart shows a note: "The maximum crane operating slope with load suspended is 0.5%. Refer to the level indicator. If the indicator reads within 0.5%, the crane is within tolerance." After a 14-foot load lowering, the operator checks the level indicator and it reads 0.48% — within the 0.5% tolerance. Earlier in the shift, the crane read 0.0% at the same position. What does the progression from 0.0% to 0.48% during a single load cycle indicate?

A. Nothing — the 0.48% reading confirms the crane is within the note's tolerance

B. Nothing — the level indicator naturally drifts during operations due to thermal effects on the inclinometer

C. The progression from 0.0% to 0.48% during a single load cycle indicates progressive outrigger settlement or soil yielding on one side of the crane — even though the current reading is within tolerance, the trend shows the condition is worsening; at the current rate, the next load cycle may push the reading beyond 0.5%; this trend requires investigation before further operations regardless of the current reading being within tolerance

D. Nothing — the 0.48% reading confirms the ground conditions are adequate; the initial 0.0% simply reflects better-than-expected settlement

60. A crane load chart shows a note: "All capacity values in this section include the effects of the crane's self-weight and standard equipment as delivered from the factory. Any additional items installed after delivery — such as additional lighting, cab guards, or non-standard counterweights — must be accounted for by deducting their total weight from all capacity values in this section." The crane has a 400-lb custom cab protection cage installed that was not part of the factory delivery. The tabulated capacity is 28,600 lbs. What is the applicable capacity?

A. Applicable capacity = $28,600 - 400 = 28,200$ lbs; the 400-lb cage must be deducted from the tabulated capacity per the note; the crane was not analyzed with the cage's mass when the capacity

values were derived; any mass added after factory delivery that was not part of the stability and structural analysis must be deducted from the available capacity

B. Nothing — 400 lbs is below the 1% threshold for capacity adjustments on crane add-on equipment

C. Nothing — cab protection equipment is a safety device and is explicitly exempt from capacity deduction requirements

D. Nothing — the cage weight deduction applies only to counterweight additions, not to structural accessories

61. A crane is performing a critical lift when the load chart note states: "For lifts above 85% of gross capacity in this section, a pre-lift load verification scale must confirm the actual load weight within 24 hours." The total suspended weight is estimated at 87% of gross capacity based on the material certification. The last certified scale measurement was 36 hours ago. Does the 36-hour-old scale measurement satisfy the note?

A. Nothing — material certifications always satisfy load verification requirements regardless of timing

B. Nothing — the 36-hour measurement is within a reasonable tolerance of the 24-hour requirement

C. Nothing — the note's 24-hour requirement is met since the measurement is from the same calendar day

D. The 36-hour-old measurement does not satisfy the note's 24-hour requirement — the note establishes 24 hours as the maximum age of a load verification scale measurement before a lift above 85% of gross capacity; the load may have been modified, may have absorbed moisture, or may have had materials added since the 36-hour-old measurement; the load must be re-weighed within 24 hours of the planned lift before proceeding

62. A crane load chart shows: "80-FT BOOM — ON OUTRIGGERS — FULL EXTENSION — ALL DIRECTIONS": 25 ft = 44,200 lbs; 30 ft = 35,000 lbs; 35 ft = 27,600 lbs. A lift at 32 feet of radius uses linear interpolation between 30 and 35 feet. The total suspended weight is 31,400 lbs. What is the interpolated capacity and does the lift proceed?

A. Nothing — the conservative approach at 35 ft = 27,600 lbs governs; 31,400 lbs exceeds this — lift cannot proceed

B. Interpolated capacity at 32 ft = $35,000 - [(2/5) \times (35,000 - 27,600)] = 35,000 - (0.4 \times 7,400) = 35,000 - 2,960 = 32,040$ lbs; 31,400 lbs is within 32,040 lbs — lift proceeds; a critical lift plan is required since the lift percentage = $31,400 \div 32,040 = 98.0\%$

C. Nothing — the interpolated capacity at 32 ft is correct but the operator must also confirm radius management given the minimal 640-lb margin

D. Nothing — interpolated capacity at 32 ft = 32,040 lbs; 31,400 lbs is within capacity; proceed with a critical lift plan and exceptional radius management throughout all phases

63. A crane load chart shows: "THESE CAPACITIES APPLY TO LIFTS ONLY. FOR PICK-AND-CARRY OPERATIONS, REFER TO THE PICK-AND-CARRY SECTION. USING THESE LIFT-ONLY CAPACITIES FOR TRAVEL WITH LOAD IS PROHIBITED." The operator begins a lift at 88% of the tabulated lift-only capacity. After the load is rigged, the lift director asks the operator to carry the load 25 feet to a new set location rather than swinging on outriggers. What must happen?

A. Nothing — the load is already rigged and traveling 25 feet is the most efficient completion

B. Nothing — traveling 25 feet with the load is within the standard tolerance for crane "jockeying" operations

C. The crane must consult the pick-and-carry section before any travel with load — the note explicitly prohibits using lift-only capacity values for travel; travel creates different dynamic loading, road surface factors, and stability conditions than stationary lifting; the pick-and-carry section may show a much lower capacity that 88% of the lift-only capacity exceeds; the load must either be set in its current position or the pick-and-carry section must be confirmed to support the load weight before any travel begins

D. Travel 25 feet is acceptable since the distance is less than 30 feet, which is the standard pick-and-carry threshold

64. A crane load chart shows: 100-foot boom at full outrigger extension: 40 ft = 22,400 lbs; 45 ft = 17,600 lbs; 50 ft = blank. A lift at 47 feet is planned with a total suspended weight of 15,800 lbs. Conservative approach: governing capacity at 50 ft = blank (maximum rated radius is 45 ft). The 47-foot operating radius exceeds the maximum rated radius. What must the operator conclude?

A. The operator may proceed at 47 feet since 15,800 lbs is well below the 17,600-lb capacity at the adjacent 45-foot entry

B. Nothing — the blank at 50 ft means the crane has excess structural capacity; 47 ft is within the usable range

C. Nothing — the crane's LMI will alarm if the 47-foot radius exceeds any capacity threshold

D. The 47-foot operating radius exceeds the maximum rated radius of 45 feet — the crane is in an unrated configuration at 47 feet regardless of the load weight; no rated capacity exists at 47 feet; the lift

cannot proceed at this radius; the crane must be repositioned to bring the operating radius to 45 feet or less, where the tabulated capacity of 17,600 lbs (confirmed to exceed the 15,800-lb total suspended weight) applies

65. A crane's load chart shows: 100-foot boom at full outrigger extension, maximum counterweight, all-directions: 30 ft = 38,400 lbs; 35 ft = 30,200 lbs; 40 ft = 23,600 lbs. A final series of 5 identical critical lifts is planned at 32 feet of operating radius with a total suspended weight of 34,800 lbs. Using the conservative approach, the governing capacity at 35 feet is 30,200 lbs. The lift percentage = $34,800 \div 30,200 \times 100 = 115.2\%$. What must the operator conclude?

A. Nothing — use the interpolated capacity at 32 ft (36,760 lbs); 34,800 lbs is within this; critical lift plan required

B. Nothing — the lift director may authorize a temporary capacity increase for time-critical final project lifts

C. Nothing — for the final lifts on a project, the conservative approach requirement may be waived by the employer

D. The conservative governing capacity at 35 feet (30,200 lbs) does not support the 34,800-lb total suspended weight — the lift series cannot proceed at 32 feet using the conservative approach; the 115.2% lift percentage confirms the load significantly exceeds the conservative capacity; the operator must either reduce the total suspended weight to below 30,200 lbs, or reposition the crane to bring the operating radius to 30 feet or less where the 38,400-lb conservative capacity directly supports all 5 planned lifts

Specialty Exam 13 Answer Key and Full Explanations

1. D — Bearing pressure = $78,000 \div 2.5 = 31,200$ psf — far exceeding any utility tunnel's designed structural capacity. Utility tunnels are designed for soil overburden and internal service loads, not for concentrated point loads from crane outriggers. A structural engineer must evaluate whether the tunnel roof can resist both the existing overburden and the additional concentrated crane outrigger load before any setup proceeds.

2. B — Concrete saw-cutting creates two simultaneous hazards: the blade creates vibration that propagates through the ground to the outrigger bearing zone, and the blade cooling water flows across the surface toward the outrigger positions. Vibration can cause progressive soil settlement, and water infiltration softens fine-grained soils. Both effects require monitoring, and either one reaching a meaningful threshold requires stopping operations for re-evaluation.

3. C — Bearing capacity at one location does not reliably represent conditions 200 feet away. Soil conditions can change significantly over distances of 50 feet or less — particularly in areas with fill, buried utilities, or varied subsurface geology. The crane employer cannot safely confirm outrigger positions are adequate using documentation derived from testing at a different location. Accurate documentation for the specific setup location is required before operations begin.

4. A — Steam from a ruptured pipe beneath a floor slab actively introduces high-temperature, high-pressure moisture into the subbase materials directly under the outrigger position. Steam condensate can rapidly saturate and weaken the subbase, reducing its bearing capacity to near zero. The steam pressure itself can also create localized voids in the subbase as it escapes. Both the thermal and moisture effects on the concrete and subbase must be evaluated before any further loading.

5. D — Container handling equipment ratings are based on distributed wheel loads from straddle carriers or rubber-tired gantry cranes — not concentrated point loads from crane outrigger floats. A concentrated 112,000-lb point load on a 2-square-foot float creates bearing pressures that the deck structure was never designed to carry. A structural engineer must confirm the deck and pile system can handle the crane's specific concentrated outrigger loads before any operations proceed.

6. B — A soil bulge forming adjacent to a loaded outrigger mat is one of the clearest visible indicators of bearing capacity failure in progress. The Prandtl failure mechanism creates a shear zone where soil is pushed laterally outward and upward at the edge of the loaded area. This is not a warning sign — it is the beginning of actual failure. Continued loading will complete the shear failure with sudden, catastrophic outrigger drop. Operations must stop immediately.

7. C — OSHA 1926.1402 specifically requires the controlling entity to provide ground condition information including surface and subsurface conditions, underground utility locations, and any other site characteristics that could affect safe crane operations. This information must be sufficient for the crane employer to plan safe outrigger positions. The requirement covers the current conditions at the specific setup area — not general descriptions of the broader site.

8. A — Bearing pressure at the float = $76,000 \div 4 = 19,000$ psf — five times the confirmed 3,800 psf capacity. The float's small contact area transmits the full outrigger reaction as a concentrated point load to the soil beneath it. A mat and cribbing system must provide enough contact area to distribute the 76,000-lb load over a surface area large enough to stay within the 3,800 psf limit — requiring at minimum $76,000 \div 3,800 = 20$ sq ft of contact area.

9. D — Demolition rubble backfill placed without engineered compaction has highly variable bearing capacity. The irregular geometry of rubble pieces creates void-rich, non-uniform fill with unpredictable

settlement characteristics. Large voids between rubble pieces can collapse suddenly under concentrated crane outrigger loads without any surface warning. Eighteen months of self-weight consolidation does not replace compaction testing — loose rubble never achieves the density of engineered compacted fill regardless of elapsed time.

10. B — A barge's stability is sensitive to load distribution — the position and arrangement of all weights on the deck directly affects trim, list, and stability. When the deck crew repositions heavy material without the stability engineer's knowledge, the carefully planned load distribution that confirmed the crane's operating slope tolerance is altered. Any change to the barge load distribution during crane operations must be evaluated to confirm the crane remains within its operating slope tolerance.

11. C — A loaded outrigger mat positioned with its edge 4 inches from a drain grate concentrates load at the mat edge very close to the drain opening. When the mat rotates slightly under load, the edge can transfer load directly through the grate rather than through the surrounding concrete. Cast iron drain grates and their connections are not designed for concentrated edge loads from crane outriggers. The mat must be positioned to prevent any load transfer through the grate structure.

12. A — A LOX vault is a specialized structure designed for specific equipment loads, thermal conditions, and seismic requirements. Its roof structure was engineered for those specific conditions — not for concentrated crane outrigger point loads. Any structural crack or movement of the vault under crane loading could compromise the cryogenic containment system. An LOX release in a confined area creates an oxygen-enriched atmosphere that dramatically increases fire and explosion risk. Structural evaluation is mandatory before any setup proceeds.

13. C — Environmental certification and geotechnical bearing capacity are entirely separate engineering assessments that address completely different soil properties. An environmental closure certifies the soil chemistry meets regulatory standards — it says nothing about compaction, density, or structural bearing capacity. Certified clean fill placed in a 10-foot-deep excavation without compaction testing has unknown bearing capacity regardless of its environmental status. Compaction verification is a separate and independent requirement.

14. B — A 3-foot rise in river level increases hydrostatic pressure acting laterally through the riverbank soil. This elevated pore pressure reduces effective stress between soil particles throughout the bank, decreasing shear strength and bearing capacity. The 40-foot setback may be within the lateral seepage influence zone depending on the bank's soil permeability. The 6-hour timeline means the bearing capacity change may occur while crane operations are underway — suspension until the situation is confirmed is the prudent response.

15. D — Crane outrigger loads create stress at significant depths below the surface — often 10 feet or more depending on the contact area and reaction load. If UXO clearance only extends to 18 inches, UXO may exist at depths that fall within the crane's stress influence zone. The stress transmitted to that depth could potentially detonate unexploded ordnance. The UXO office must confirm clearance to the depth of the crane's stress influence before any setup proceeds.

16. A — An extended hold at 84% of rated capacity creates time-dependent concerns that do not apply during brief holds. The crane's fuel must be sufficient for the total hold duration, the hydraulic oil temperature must remain in the normal range throughout, and the operator must maintain continuous control without fatigue impairing their judgment. None of these factors self-resolve without monitoring — each must be specifically assessed before committing to an additional 45-minute hold.

17. D — ASME B30.5 requires hand signals to be clear and unambiguous. An object held in the signaling hand changes the visual appearance of each signal — and the STOP and EMERGENCY STOP signals are most at risk because their visual distinctiveness is critical. A waving flag can make a STOP signal look like a directional signal or obscure the specific hand position that defines each signal. The signal person must be able to give each standard signal in its standard unmodified form.

18. B — A worker leaning over the platform railing has changed the platform's effective center of gravity and is no longer fully protected by the platform's fall arrest design. Any unexpected crane movement — a hoist start, stop, or platform sway — with the worker in this overhanging position creates a fall hazard that the platform's safety systems were not designed for. All crane movement must stop until the worker is fully within the platform's protected area.

19. C — Contact between a newly-lifted load and an adjacent structure means the crane is not executing a free vertical lift — it is side-pulling against the structure. Side-pulling applies a horizontal force component to the boom that it was not designed to carry. The attached structural bracket may also be anchored to the building, meaning the crane is pulling against the building's structure. The load must return to the ground and the contact situation must be resolved before the crane picks the load again.

20. A — Generator exhaust stacks can reach 800°F or higher during operation. Synthetic sling materials begin to degrade at relatively low temperatures — polyester starts losing capacity above 194°F and nylon above 250°F. A load passing 3 feet above a running exhaust stack places rigging within the hot gas plume. Additionally, contact between the load and the generator's fuel system creates an immediate fire hazard. The generator must be shut down and cooled before any load travels above it.

21. D — OSHA 1926.1416(c) establishes an absolute prohibition on leaving the crane cab while a load is suspended. The operator is the only person who can respond immediately to sudden changes in load conditions, crane stability, or system function. There is no authorized exception for any reason including emergencies, bathroom breaks, or brief absences. The load must reach the ground and the crane must be secured before the operator may leave the controls.

22. B — A 1-foot radius increase can represent a meaningful capacity decrease — particularly at radii where the capacity curve is steep. At 82% of the original radius's capacity, even a modest percentage increase from the additional radius could push the configuration closer to or beyond rated capacity. The load chart must be consulted for the actual radius before proceeding. The operational principle is that any deviation from the confirmed parameters requires re-verification before continuing.

23. C — Increasing oscillation amplitude during crane swing is the diagnostic signature of resonance — each swing cycle is adding energy to the pendulum rather than removing it. This occurs when the swing frequency coincidentally matches the load's natural pendulum frequency. Resonance-driven amplitude growth is not self-limiting and can rapidly reach amplitudes where the load contacts adjacent structures or rigging is dynamically overloaded. Only stopping the energy input allows the oscillation to decay.

24. A — A spreader beam tilted 8 inches over its 14-foot span during the initial pick indicates either a significant CG offset from the beam's centerline or an unequal leg length in the rigging. Either condition concentrates load on the lower end's sling leg beyond its planned load share. At the lower end, the sling may be approaching or exceeding its rated capacity while the higher end's sling carries far less than its planned share. The rigging geometry must be corrected before the load rises further.

25. D — Each crane operator bears personal responsibility for confirming ground conditions, crane configuration, level condition, and outrigger mat positions at the start of their shift. The incoming operator's independent pre-shift verification is not a formality — it is the mechanism that catches changes that occurred since the previous operator's last confirmation. Six successful lifts in the previous shift do not guarantee the conditions are unchanged for the next shift.

26. B — At 15 degrees of rotation with only 4-inch clearance on each side, the load's corners are sweeping through an area that exceeds the available clearance by a significant margin. A rectangular load rotated 15 degrees in a square shaft experiences diagonal-to-wall contact long before the 4-inch clearance is consumed. Continuing the descent guarantees wall contact, which can cause the load to jam, tilt, or drop. The load must be raised and rotation arrested before re-entering the shaft.

27. C — A STOP signal ends one command — it does not automatically initiate the next command. The signal person must assess the current load position, confirm the path for the next intended movement is clear, and then deliver a positive, complete, unambiguous signal for the specific next movement. Giving an unclear or partial signal after a STOP creates ambiguity about what the operator is being directed to do. The signal must meet the same standard of clarity as the original signals that preceded the stop.

28. A — A falling debris event indicates the adjacent structure has an unstable element that has already failed and may have additional unstable elements. Completing the current swing would bring the crane's boom and load line into proximity with the debris source area — the same area that just generated falling material. Additionally, site personnel may need to evacuate from beneath the debris risk zone. The situation must be assessed before the crane's load travels further under or near the affected structure.

29. D — Plywood placed over a trench by excavation crew as a temporary cover is not designed or rated for crane travel loads. The crane's travel weight, concentrated on the plywood across the trench opening, can cause the plywood to fail catastrophically if it lacks adequate span capacity. The trench depth of 4 feet means a plywood failure causes the crane's travel mechanism to drop 4 feet into the trench — a severe incident. The plywood's span capacity must be confirmed before crossing.

30. B — If hand signals were established as an authorized communication method and the signal person is in confirmed visual contact, hand signals can continue as the primary method — they are an ASME-approved communication system. However, if radio was the established primary method, the radio must be replaced before proceeding. In either case, the failed radio removes emergency communication capability that must be addressed. The resolution depends on whether hand signals were pre-established or the radio was the sole method.

31. D — Diameter reduction = $0.750 - 0.691 = 0.059$ inches. Converting to 64ths: $0.059 \times 64 \approx 3.8/64$ inch. The ASME B30.5 removal criterion for diameter reduction is $3/64$ inch (0.047 inches). Since 0.059 inches exceeds 0.047 inches, the rope meets the removal criterion and must be taken out of service. Wire diameter reduction indicates corrosion, abrasion, or core failure have reduced the rope's tensile capacity at the affected section.

32. A — ASME B30.9 requires synthetic web slings to be marked with all rated WLL values and any angle limitations. The angle limitation is a required marking because exceeding the minimum angle increases the tension per leg beyond the WLL. A sling with an illegible angle limitation cannot be confirmed for use at the planned angle. Partial legibility does not satisfy the requirement — the sling must be removed from service until a replacement tag with all required information is provided.

33. D — Strand waviness (corkscrewing) indicates the rope has been permanently deformed — the strands have been displaced from their designed helical position. This occurs from kinking, shock loading, or running over sheaves with insufficient radius. When strands are permanently displaced, they no longer carry load uniformly — the high strands carry more than the low strands. The rope's effective tensile capacity is reduced below its rated breaking strength due to unequal strand loading.

34. B — Choker hitch WLL = $12,000 \times 0.75 = 9,000$ lbs per leg. Tension per leg at $60^\circ = (14,000 \div 2) \times (1 \div \sin 60^\circ) = 7,000 \times 1.155 = 8,085$ lbs. Since 8,085 lbs is within the 9,000-lb choker hitch WLL, the configuration is adequate. Both the hitch factor derating and the angle factor must be applied simultaneously — these are independent reductions that compound.

35. C — Drum groove depth provides lateral containment for the rope, preventing it from shifting across the drum face during winding. At 30% depth versus the original 50%, the rope rides higher in the groove, reducing the contact arc angle and the lateral restraint force. Reduced containment allows the rope to shift laterally during winding, causing the rope in upper layers to cross over lower-layer ropes rather than following the groove's helical path, creating crushing forces at crossover points.

36. A — An elevated iron particle count indicates accelerated internal wear was occurring at the time of analysis. A "monitor closely" notation requires follow-up to confirm whether the wear has stabilized or is accelerating. Without documented follow-up over 6 months, the wear condition has been progressing without monitoring. The current iron particle count may be significantly higher than the already-elevated level 6 months ago. An immediate follow-up analysis is required before near-capacity operations rely on the hydraulic system.

37. B — A concrete counterweight's mass is precisely specified in the load chart's stability analysis. A 25% cross-section crack can eventually cause the cracked section to separate and fall, permanently reducing the counterweight mass. An unknown counterweight mass invalidates the stability-limited capacity values, which were calculated for the specific counterweight mass shown in the load chart. Even if the section has not yet separated, its structural integrity and future mass stability are in question.

38. B — ASME B30.5's broken wire criteria are evaluated by analyzing the distribution pattern, not just the total count in any single lay length. Four broken wires in one lay and 3 in the adjacent constitute a concentrated cluster of fatigue that indicates accelerated progression in that section. While neither individual lay length reaches the 10-wire criterion independently, the concentration pattern requires qualified inspector evaluation of whether the pattern's progression rate makes removal appropriate — the standard requires assessment beyond single-lay counting.

39. C — A flat spot on a sheave creates a periodic impact on the rope every time the flat zone contacts the moving rope. The transition from the curved groove to the flat and back creates a sudden bending and straightening event in the wires at the impact locations — this is fatigue loading concentrated at one point. The same wire locations experience this impact on every hoist cycle, accumulating fatigue rapidly. Both the sheave and the rope section that has been running over the flat spot require replacement.

40. A — The slewing ring backlash at 0.065 inches exceeds the manufacturer's 0.060-inch maximum specification. Operating with out-of-specification slewing ring backlash allows micro-movement of the upper works at each swing direction change, creating shock loading at the ring gear mesh. This shock loading accelerates ring gear tooth wear and fatigue in the slewing ring mounting bolts. The crane cannot rely on the load chart values derived for a specification-compliant slewing ring while operating with an out-of-specification one.

41. D — ASME B30.5 treats permanent bending deformation as an unconditional removal condition. A rope bent below minimum bend radius and retaining a permanent set has been plastically deformed — the wires and strands have been permanently displaced from their designed helical geometry. The stress concentrations remaining at the bent section are permanent and cannot be corrected by straightening. The rope cannot recover its original load distribution geometry.

42. B — A V-shaped notch on a G80 alloy steel chain link creates a sharp-tipped stress concentration. Under load, the stress at the notch tip can be many times the nominal link stress — sufficient to initiate a fatigue crack from the first loading cycle. High-strength alloy steel is more notch-sensitive than mild steel, meaning smaller notches create proportionally larger stress concentrations. ASME B30.9 lists notching as a removal condition because the notch-initiated failure mode is unpredictable and rapid.

43. A — Conservative approach: next larger tabulated radius beyond 33 feet = 35 feet, capacity = 29,600 lbs. Total suspended weight = 1,600 + 720 + 180 + 25,400 = 27,900 lbs. Since 27,900 lbs is within 29,600 lbs, the lift proceeds. Lift percentage = $27,900 \div 29,600 \times 100 = 94.3\%$ — this exceeds the 75% critical lift threshold, requiring a written critical lift plan and pre-lift meeting before the lift begins.

44. A — The LMI shows standard counterweight but maximum counterweight is physically installed. Standard counterweight sections show higher capacity values than maximum counterweight sections at the same radius — because maximum counterweight sections are derived for heavier rear-weighted configurations that may have different structural limiting members. An LMI configured for standard CW with maximum CW installed displays lower percentages than the actual loading warrants, creating false confidence. The LMI must match the actual configuration.

45. D — Conservative approach: next larger tabulated radius beyond 28 feet = 35 feet, capacity = 28,400 lbs. Total suspended weight = 40,600 lbs. Lift percentage = 143% — the load significantly exceeds the conservative governing capacity. The lift cannot proceed at 28 feet. The operator must reduce the total suspended weight to below 28,400 lbs or reposition to 25 feet or less where the 45,200-lb tabulated capacity directly supports the load.

46. B — The set location at 28 degrees right of front center is 3 degrees outside the over-front sector boundary of 25 degrees. The load must swing to and be set in the all-directions zone. The all-directions capacity of 34,600 lbs applies at the set location. The total suspended weight of 38,000 lbs exceeds the all-directions capacity — the lift cannot proceed as planned. The load must be reduced or the set location must be redesigned to stay within the over-front sector.

47. C — Adding 8,000 lbs of counterweight without changing the outrigger extension creates a configuration that is neither the standard rig nor the heavy lift configuration as defined in the load chart. The manufacturer's heavy lift section may require both the counterweight addition and extended outriggers simultaneously — partial changes may create an intermediate configuration that is not covered by either section. The manufacturer must confirm which section applies to the specific combination of changes actually made.

48. A — Interpolation from 35 to 40 feet: drop per foot = $(28,400 - 22,200) \div 5 = 6,200 \div 5 = 1,240$ lbs/ft. At 37 ft (2 ft beyond 35 ft): $28,400 - (2 \times 1,240) = 28,400 - 2,480 = 25,920$ lbs. This is confirmed by the alternative calculation: $22,200 + (3 \times 1,240) = 22,200 + 3,720 = 25,920$ lbs, approaching from 40 feet and working backward for a 3-foot reduction.

49. D — The note explicitly states that non-conforming reeving voids all capacity values in this section. Appendix D defines the specific required reeving configuration — the note creates a binary condition: the reeving either matches Appendix D exactly or the section cannot be used. A non-standard block arrangement can change the mechanical advantage, fleet angle, and rope path in ways that alter structural loading differently from what was analyzed. The reeving must match Appendix D before any lifting.

50. D — When structural limits govern capacity, the capacity is set by a specific structural element in the load path — the boom foot pins, slewing ring, or rotating bed structure. For the same operating radius, a shorter boom may create a different moment arm at the governing structural element than a longer boom. If the shorter boom produces lower stress at the governing element for the same load at the same radius, it can sustain a higher structural-limited capacity. The structural geometry, not boom length alone, determines the governing limit.

51. B — In 4-part reeving, the total suspended load is distributed equally among the 4 rope parts, with each part carrying total load \div 4. At 40,000 lbs with 4-part line, each line carries 10,000 lbs — well below the 22,000-lb single-line pull maximum. The note's limit protects the drum, hoist motor, and rope end termination from excessive single-line tension. With 4-part reeving, the mechanical advantage reduces the required single-line pull to one-fourth of the total load.

52. A — Conservative approach: next larger tabulated radius beyond 22 feet = 25 feet, capacity = 46,800 lbs. Total suspended weight = 54,200 lbs. Since 54,200 lbs exceeds 46,800 lbs by 7,400 lbs, the lift cannot proceed using the conservative approach. The operator must reduce the total suspended weight to below 46,800 lbs or reposition the crane to 20 feet or less where the 58,600-lb tabulated capacity directly supports the load.

53. D — The note establishes a specific prohibition on simultaneous multi-function operation for lifts within 5% of the tabulated capacity. At 97%, the operator is 3 percentage points within the note's 5% zone — clearly subject to the restriction. Boom-up while hoisting simultaneously creates combined dynamic loads from both movements. The static capacity value was derived for single-function operation; adding a second simultaneous function adds dynamic loading beyond what the static analysis accounts for.

54. B — The maximum counterweight section's stability values were derived assuming the heavier counterweight's restoring moment is present. When the standard (lighter) counterweight is installed, the actual restoring moment is lower than the maximum CW section assumed. Using maximum CW capacity values with standard CW physically installed means the crane's actual stability margin is less than what the load chart values reflect — the crane could tip over at loads that appear within the maximum CW section's capacity.

55. C — Conservative approach at pick (42 ft): next larger tabulated radius = 45 ft = 9,200 lbs. Conservative approach at set (44 ft): next larger tabulated radius = 45 ft = 9,200 lbs. Total suspended weight = 10,000 lbs. Since 10,000 lbs exceeds 9,200 lbs at both positions, the lift cannot proceed using the conservative approach. The operator must reduce the total suspended weight or reposition to 40 feet or less where the 11,800-lb tabulated capacity supports the load.

56. A — The note explicitly conditions the use of larger pads on prior confirmation by a structural engineer that the pads are adequate for the outrigger reaction loads. Larger mats improve bearing pressure distribution to the soil, but the mat itself must be structurally capable of carrying the concentrated outrigger float load across the mat's unsupported span. A timber or composite mat that deflects, splits, or crushes under the float load fails before the bearing pressure benefit is realized.

57. D — The over-rear section establishes a lower capacity limit for operations in the rear sector, regardless of the all-directions section showing a higher value. The over-rear restriction reflects reduced stability when the boom is pointed away from the counterweight — the stability geometry is less favorable behind the crane than in other directions. The 22,000-lb load exceeds the 19,200-lb over-rear limit. The all-directions section's higher value does not override the sector-specific restriction.

58. B — Visual confirmation of outrigger float contact from the cab cannot confirm whether each float is in firm, full contact with a supportive surface. From the cab, the operator may see the float touching the mat surface while a portion of the mat is on a soft spot, a void, or unsupported at its edge. Physical confirmation — someone on the ground visually confirming each float's contact condition — is required to satisfy the note's explicit requirement for confirmed firm contact at all four positions.

59. C — The progression from 0.0% to 0.48% during a single load cycle indicates ongoing soil consolidation or settlement — not elastic deflection. Elastic deflection would have occurred immediately upon loading, not progressively. A reading already at 96% of the tolerance limit and actively trending toward it means the next load cycle may exceed 0.5%. The trend is more important than the current value — it predicts the next condition. Investigation before further operations is required regardless of current compliance.

60. A — The note explicitly requires deducting the weight of any post-factory additions from all capacity values. The 400-lb cage was not present during the structural and stability analysis that produced the tabulated values — its mass was not included in the rotating mass calculations. Applicable capacity = $28,600 - 400 = 28,200$ lbs. The deduction is required per the note's explicit instruction for any non-factory equipment.

61. D — The note's 24-hour requirement is specific and time-bound. A 36-hour-old measurement exceeds this limit by 50%. Loads above 85% of gross capacity must be weighed within 24 hours because loads can change — moisture absorption, additional attachments, or material modifications can change weight between measurements. The note protects against using a stale weight measurement for a lift where the margin between the load and rated capacity is very small.

62. B — Interpolation from 30 to 35 feet: drop = $35,000 - 27,600 = 7,400$ lbs over 5 ft = 1,480 lbs/ft. At 32 ft (2 ft beyond 30 ft): $35,000 - (2 \times 1,480) = 35,000 - 2,960 = 32,040$ lbs. Total suspended weight = 31,400 lbs — within 32,040 lbs by 640 lbs. Lift percentage = $31,400 \div 32,040 = 98.0\%$ — requiring a critical lift plan and exceptional radius management given the 640-lb margin.

63. C — The note creates an absolute prohibition: lift-only capacity values may not be used for travel with load. Pick-and-carry operations have fundamentally different stability characteristics than stationary lifts — travel surface unevenness, dynamic acceleration loads, and turning forces all create conditions that the lift-only analysis did not address. The pick-and-carry section may show capacity dramatically lower than 88% of the lift-only value. The pick-and-carry section must be confirmed before any travel with the load.

64. D — The maximum rated radius for this configuration is 45 feet, confirmed by the blank cell at 50 feet. A planned operating radius of 47 feet exceeds this absolute boundary — no rated capacity exists at 47 feet regardless of the load weight. The load chart does not extend to 47 feet, meaning the structural and stability analysis for this configuration was not performed at that radius. The crane must be repositioned to 45 feet or less before any lifting proceeds.

65. D — Conservative approach: next larger tabulated radius beyond 32 feet = 35 feet, capacity = 30,200 lbs. Total suspended weight = 34,800 lbs. Lift percentage = 115.2% — the load exceeds the conservative capacity by 15.2%. None of the 5 planned lifts can proceed at 32 feet using the conservative approach. The operator must either reduce the total suspended weight to below 30,200 lbs or reposition to 30 feet or less where the 38,400-lb conservative capacity directly supports all 5 lifts.