

PART THREE: COMPREHENSIVE REVIEW EXAMINATIONS

Introduction

You have now completed the full learning journey through this study guide — from the foundational knowledge presented in Part One's fifteen chapters through the extensive domain-specific practice testing in Part Two's 1,075 questions spanning all four examination domains. Part Three represents the final stage of your preparation: two full-length simulated examinations designed to replicate the actual NCCCO Tower Crane Operator Written Examination as closely as possible.

Each comprehensive review exam contains 55 questions — the same number you will encounter on test day — drawn from all four domains in the same approximate proportions used by the NCCCO examination. Domain 1 (Site) contributes roughly 10% of the questions, Domain 2 (Erection, Climbing, and Dismantling) contributes approximately 25%, Domain 3 (Operations) makes up about 50%, and Domain 4 (Technical Knowledge) accounts for the remaining 15%. The questions are integrated across domains rather than grouped by topic, just as they appear on the actual certification exam, requiring you to shift between different knowledge areas as you work through each test.

These simulated exams serve a purpose that individual domain tests cannot. Throughout Part Two, you always knew which subject area was being tested — when you were working through Domain 3 practice tests, every question related to operations. On the actual NCCCO exam, you receive no such guidance. A question about load chart interpretation might be followed by a question about climbing procedures, then a question about wire rope inspection, and then a question about site hazards. This random integration tests not only your knowledge of each topic but your ability to recall the correct information without the contextual cues that topic-specific testing provides. The comprehensive review exams train you for exactly this experience.

To get the maximum benefit from these examinations, treat each one as a genuine test simulation. Find a quiet location free from distractions. Set a timer for 60 minutes — the same time allotment given on the actual NCCCO written exam. Put away your study materials, notes, and reference guides. Work through all 55 questions under timed conditions without looking up answers or returning to earlier chapters. Mark questions you are uncertain about but continue moving forward rather than spending excessive time on any single question. When you have completed the exam, check your answers against the answer key and carefully read the explanation for every question you missed.

Your score on these simulated exams provides the most realistic assessment of your readiness for the actual certification test. A consistent score of 80% or above across both exams indicates strong preparation

and a high likelihood of passing. Scores between 70% and 80% suggest you are approaching readiness but should review the specific topics where you missed questions before scheduling your exam. Scores below 70% indicate that additional study time with the Part One chapters and Part Two domain tests would significantly improve your chances of success.

Remember that the actual NCCCO Tower Crane Operator Written Examination does not permit the use of calculators. All questions are designed to be answered through knowledge, understanding, and professional judgment rather than mathematical computation. Trust the preparation you have invested in throughout this guide, manage your time wisely across all 55 questions, and approach each question with the confidence that comes from thorough study and genuine understanding of tower crane operations.

FULL-LENGTH SIMULATED EXAM 1

INSTRUCTIONS: This examination simulates the actual NCCCO Tower Crane Operator Written Examination. You have 60 minutes to complete all 55 questions. Calculators are not permitted. Select the single best answer for each question.

55 Questions / 60-Minute Format

1. Before setting up a tower crane on a construction site, what must be assessed about the ground where the crane will be positioned?
 - A. Only the surface flatness needs evaluation
 - B. The bearing capacity of the supporting surface must be verified to ensure it can support the crane's total imposed loads
 - C. Only the soil type needs to be identified
 - D. Ground assessment is only required for cranes over 200 feet tall

2. During a climbing operation, the wind speed reaches the manufacturer's maximum allowable limit for climbing. What action must be taken?
 - A. Continue climbing if the procedure is more than 50% complete
 - B. Speed up the climbing process to finish before winds increase further
 - C. Continue climbing at reduced speed
 - D. Stop the climbing operation immediately and secure the crane in its current configuration until wind conditions improve

3. The operator notices the LMI display shows 92% of rated capacity while placing a load. What is the appropriate response?

- A. Proceed with extreme caution, confirming the load weight and radius are within the chart values, and avoid any action that would increase the load moment
- B. Continue operations normally because the crane is not yet at 100%
- C. Immediately set the load down regardless of landing zone readiness
- D. Increase the trolley speed to place the load before capacity is reached

4. What is the minimum clearance distance required between any part of the crane or load and energized power lines up to 50 kV per OSHA regulations?

- A. 10 feet from the nearest power line
- B. 15 feet from the nearest power line
- C. 20 feet from the nearest power line
- D. 25 feet from the nearest power line

5. What is the correct procedure when the operator discovers a frayed trolley drive cable during the pre-shift inspection?

- A. Wrap the frayed area with tape and continue operations
- B. Take the crane out of service and report the condition for repair — a frayed drive cable can fail during operations causing loss of trolley control
- C. Continue operations but avoid maximum radius positions
- D. Only report the condition if fraying exceeds 25% of the cable diameter

6. What is the primary purpose of the anti-two-block device on a tower crane?

- A. It prevents the hook block from contacting the jib tip sheaves by stopping the hoist and activating a warning before a two-blocking condition occurs
- B. It prevents the load from swinging during hoisting
- C. It limits the crane's maximum swing speed
- D. It prevents the trolley from traveling past the jib tip

7. The crane's foundation is located near a recently excavated area. What hazard does this present?

- A. Excavations only affect the crane if they fill with water
- B. The excavation has no effect on the crane's foundation
- C. The excavation only affects mobile cranes, not tower cranes
- D. The excavation may have reduced the lateral support for the soil beneath the foundation, potentially compromising the foundation's bearing capacity and stability

8. What counterweight configuration must be used on a tower crane?

- A. Any available counterweight blocks that approximate the specified weight
- B. The maximum counterweight available to provide the greatest stability
- C. The exact configuration specified by the manufacturer for the crane's current jib length and tower height
- D. The minimum counterweight necessary to balance the jib's self-weight

9. What is the operator's first responsibility at the beginning of each shift?

- A. Perform a thorough pre-operational inspection of the crane and review the previous shift's log entries
- B. Begin lifting operations immediately to meet the construction schedule
- C. Test the crane at maximum capacity to verify all systems
- D. Contact the crane manufacturer to verify the load chart

10. During operations, the signalperson gives a signal the operator does not recognize. What should the operator do?

- A. Attempt to interpret the signal based on the signalperson's gestures
- B. Stop all crane movements and clarify the signal with the signalperson before proceeding
- C. Continue the current operation and ask about the signal afterward
- D. Ignore the unrecognized signal and wait for the next one

11. What is the purpose of the pendant lines on a hammerhead tower crane?

- A. They serve as the main hoisting ropes
- B. They provide electrical connections to the jib tip lights
- C. They anchor the crane's foundation to the ground
- D. They connect the jib tip and counter jib tip to the tower head apex, providing structural support that allows the jib to carry loads

12. The operator needs to shut down the crane and leave it unattended for the night. What is the correct procedure?

- A. Simply turn off the main power switch and exit the cab
- B. Lower the hook to the ground and turn off the power
- C. Position the hook at a safe height, release the swing brake to allow weathervaning, secure all controls, and follow the manufacturer's complete shutdown procedure
- D. Leave the crane in its current working position with all brakes engaged

13. What information must be verified before beginning any lift?

- A. The weight of the load, the weight of rigging and hook block, the radius at pickup and landing, and confirmation that the total suspended weight is within the load chart capacity at the most restrictive radius

- B. Only the weight of the load itself
- C. Only the radius at the landing position
- D. Only whether the LMI system is functioning

14. A crew member on the ground reports that the crane's mast appears to be leaning. What should the operator do?

- A. Continue operations if the LMI system is not showing any warnings
- B. Stop operations and have the mast's plumb condition measured by qualified personnel — an out-of-plumb mast affects the effective radius and may invalidate the load chart values
- C. Only investigate if the lean is visible from the cab
- D. Increase the counterweight to compensate for the lean

15. What is the maximum freestanding height of a tower crane determined by?

- A. The number of mast sections the site has available
- B. The height of the building being constructed
- C. Only the foundation size and type
- D. The manufacturer's engineering specifications based on the mast cross-section, base configuration, and loading conditions

16. What must the operator do when approaching the crane's maximum rated capacity during a planned critical lift?

- A. Rely solely on the LMI readings to confirm capacity
- B. Proceed quickly to minimize the time at high capacity
- C. Verify load weight independently, confirm all rigging weights, check the radius at every phase of the lift, and ensure all critical lift planning requirements are satisfied
- D. Only verify the load weight on the shipping manifest

17. The operator observes several broken wires protruding from the hoist rope during inspection. What determines whether the rope must be replaced?

- A. The number of broken wires counted within one rope lay length compared against the manufacturer's and regulatory removal criteria
- B. Whether the broken wires are sharp enough to cut gloves
- C. The age of the rope since installation
- D. Whether the broken wires are visible from more than 5 feet away

18. What is the correct procedure for positioning the trolley on a hammerhead crane to decrease the operating radius?

- A. Move the trolley outward away from the mast
- B. Move the trolley inward toward the mast, which decreases the radius and increases the available capacity
- C. Lower the jib angle to decrease radius
- D. Increase the reeving to decrease the effective radius

19. What type of brake is standard on tower crane hoist systems and why?

- A. A hydraulic disc brake because it provides the strongest clamping force
- B. A manual foot brake because the operator can control stopping force
- C. A centrifugal brake because it activates automatically at high speed
- D. A spring-applied, electrically released brake because it automatically engages when power is lost, providing fail-safe load holding

20. The operator is working on a site where another tower crane's swing radius overlaps with their crane's operating area. What coordination is required?

- A. Both cranes can operate freely within the overlapping area
- B. Only the lower crane's operator needs to monitor the overlap zone
- C. A zoning plan or anti-collision protocol must be established so both cranes never occupy the overlapping zone simultaneously
- D. The cranes can operate in the overlap zone if they are lifting different loads

21. What is the purpose of the electrical grounding system on a tower crane?

- A. It protects personnel from electrical shock by providing a low-resistance fault current path that triggers protective devices to disconnect power in the event of an electrical fault
- B. It prevents lightning from striking the crane
- C. It reduces the crane's electrical power consumption
- D. It protects the crane's paint from electrostatic damage

22. During operations, the operator notices an unusual grinding sound from the slewing gearbox. What action should be taken?

- A. Continue operations because slewing gearboxes commonly produce noise
- B. Stop slewing operations, report the sound, and have the gearbox inspected before resuming — grinding indicates potential gear or bearing damage
- C. Add lubricant to the gearbox and continue operations
- D. Only report the sound at the end of the shift

23. What is the proper hand signal for "stop" as specified by OSHA standard signals?

- A. Both arms extended outward with palms facing down, moving up and down

- B. One arm raised straight overhead with an open palm
- C. One arm extended horizontally to the side with the palm facing down, held motionless
- D. Both fists clenched in front of the chest

24. What is the correct conversion of a load weighing 3,500 kilograms to U.S. pounds?

- A. 1,590 pounds
- B. 3,500 pounds
- C. 5,250 pounds
- D. 7,700 pounds

25. The crane's anemometer indicates wind speeds are approaching the manufacturer's maximum operational limit. What should the operator do?

- A. Begin reducing operations, secure any suspended loads, prepare for shutdown, and cease all lifting when the limit is reached
- B. Continue operations until wind speed exceeds the limit by 10%
- C. Only stop operations if the load begins to swing
- D. Wait for the site supervisor to instruct a shutdown

26. What are the standard minimum and maximum tie-in spacing requirements based on?

- A. Universal standards that apply equally to all tower crane models
- B. The height of the building floors only
- C. The crane manufacturer's specifications for the specific crane model, mast type, and configuration
- D. Only the wind conditions expected at the site

27. During the pre-operational inspection, the operator discovers that the fire extinguisher in the cab has an expired inspection tag. What action is required?

- A. Continue operations because the extinguisher is probably still functional
- B. Report the expired extinguisher and have it inspected or replaced before beginning operations — an expired extinguisher cannot be relied upon in an emergency
- C. Only report it at the end of the shift
- D. Remove the extinguisher to reduce weight in the cab

28. What is the function of the climbing frame on a tower crane?

- A. It provides the operator with a platform for viewing climbing operations
- B. It connects the crane's mast to the building during climbing
- C. It houses the crane's electrical distribution panel
- D. It attaches to the mast and uses hydraulic cylinders to raise the upper structure so new mast sections can be inserted

29. A load is rigged with a sling that shows visible damage including crushed fibers and cuts in the webbing. What action must the operator take?

- A. Refuse to lift the load until the damaged sling is removed from service and replaced with an undamaged sling that meets the rigging requirements
- B. Proceed with the lift if the damage appears minor
- C. Lift the load at reduced capacity to compensate for the sling damage
- D. Wrap the damaged area with tape to reinforce the sling

30. What must the operator verify about the crane's configuration before consulting the load chart?

- A. Only the jib length needs to match the chart

- B. Only the counterweight configuration needs to match the chart
- C. The actual crane configuration — including jib length, reeving, counterweight arrangement, and tower height — must match the specific chart posted in the cab
- D. Configuration verification is only needed during initial erection

31. What electrical hazard must be identified during the site assessment before crane erection?

- A. Only underground electrical cables need to be identified
- B. The location, voltage, and clearance requirements of all overhead and underground power lines in and around the crane's operating area
- C. Only power lines that cross directly over the crane's foundation
- D. Electrical hazards are identified by the electrical contractor, not the crane operator

32. What does the term "load moment" represent in crane operations?

- A. The time required to lift a load to its maximum height
- B. The speed at which the load moves during swing
- C. The weight of the load alone
- D. The product of the total suspended weight multiplied by the radius, representing the overturning force the load creates on the crane

33. What information does the operator use to determine how many wraps of wire rope are on the hoist drum?

- A. Visual observation during each shift to confirm proper spooling and adequate dead wraps remain on the drum
- B. The LMI automatically tracks rope wraps
- C. Only the maintenance crew monitors rope wraps
- D. The number of wraps is only checked during annual inspections

34. What is the purpose of the LMI warning alarm on a tower crane?

- A. It alerts the operator when wind speed exceeds the limit
- B. It signals that the crane requires maintenance
- C. It warns the operator that the crane is approaching its rated capacity at the current radius, providing an opportunity to stop the operation before the capacity is exceeded
- D. It only activates during two-blocking conditions

35. The operator must lift a load and swing it 180 degrees to the landing area. During the swing, the load will pass over an area where workers are present. What action is required?

- A. Swing the load quickly to minimize the time over the workers
- B. Clear all workers from the area beneath the load's path before beginning the swing — no personnel should be positioned under a suspended load
- C. Sound the horn continuously during the swing to warn workers
- D. Only swing the load over workers if it is below 10 feet off the ground

36. What power source configuration is most commonly used on tower cranes?

- A. External electrical supply with individual electric motors for hoisting, slewing, and trolley travel
- B. A single diesel engine driving all crane functions
- C. Solar panels mounted on the jib
- D. Hydraulic motors powered by an engine-driven pump

37. What are the requirements for proper bolting during tower crane erection?

- A. Bolts only need to be hand-tightened during initial erection

- B. Any available bolt of the correct diameter may be used
- C. Bolts should be installed loosely to allow for thermal expansion
- D. All bolts must be the correct grade and size specified by the manufacturer, installed in every required location, and torqued to the specified values

38. The operator receives a request from the site superintendent to continue lifting operations even though wind speeds have exceeded the manufacturer's limit. What is the correct response?

- A. Follow the superintendent's instructions because they are responsible for the site
- B. Continue lifting lighter loads only
- C. Refuse to operate — the manufacturer's wind speed limit is an absolute restriction that overrides any instruction from site supervision
- D. Continue operations for no more than 30 additional minutes

39. What must be verified about the crane's wire rope during the pre-operational inspection?

- A. Only the rope's color and appearance
- B. The rope must be checked for broken wires, kinks, crushing, corrosion, proper spooling on the drum, and adequate dead wraps
- C. Only the rope's connection at the drum anchor
- D. Wire rope inspection is performed monthly, not daily

40. What is the correct procedure when the crane's hoist upper limit switch activates during operations?

- A. Stop hoisting immediately — the limit switch has activated because the hook block is approaching the jib tip sheaves, and continued hoisting would cause a two-blocking condition
- B. Override the limit switch to continue operations
- C. The limit switch activation is only a suggestion, not a requirement to stop
- D. Reset the limit switch and continue hoisting at reduced speed

41. During crane erection, what determines the proper position of the climbing collar on the mast?

- A. The climbing collar is placed at whichever mast joint is most accessible
- B. The erection crew selects the position based on convenience
- C. The climbing collar position is arbitrary as long as it is below the slewing unit
- D. The manufacturer's erection manual specifies the exact mast section and position for the climbing collar based on the crane's configuration

42. The operator notices that the crane's obstruction lights are not functioning at the beginning of the shift. What action is required?

- A. Continue operations because obstruction lights are only needed at night
- B. Report the failure immediately — obstruction lights are a required safety system and the appropriate authority must be notified, as inoperative lights may violate aviation safety regulations
- C. Only report the failure if the crane is near an airport
- D. Replace the bulbs personally before beginning operations

43. What is the correct procedure for verifying the weight of a load before lifting?

- A. Estimate the weight based on the load's visual size
- B. Rely on the rigging crew's verbal estimate
- C. Use verified sources such as shipping documents, manufacturer specifications, engineering calculations, or certified scales, and add rigging and hook block weight to determine total suspended weight
- D. Only verify weights for loads that appear to exceed the crane's capacity

44. What is the function of the overload relay in the crane's motor circuits?

- A. It protects motors from damage by tripping the circuit when current draw exceeds safe levels, indicating mechanical overload, electrical fault, or jammed components
- B. It increases motor power during heavy lifts
- C. It regulates the crane's swing speed automatically
- D. It monitors the crane's total energy consumption

45. What must be included in the pre-operational inspection of the crane's hook?

- A. Only the hook's paint condition
- B. Only whether the hook rotates freely
- C. Only the hook's weight
- D. Check for cracks, deformation, excessive throat opening, proper operation of the safety latch, and free rotation of the swivel

46. What is the standard procedure when the operator must temporarily leave the cab during the shift?

- A. Leave all controls in their current position
- B. Place all controls in neutral, ensure no load is suspended, engage all brakes, and notify appropriate personnel before leaving the cab
- C. Only engage the swing brake before leaving
- D. Leaving the cab during a shift is prohibited

47. What hazard does a public access area adjacent to the crane's operating zone present?

- A. Public areas have no effect on crane operations
- B. Public areas only need to be monitored during school hours

C. Loads must never be swung over public access areas, appropriate barriers and warning signs must be maintained, and the operator must be aware of pedestrian activity near the crane's operating zone

D. Only the site safety manager is responsible for public safety

48. A self-erecting tower crane must assess whether there is adequate room for its outriggers and tail swing. Why is this assessment critical?

A. It only affects the crane's appearance on the site

B. It determines which direction the crane must face

C. Outrigger and tail swing clearance only matters during transport

D. Inadequate outrigger space prevents the crane from being properly leveled and stabilized, and insufficient tail swing clearance creates a struck-by hazard for nearby structures, equipment, and personnel

49. What is the operator's responsibility regarding the crane's load chart?

A. The operator must understand how to read the chart, verify it matches the crane's actual configuration, and confirm that every lift's total suspended weight is within the rated capacity at the required radius

B. The load chart is the rigging crew's responsibility

C. The operator only needs to know the crane's maximum capacity

D. Load chart verification is only required during the annual inspection

50. What is the correct procedure when the operator observes water accumulating near the crane's foundation?

A. Water near the foundation is common and requires no action

B. Only report standing water that is more than 6 inches deep

C. Report the condition immediately — water accumulation can erode or soften the soil beneath the foundation, potentially undermining the crane's stability

D. Wait for the water to drain naturally before reporting

51. What does the crane's reeving configuration determine?

- A. Only the crane's maximum swing speed
- B. The trade-off between lifting capacity and hoisting speed — more parts of line increase capacity but decrease speed
- C. Only the color coding for different wire rope types
- D. Only the direction the drum rotates during hoisting

52. What must be confirmed about the crane's safety devices during the pre-operational inspection?

- A. All safety devices — including the LMI, anti-two-block device, hoist limit switches, anemometer, and all warning systems — must be confirmed operational before beginning lifting operations
- B. Only the LMI needs to be verified each shift
- C. Safety device checks are performed monthly, not daily
- D. Only devices that malfunctioned the previous day need checking

53. What is the purpose of releasing the swing brake when the crane is left unattended?

- A. To reduce wear on the swing brake pads
- B. To allow maintenance access to the slewing ring
- C. To conserve electrical power during unattended periods
- D. To allow the jib to weathervane freely with the wind, reducing wind loading on the crane structure during unattended periods

54. The operator must lift a load near the edge of the crane's maximum radius. What specific precaution applies?

- A. No special precautions are needed if the LMI is functioning
- B. Operations at maximum radius require no additional planning
- C. Verify the capacity at the exact maximum radius, account for potential load swing that could momentarily increase the radius beyond the jib tip, and recognize that capacity at maximum radius is at its lowest value
- D. Only the site engineer needs to approve maximum radius lifts

55. What fundamental principle governs the operator's authority regarding crane safety?

- A. The site superintendent has final authority on all crane safety decisions
- B. The operator has the authority and the responsibility to stop operations or refuse any lift they believe is unsafe, regardless of instructions from supervision
- C. Safety decisions are shared equally among all site personnel
- D. Only the crane manufacturer can authorize stopping crane operations

FULL-LENGTH SIMULATED EXAM 1: ANSWER KEY WITH EXPLANATIONS

- 1. B. Bearing capacity of the supporting surface must be verified to support the crane's total imposed loads** — The ground beneath a tower crane must support enormous forces — the crane's own weight, the weight of every lifted load, dynamic forces from operations, and wind forces, all concentrated through the foundation onto the supporting surface. Before erection begins, a geotechnical assessment must verify that the soil's bearing capacity can handle these combined loads without excessive settlement or failure. Different soil types have vastly different bearing capacities — solid rock can support massive loads while loose fill may be entirely inadequate. The assessment must also consider how soil conditions change with moisture content, seasonal variations, and the effects of nearby excavation or construction activities that could alter the soil's load-bearing characteristics over the crane's operational period.
- 2. D. Stop climbing immediately and secure the crane in its current configuration until winds improve** — Climbing operations are among the most vulnerable phases of tower crane work because the upper structure is temporarily separated from the mast and supported only by the climbing frame's hydraulic cylinders. Wind forces on the elevated upper structure — which presents an enormous surface area — create lateral loads that the climbing frame was not designed to resist during sustained high winds. The manufacturer's maximum wind speed for climbing is calculated based on the climbing frame's structural capacity and the stability of the crane in its mid-climb configuration. Exceeding this limit risks the upper structure shifting on the climbing frame, structural overload of the climbing components, or loss of control of the entire upper section. The crane must be secured in its current position with all climbing components locked until conditions improve.
- 3. A. Proceed with extreme caution, confirming load weight and radius are within chart values** — At 92% of rated capacity, the crane is operating within its design limits but has relatively little remaining margin. The operator should verify that the load weight, rigging weight, and radius have all been accurately determined, because any error in these values could mean the actual loading is higher than indicated. The operator should avoid any action that would increase the load moment — such as moving the trolley outward or allowing the load to swing — and should complete the placement with smooth, controlled movements. This is not an emergency requiring the load to be set down immediately, but it does require heightened awareness and precision. The 8% remaining margin is there to accommodate normal operational variables, not to invite additional risk.
- 4. C. 20 feet from the nearest power line** — OSHA regulations require a minimum clearance of 20 feet between any part of the crane — including the boom, jib, load line, and load — and energized

power lines carrying up to 50,000 volts (50 kV). This clearance distance accounts for the potential for electrical arcing through the air, the difficulty of judging distances accurately from the operator's cab at height, and the movement of the load and rigging during operations. For power lines carrying voltages above 50 kV, the required clearance increases by specified amounts for each additional voltage increment. These clearances are absolute minimums — many safety professionals recommend maintaining greater distances whenever possible because the consequences of power line contact are typically fatal.

5. **B. Take the crane out of service and report for repair** — The trolley drive cable is the mechanical link that moves the trolley along the jib, controlling the crane's operating radius. A frayed cable has lost a portion of its cross-sectional area and strength, and the fraying will accelerate rapidly once it begins because the broken strands can snag on sheaves and guides, tearing additional strands. A complete cable failure during operations would result in loss of trolley control — depending on the failure mode, the trolley could run uncontrolled to one end of the jib, suddenly changing the radius and load moment. The crane cannot be operated safely until the cable is replaced with one that meets the manufacturer's specifications.
6. **A. Prevents hook block from contacting jib tip sheaves by stopping the hoist and activating a warning** — The anti-two-block device is a critical safety system that prevents one of the most catastrophic tower crane failures. Two-blocking occurs when the hook block is hoisted until it contacts the jib tip sheaves, creating enormous overloads on the wire rope and sheave system that can cause the rope to break, dropping the load and hook block from full height. The anti-two-block device consists of a weighted switch suspended below the jib tip sheaves that detects the approaching hook block and triggers both a warning alarm and a hoist cutoff before contact occurs. This dual-action response — audible warning plus automatic hoist stop — provides two layers of protection against this potentially fatal condition.
7. **D. Excavation may have reduced lateral support for soil beneath the foundation, compromising stability** — Soil beneath a foundation derives part of its bearing capacity from the confining pressure of the surrounding soil. When an excavation removes soil near the foundation, this confining pressure is reduced on the excavation side, potentially allowing the soil beneath the foundation to shift laterally toward the open excavation. This lateral movement can cause the foundation to settle unevenly, tilting the crane and creating an out-of-plumb condition. In severe cases, the loss of lateral support can cause a bearing capacity failure where the soil beneath the foundation shears and moves toward the excavation, resulting in sudden, catastrophic foundation settlement. The proximity, depth, and orientation of excavations relative to the crane's foundation must be continuously monitored throughout the project.
8. **C. Exact configuration specified by the manufacturer for the crane's current jib length and tower height** — The counterweight configuration is precisely engineered for each specific combination of jib length and tower height. The counterweights serve two purposes — they balance the jib-side overturning moment to maintain stability, and they provide the correct loading

on the mast to ensure the structural forces remain within design limits. Too little counterweight reduces the crane's resistance to overturning on the jib side. Too much counterweight overloads the counter jib structure and creates an overturning risk on the counter jib side when the crane operates at minimum radius. The load chart values are calculated assuming the exact specified counterweight configuration — any deviation means the chart's capacity values are unreliable.

9. **A. Perform a thorough pre-operational inspection and review the previous shift's log** — The pre-operational inspection is the operator's systematic verification that the crane is safe to operate before any loads are lifted. This inspection covers every safety-critical system — structural components, wire rope condition, safety devices, controls, brakes, and overall crane condition. Reviewing the previous shift's log alerts the operator to any conditions reported by the previous operator that may require attention or monitoring. Together, these two activities ensure the operator has complete knowledge of the crane's current condition before accepting responsibility for its operation. Beginning lifting operations without completing the inspection risks operating a crane with undetected defects that could lead to equipment failure during a lift.
10. **B. Stop all crane movements and clarify the signal before proceeding** — Clear communication between the operator and signalperson is fundamental to safe crane operations. When the operator receives a signal they do not recognize, they have no way to know what action the signalperson is requesting. Attempting to interpret an unclear signal creates the risk of performing the wrong action — moving the load in the wrong direction, at the wrong speed, or toward an unsafe position. The universal rule for any communication uncertainty is to stop all crane movements immediately and maintain the current position until clear communication is re-established. This may involve radio communication, a face-to-face discussion, or simply waiting for the signalperson to repeat the signal using standard OSHA hand signals.
11. **D. Connect jib tip and counter jib tip to tower head apex, providing structural support for loads** — The pendant lines form the critical structural link between the jib system and the tower head that allows the jib to carry loads. Without pendant lines, the jib would be a simple cantilever beam supported only at its root connection — a configuration that could not support the loads required for construction work. The pendant lines create a triangulated structure where the jib carries compression while the pendant lines carry tension, dramatically increasing the system's capacity. The forces in the pendant lines are enormous — they carry the cumulative effect of the load weight, jib self-weight, and dynamic operational forces, all concentrated at their connection points at the tower head and jib tip.
12. **C. Position hook at safe height, release swing brake for weathervaning, secure controls, follow manufacturer's shutdown procedure** — The complete shutdown procedure addresses every aspect of leaving the crane safely unattended. Positioning the hook at a safe height ensures it does not pose a hazard to ground-level activities. Releasing the swing brake allows the jib to weathervane — rotating freely with the wind to present minimum resistance — which dramatically reduces the wind forces on the crane during unattended periods. Securing all controls in neutral

prevents any inadvertent function activation. Following the manufacturer's complete procedure ensures all model-specific requirements are met, including any unique locking mechanisms, electrical isolation steps, or positioning requirements for that particular crane. Failure to release the swing brake is the most critical omission because broadside wind on a locked jib can generate forces far exceeding what the crane was designed to withstand.

13. **A. Weight of load, rigging, and hook block, the radius at pickup and landing, and confirmation that total suspended weight is within capacity at most restrictive radius** — Every lift requires a complete capacity verification that accounts for all the variables that determine whether the crane can safely handle the operation. The total suspended weight includes everything hanging from the hook — the load itself, all rigging hardware, and the hook block weight. The radius must be verified at every phase of the lift because the capacity changes with radius — the capacity at the landing radius may be different from the capacity at the pickup radius, and the transit path may include radii with even lower capacity. The total suspended weight must be compared against the most restrictive capacity — the lowest capacity at any radius the load will pass through during the entire operation.
14. **B. Stop operations and have mast plumb measured by qualified personnel** — A visually apparent lean in a tower crane mast is a serious condition that requires immediate investigation. The load chart's capacity values are calculated assuming a perfectly vertical mast, and any lean changes the crane's geometry in ways that affect capacity. When the mast leans toward the load, the effective radius increases, meaning the actual load moment is greater than the instruments indicate. Even a small lean — measured in inches at the mast top — translates to meaningful changes in the effective radius at the jib tip level. Qualified personnel using precision instruments — theodolites, transits, or precision inclinometers — must measure the actual deviation and compare it against the manufacturer's tolerance. If the tolerance is exceeded, the crane must remain out of service until corrected.
15. **D. Manufacturer's engineering specifications based on mast cross-section, base configuration, and loading conditions** — The maximum freestanding height results from detailed structural engineering analysis specific to each crane model. The analysis considers the mast's ability to resist the combined bending forces from wind pressure, the overturning moments from loads at radius, and the compressive loads from the crane's self-weight. The mast's cross-section — its dimensions, member sizes, and connection details — determines its bending resistance. The base configuration — fixed, traveling, or ballasted — determines the foundation's ability to resist the moments transmitted to it. When the combined forces at the maximum freestanding height equal the mast's structural capacity, that height cannot be exceeded without adding lateral support through tie-in connections to the building.
16. **C. Verify load weight independently, confirm rigging weights, check radius at every phase, and ensure all critical lift requirements are satisfied** — Critical lifts — those approaching the crane's maximum rated capacity — require enhanced verification because the margin for error is

minimal. Independent weight verification means confirming the load weight through multiple sources rather than relying on a single estimate. All rigging component weights must be included in the total suspended weight calculation because at near-maximum capacity, even the rigging weight can push the total over the limit. The radius must be verified at every phase — pickup, transit, and landing — because the capacity changes with radius and the most restrictive radius governs the lift. All critical lift planning requirements — including engineering review, detailed lift plan documentation, and supervisor approval — must be completed before the lift begins.

17. **A. Number of broken wires within one rope lay length compared against removal criteria** — Wire rope deterioration is assessed quantitatively by counting broken wires within standardized lengths. A rope lay is the distance along the rope for the outer strands to complete one full spiral revolution around the core. Counting broken wires within this defined length provides a standardized measurement of the rope's localized deterioration. The removal criteria — established by the manufacturer, ASME standards, and OSHA regulations — specify the maximum number of broken wires permitted within one rope lay before the rope must be removed from service. This quantitative approach replaces subjective judgments about rope condition with measurable, repeatable criteria that ensure consistent safety standards regardless of who performs the inspection.
18. **B. Move the trolley inward toward the mast, decreasing radius and increasing capacity** — On a hammerhead tower crane, the operating radius is controlled by the trolley's position along the fixed horizontal jib. Moving the trolley toward the mast decreases the horizontal distance between the mast center and the hook — decreasing the radius. As the radius decreases, the load moment decreases for the same load weight, and the load chart shows higher capacity values at shorter radii. This relationship allows the operator to increase the crane's available capacity by positioning the trolley closer to the mast. The reverse is also true — moving the trolley outward increases the radius and decreases the available capacity. The operator must monitor the capacity at every trolley position throughout the lift.
19. **D. Spring-applied, electrically released brake because it automatically engages when power is lost** — This brake design is the industry standard for tower crane hoist systems because of its inherent fail-safe characteristics. The brake is held engaged by powerful springs in its default, unpowered state. Electrical power must be actively applied to an actuator to compress the springs and release the brake. This means any interruption in electrical power — from any cause including power failures, cable damage, control malfunctions, or emergency stops — results in the brake immediately engaging by spring force alone. The load is secured by mechanical force that requires no power, no operator action, and no functioning electronics. This design ensures the most critical safety function — holding the load — defaults to its safest state whenever anything goes wrong.
20. **C. A zoning plan or anti-collision protocol ensuring cranes never occupy the overlapping zone simultaneously** — When multiple tower cranes on a site have overlapping swing radii, the potential for collision between the cranes themselves or between one crane's load and the other

crane's structure creates a serious hazard. A formal coordination plan must be established that prevents both cranes from operating in the overlap zone at the same time. This may involve designating one crane as having priority while the other must wait, establishing communication protocols between operators, installing anti-collision systems that automatically prevent simultaneous operation in the shared zone, or defining specific operating windows for each crane. The plan must be clearly communicated to both operators and enforced throughout the project.

21. **A. Protects personnel from electrical shock by providing a fault current path that triggers protective devices** — The grounding system is the safety infrastructure that protects everyone who contacts the crane. Under normal conditions, all electrical current flows through designed circuits and the grounding system carries no current. When a fault occurs — a damaged wire energizes the crane structure, a motor winding fails, or moisture creates an unintended path — the grounding system provides a low-resistance path for fault current to flow to earth. This large fault current triggers protective devices — circuit breakers and ground fault interrupters — that disconnect power within fractions of a second. Without proper grounding, fault current would seek alternative paths to ground, potentially through any person who touches the crane while standing on the ground.
22. **B. Stop slewing, report the sound, and have the gearbox inspected before resuming** — An unusual grinding sound from the slewing gearbox indicates that internal components are not operating normally. Grinding typically results from damaged gear teeth, worn bearings, inadequate lubrication, or foreign material inside the gearbox. Continuing to operate with a damaged gearbox risks progressive damage that can lead to complete gear failure — which could result in uncontrolled swing of the upper structure, especially if the slewing brake also relies on the same gearbox. The operator's familiarity with the crane's normal sounds is a valuable diagnostic tool — when something sounds wrong, it usually is. Stopping operations and reporting immediately allows maintenance to diagnose and repair the problem before it progresses to a catastrophic failure.
23. **C. One arm extended horizontally to the side with the palm facing down, held motionless** — The OSHA standard hand signal for "stop" is a clear, unambiguous gesture designed to be visible and recognizable at a distance. The signalperson extends one arm straight out to the side at shoulder height with the palm facing down and holds this position motionless. The stillness of the gesture contrasts with the movement of other signals, making it instantly distinguishable even at the distances typical of tower crane operations. Every operator must know this and all other standard OSHA hand signals perfectly because misidentifying a stop signal as another command could result in continued crane movement when a hazardous condition requires immediate stoppage. The emergency stop signal — both arms extended with palms down — conveys even greater urgency.
24. **D. 7,700 pounds** — Converting kilograms to pounds requires multiplying by 2.2. A load of 3,500 kilograms equals $3,500 \times 2.2 = 7,700$ pounds. This conversion is critical when handling loads with metric weight markings — common with imported materials, international shipping, and

equipment manufactured outside the United States. If the operator mistakenly used 3,500 pounds without converting, they would underestimate the actual load by more than half, creating a potentially catastrophic overload condition. The total suspended weight would then include this 7,700-pound load weight plus the rigging weight and hook block weight, and the entire sum must be compared against the load chart capacity at the required radius.

25. **A. Begin reducing operations, secure suspended loads, prepare for shutdown, and cease lifting when limit is reached** — The approach to the manufacturer's wind speed limit should be gradual and proactive rather than abrupt. As wind speeds increase toward the limit, the operator begins taking precautionary steps — completing current lifts rather than starting new ones, securing any loads that are in transit, and preparing the crane for shutdown. Loads become increasingly difficult to control as wind speed increases, so reducing operations before the limit is reached improves safety during the transition period. When the anemometer reading reaches the manufacturer's limit, all lifting operations must cease — this limit is an absolute restriction based on the crane's structural capacity and stability, not a guideline subject to the operator's judgment.
26. **C. Manufacturer's specifications for the specific crane model, mast type, and configuration** — Tie-in spacing requirements are not universal standards that apply to all tower cranes — they are specific engineering requirements determined by the manufacturer for each crane model and configuration. The spacing is calculated based on the mast's structural capacity to resist lateral loads between tie-in points, the wind loading expected at the crane's height, and the forces generated by crane operations. Different crane models with different mast cross-sections have different spacing requirements, and the same crane model may have different spacing requirements for different configurations — a longer jib that generates greater operational loads may require closer tie-in spacing than a shorter jib configuration on the same mast.
27. **B. Report the expired extinguisher and have it inspected or replaced before beginning operations** — The fire extinguisher in the operator's cab is the only firefighting equipment available if a fire occurs at the top of the crane. An expired inspection tag means the extinguisher has not been verified as functional within the required maintenance interval — the pressure may have dropped below effective levels, the chemical agent may have settled and become unable to discharge properly, or the mechanism may have developed a fault. In the isolated environment of the crane cab, where a fire could block the only descent route and trap the operator at hundreds of feet above ground, a non-functional extinguisher provides a false sense of security that could have fatal consequences. The extinguisher must be confirmed functional before the operator begins work at height.
28. **D. Attaches to the mast and uses hydraulic cylinders to raise the upper structure for new section insertion** — The climbing frame is the specialized mechanism that enables the crane to increase its height incrementally as the building under construction grows taller. It consists of a steel framework that surrounds the mast, hydraulic cylinders with sufficient force to lift the entire upper structure — including the jib, counter jib, counterweights, slewing unit, and cab — and

guide systems that maintain alignment during the lift. The climbing sequence begins with the hydraulic cylinders raising the upper structure by the height of one mast section, creating a gap in the mast. A new section is then positioned in the gap — often lifted by the crane's own jib and slid horizontally into place — and bolted to the existing mast sections above and below. The climbing frame then lowers the upper structure onto the extended mast.

29. **A. Refuse to lift until the damaged sling is replaced with an undamaged sling** — A sling with visible damage — crushed fibers, cuts, excessive wear, or deformation — has lost an unknown percentage of its original capacity. Unlike wire rope, where broken wire counts provide quantitative removal criteria, synthetic sling damage is evaluated through visual assessment because the internal damage typically exceeds what is visible on the surface. Cuts in the webbing sever load-carrying fibers, and crushed areas indicate internal fiber damage from overloading or sharp contact. The operator cannot determine the remaining capacity of a damaged sling, and no reduction factor can be reliably applied to compensate for unknown damage. The only safe course is to remove the damaged sling from service and replace it with an undamaged sling that meets the rigging requirements for the lift.
30. **C. Actual configuration — jib length, reeving, counterweight, and tower height — must match the chart posted in the cab** — The load chart is calculated for one specific crane configuration. Every variable — jib length, reeving arrangement, counterweight placement, and tower height — affects the capacity values on the chart. If any element of the actual configuration differs from the chart, the capacity values are unreliable. A chart for a shorter jib shows capacities that do not apply to a longer jib. A chart for 4-part reeving shows higher capacities than are available with 2-part reeving. A chart for heavier counterweight shows greater stability than exists with lighter counterweight. The operator must verify the match between the physical crane and the posted chart at the beginning of every shift and after any configuration change.
31. **B. Location, voltage, and clearance requirements of all overhead and underground power lines** — The site assessment for electrical hazards must be comprehensive, identifying every power line — both overhead and underground — within and around the crane's entire operating area. The assessment must determine the voltage of each line because clearance requirements increase with voltage. Overhead lines are the most obvious hazard because the crane's jib, load line, and loads operate at height where contact is possible. Underground lines are a hazard during foundation construction because excavation can damage buried cables. The assessment must map the location of every line relative to the crane's swing radius, maximum radius, and all areas where the load might travel, and must establish specific procedures for maintaining required clearances during all phases of crane operations.
32. **D. Product of total suspended weight multiplied by radius, representing the overturning force** — Load moment is the fundamental engineering quantity that determines whether the crane is within its safe operating limits. It captures the combined effect of both critical variables — how heavy the load is and how far from the mast it hangs. A 10,000-pound load at 50 feet creates the

same 500,000 foot-pound load moment as a 5,000-pound load at 100 feet. The crane's structure and stability must resist this overturning force regardless of which combination of weight and distance creates it. The LMI continuously calculates the current load moment and compares it against the maximum allowable moment at the current radius, providing the operator with a percentage of capacity that reflects how close the crane is to its limits.

33. **A. Visual observation during each shift to confirm proper spooling and adequate dead wraps** — The operator monitors the wire rope's spooling pattern and dead wrap count through visual observation during every shift. Proper spooling means each wrap sits neatly against the previous wrap with no gaps, crossovers, or overlapping — any departure from this orderly pattern indicates a problem that could damage the rope or cause it to jump off the drum. The dead wrap count — the number of wraps remaining on the drum when the hook is at its lowest operational point — must maintain the required minimum of two wraps at all times. The operator watches the spooling during each lowering cycle, particularly when the hook approaches its lowest positions, to verify that adequate dead wraps remain and that the rope continues to spool properly.
34. **C. Warns that the crane is approaching rated capacity, providing opportunity to stop before exceeding limits** — The LMI warning alarm activates at a predetermined threshold below the rated capacity — typically around 90% — alerting the operator that continued increases in load weight or radius will approach the crane's limits. This early warning provides the operator time to assess the situation and take corrective action before the rated capacity is reached. The operator can verify the load weight, check the radius, and determine whether the operation can be completed within the remaining capacity margin. If the crane reaches 100% of rated capacity, the LMI typically activates a more urgent warning or begins restricting functions. The warning alarm is a planning tool that helps the operator manage capacity proactively rather than reactively.
35. **B. Clear all workers from beneath the load's path before beginning the swing** — OSHA regulations and fundamental crane safety principles prohibit personnel from being positioned beneath a suspended load at any time. Before the operator begins any swing that carries a load over an occupied area, all personnel in the load's path must be cleared and the area must be secured against re-entry for the duration of the swing. The signalperson, rigging crew, and site supervision all share responsibility for clearing the area, but the operator must verify clearance before beginning the swing. Sounding the horn provides an additional warning but does not substitute for physically clearing the area — people may not hear the horn, may not understand its meaning, or may not react quickly enough to move to safety.
36. **A. External electrical supply with individual electric motors for hoisting, slewing, and trolley travel** — Tower cranes use external electrical power because they remain in one location for extended periods and can be connected to the construction site's power supply. Each major function has its own dedicated motor, allowing independent control. The external supply provides virtually unlimited energy for continuous operations without the fuel storage, exhaust, and fire hazards of internal combustion engines. High-voltage power is delivered to the crane's base, transformed to

operating voltage, and distributed to each motor through the crane's internal wiring with individual protection circuits. The fixed power supply also eliminates the weight and maintenance requirements of carrying an engine and fuel system at the top of the crane.

37. **D. Correct grade and size per manufacturer's specification, installed in every required location, torqued to specified values** — Every bolted connection on a tower crane is a structural joint that must carry the forces generated by crane operations. Using the wrong bolt grade — which determines the bolt's strength — can result in a joint that fails under loads the crane is designed to handle. Missing bolts leave the remaining bolts overloaded. Insufficient torque allows the joint to slip under load, while excessive torque can stretch or break the bolt. The manufacturer specifies every detail of every connection — bolt grade, diameter, length, quantity, location, and torque value — based on engineering analysis of the forces each joint must carry. Deviation from any of these specifications compromises the structural integrity of the crane.
38. **C. Refuse to operate — the manufacturer's wind speed limit is absolute and overrides instructions from supervision** — The manufacturer's maximum operational wind speed is established through engineering analysis of the crane's structural capacity and stability under wind loading. Exceeding this limit subjects the crane to forces beyond its design capacity, risking structural failure, loss of load control, or overturning. No person on the construction site — regardless of their position or authority — can authorize operations that exceed the crane's design limits. The operator has both the authority and the professional obligation to refuse any instruction to operate beyond the manufacturer's specified limits. This authority is supported by OSHA regulations, ASME standards, and the crane manufacturer's requirements, and the operator's refusal is legally protected.
39. **B. Checked for broken wires, kinks, crushing, corrosion, proper spooling, and adequate dead wraps** — The daily wire rope inspection is a comprehensive visual assessment of the rope's condition covering every type of deterioration that can affect safety. Broken wires indicate fatigue from repeated bending and are counted against removal criteria. Kinks indicate permanent structural damage from improper handling. Crushing shows damage from spooling problems or pinch points. Corrosion indicates protective lubrication failure and ongoing material loss. Proper spooling on the drum prevents the crushing and jump-off hazards created by crossed wraps. Adequate dead wraps ensure the rope anchor connection remains secure. Each of these conditions must be assessed during every pre-operational inspection because any of them can progress to a dangerous level between shifts.
40. **A. Stop hoisting immediately — the limit switch activated because the hook block is approaching jib tip sheaves** — The hoist upper limit switch is a safety device that detects when the hook block has been raised to a dangerous proximity to the jib tip sheave assembly. When the limit switch activates, it indicates the crane is approaching a two-blocking condition — the point where the hook block contacts the sheaves, creating enormous overloads that can break the wire rope and drop the load. The operator must stop hoisting immediately and lower the hook to restore

safe clearance. The limit switch should never be overridden, reset, or ignored — it is the last line of defense before a catastrophic failure. If the limit switch activates unexpectedly during normal operations, the cause must be investigated because it may indicate a problem with the switch, the rope length, or the reeving configuration.

41. **D. Manufacturer's erection manual specifies the exact position based on the crane's configuration** — The climbing collar must be positioned at the precise mast location specified by the manufacturer because its position affects the structural loading on the mast during climbing operations. During a climb, the hydraulic cylinders transfer the full weight of the upper structure through the climbing collar into the mast sections below it. The mast must be capable of supporting this concentrated load at the collar's position, and the collar must be properly seated on the mast joint to distribute the force evenly into the mast structure. Positioning the collar at an incorrect location could place it where the mast section cannot support the concentrated load, or where the collar cannot engage properly with the mast geometry.
42. **B. Report immediately — obstruction lights are a required safety system and may violate aviation regulations** — Obstruction lights warn aircraft of the crane's presence in the airspace. Tower cranes are among the tallest structures on construction sites and often extend well above surrounding buildings, placing them in flight paths for helicopters and, near airports, fixed-wing aircraft. Inoperative obstruction lights mean the crane is effectively invisible to pilots at night or in reduced visibility conditions, creating a collision hazard. Aviation regulations administered by the FAA require obstruction marking and lighting on structures above certain heights, and failure to maintain these systems can result in regulatory violations and potentially catastrophic aircraft collisions. The failure must be reported to the appropriate authority immediately so alternative measures can be implemented.
43. **C. Use verified sources such as shipping documents, manufacturer specs, engineering calculations, or certified scales, adding rigging and hook block weight** — Accurate load weight determination is the foundation of every safe lift because the total suspended weight must be compared against the load chart capacity. Verified sources provide reliable weight information — shipping documents show the weight recorded when the item was manufactured or shipped, manufacturer specifications provide design weights, engineering calculations can determine weights from material properties and dimensions, and certified scales provide direct measurement. Verbal estimates and visual assessments are unreliable because people consistently underestimate the weight of construction materials. The total suspended weight must include everything hanging from the hook — the load, all rigging hardware, and the hook block weight — not just the load alone.
44. **A. Protects motors by tripping when current exceeds safe levels due to overload, fault, or jammed components** — The overload relay monitors the electrical current flowing to each motor and disconnects power when the current exceeds the motor's rated capacity. Excessive current generates heat in the motor windings — if allowed to continue, this heat destroys the winding

insulation, causing permanent motor failure. The overload relay prevents this damage by disconnecting power before dangerous temperatures are reached. Overload conditions can result from attempting to lift loads beyond the motor's capacity, from mechanical components that have seized or jammed and are resisting the motor's rotation, or from electrical faults that draw additional current through the motor circuit. The relay protects the motor in all of these scenarios.

45. **D. Check for cracks, deformation, excessive throat opening, safety latch operation, and swivel rotation** — The hook is the critical connection between the crane and every load it lifts. Cracks in the hook body indicate metal fatigue that can lead to sudden failure under load. Deformation — bending or twisting — shows the hook has been overloaded and its remaining capacity is uncertain. An increased throat opening — the distance between the hook tip and the hook body — indicates the hook has been stretched by overloading. The safety latch must close properly to prevent rigging from slipping off the hook during lifting. The swivel must rotate freely to prevent the wire rope from twisting as the load rotates. Any deficiency in these areas compromises the hook's ability to safely carry loads.
46. **B. Place controls in neutral, ensure no load is suspended, engage all brakes, and notify appropriate personnel** — Leaving the cab temporarily requires securing the crane in a condition that prevents any movement during the operator's absence. All controls must be in neutral to prevent inadvertent function activation. No load should be suspended because an unattended suspended load is a hazard — the load could shift, the wind could cause it to swing, or changes in conditions could create a danger that the absent operator cannot respond to. All brakes must be engaged to prevent drift in any function. Appropriate personnel must be notified so they know the crane is temporarily unattended and can avoid requesting lifts or entering the crane's operating area without the operator's awareness.
47. **C. Loads must never be swung over public areas, barriers and signs must be maintained, and the operator must monitor pedestrian activity** — Public access areas create a uniquely challenging hazard because members of the public — unlike construction workers — have no safety training, wear no protective equipment, and may not recognize the dangers of crane operations. They cannot be expected to watch for overhead hazards or respond to crane signals. The operator must never swing loads over public areas because a dropped load, fallen rigging, or any debris would strike unprotected people who had no warning. Physical barriers and warning signs must separate the crane's operating zone from public access. The operator must maintain constant awareness of pedestrian patterns near the crane's boundaries.
48. **D. Inadequate space prevents proper leveling and creates struck-by hazard** — Self-erecting tower cranes deploy outriggers to establish a stable, level base before the crane unfolds into its operating configuration. If the site does not provide adequate space for the outriggers to extend fully, the crane cannot be properly leveled and its stability is compromised — one or more outriggers may bear less load than designed, reducing the crane's resistance to overturning in that direction. The tail swing assessment addresses the counter jib's rotation path — as the crane

swings, the counter jib sweeps an arc behind the mast that can strike nearby structures, vehicles, fences, or personnel if adequate clearance is not maintained. Both assessments must be completed before the crane is positioned.

49. **A. Understand the chart, verify it matches the configuration, and confirm every lift is within capacity** — The load chart is the operator's primary reference for every capacity determination, and the operator must have complete mastery of how to read and apply it. Understanding includes knowing how to locate capacity values for specific radii, how to identify which chart applies to the current reeving configuration, how to account for different jib lengths, and how to apply any footnotes or special conditions. Verification ensures the chart posted in the cab matches the crane's actual physical configuration. Confirmation that every lift is within capacity requires the operator to determine total suspended weight, identify the most restrictive radius in the lift path, and compare the two values before every lift begins.
50. **C. Report immediately — water can erode or soften soil, undermining stability** — Water accumulation near the crane's foundation is a serious concern because water's effects on soil are progressive and can lead to sudden failure. Water saturating the soil reduces its bearing capacity — the ability to support the crane's concentrated loads. Flowing water can erode soil particles from beneath the foundation, creating voids that eventually collapse. Freeze-thaw cycles in water-saturated soil create expansion forces that can crack and displace foundation elements. Clay soils swell when wet and shrink when dry, creating uneven settlement. Even standing water without flow indicates drainage problems that will worsen over time. Early reporting allows the site team to address the drainage issue, protect the foundation, and prevent a gradual deterioration from becoming a sudden stability failure.
51. **B. Trade-off between capacity and hoisting speed — more parts of line increase capacity but decrease speed** — The reeving configuration represents a fundamental mechanical trade-off. Each additional part of line creates another rope segment sharing the load, reducing the tension in each segment and allowing heavier loads to be lifted without exceeding the rope's capacity. However, each additional part also requires more rope to be wound onto the drum for each foot the load rises — in 2-part reeving, 2 feet of rope per foot of lift; in 4-part reeving, 4 feet per foot. Since the drum rotates at the same speed regardless of reeving, the load rises proportionally slower with more parts of line. The crane's reeving is configured to balance the project's capacity requirements against the desired hoisting speed.
52. **A. All safety devices must be confirmed operational before beginning lifting operations** — Safety devices are the multiple layers of protection that prevent equipment failures, overloading, collisions, and other hazards from causing injuries or damage. Each device addresses a specific hazard — the LMI prevents overloading, the anti-two-block prevents rope failure from two-blocking, the hoist limit switches prevent over-travel, the anemometer monitors wind speed, and warning systems alert the operator and ground personnel to hazardous conditions. If any safety device is not functioning, the specific protection it provides is absent, and the operator is exposed

to the hazard it was designed to prevent. All devices must be verified during every pre-operational inspection because any device can fail between shifts.

53. **D. Allow the jib to weathervane freely with wind, reducing wind loading during unattended periods** — Weathervaning is the free rotation of the crane's upper structure to align the jib with the prevailing wind direction. When the jib points into the wind, it presents its minimum surface area — the narrow profile of the lattice structure — rather than its maximum surface area when broadside to the wind. This alignment dramatically reduces the wind force on the crane, reducing the overturning moment and the structural loads on the mast, foundation, and tie-in connections. Since wind conditions can change unpredictably during unattended periods — shifting direction, gusting, or increasing in speed — the swing brake must always be released so the jib continuously adjusts its orientation as conditions change.
54. **C. Verify capacity at exact maximum radius, account for load swing, and recognize capacity is at its lowest value** — Operations at maximum radius require heightened awareness because the crane's available capacity is at its absolute minimum at this position. Load swing is a particular concern because any swing carries the load momentarily beyond the maximum radius — past the jib tip — where no capacity exists. Even small amounts of swing at maximum radius can create a momentary overload that exceeds the crane's structural or stability limits. The operator must verify the exact capacity at the maximum radius, ensure the total suspended weight provides adequate margin below this capacity, and use exceptionally smooth control inputs to minimize load swing. If conditions — wind, load shape, or site factors — make load swing likely, the lift should be planned at a radius that provides sufficient margin.
55. **B. The operator has the authority and responsibility to stop operations or refuse any unsafe lift** — This principle is the cornerstone of crane safety. The operator is the only person who has complete, real-time awareness of the crane's condition, the loading, the environmental conditions, and the operational situation. They are positioned to see hazards that ground personnel may not notice and to detect crane behavior changes that indicate developing problems. This unique position gives the operator both the authority to stop operations when they identify a hazard and the professional responsibility to exercise that authority even when facing pressure from supervision, schedule demands, or peer expectations. This authority is established by OSHA regulations, ASME B30.3 standards, and the crane manufacturer's operating requirements, and no instruction from any person can override the operator's safety judgment.