

# FULL-LENGTH SIMULATED EXAM 2

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**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. A tower crane is being erected near an active airport. What specific site hazard must be addressed during the planning phase?

- A. Only the noise from aircraft must be considered
- B. Airport proximity has no effect on tower crane operations
- C. The crane's height may require coordination with aviation authorities regarding airspace restrictions, obstruction marking, and lighting requirements
- D. Only the crane's foundation design is affected by airport proximity

2. The operator arrives for the morning shift and discovers that the previous operator's log reports a sluggish trolley response. What is the correct first action?

- A. Investigate the condition during the pre-operational inspection before beginning any lifting operations to determine if the crane is safe to operate
- B. Begin lifting operations with lighter loads to test the trolley
- C. Ignore the log entry because the previous operator may have been mistaken
- D. Only address the issue if the sluggish response continues into the afternoon

3. During a climbing operation, the crew discovers that a mast section bolt hole does not align properly with the adjacent section. What action must be taken?

- A. Drill the hole to a larger diameter to allow the bolt to fit
- B. Leave that bolt out and tighten the remaining bolts more
- C. Force the bolt through with a hammer to achieve alignment
- D. Stop the climbing operation and resolve the alignment issue per the manufacturer's procedures before continuing — all bolts must be properly installed

4. What is the crane operator's responsibility when a signalperson leaves their designated position during an active lift?

- A. Continue the lift using the last signal received
- B. Stop all crane movements immediately and wait until the signalperson returns to their position or a qualified replacement is in place
- C. Complete the current lift cycle and then stop operations
- D. Switch to radio communication with any available ground worker

5. What is the purpose of the 30-30 rule regarding lightning safety for tower crane operations?

- A. If the time between seeing lightning and hearing thunder is 30 seconds or less, operations must cease, and operations should not resume until 30 minutes after the last observed lightning or thunder
- B. Operations must stop when lightning is within 30 miles of the site
- C. The crane must be shut down for 30 minutes every 30 hours during storm season
- D. The operator must count to 30 after each lightning flash before deciding to continue

6. A load is being lifted and the operator notices the crane's mast is vibrating more than normal. What should the operator do?

- A. Continue operations because some vibration is normal during lifting
- B. Increase the hoisting speed to reduce the duration of vibration
- C. Only investigate if the vibration continues for more than 10 minutes
- D. Carefully set the load down, stop operations, and report the unusual vibration for investigation — abnormal mast vibration may indicate a structural or foundation problem

7. What determines the correct load chart to use when a tower crane has been reconfigured with a different jib length?

- A. The operator selects the chart with the highest capacity values
- B. The previous jib length chart can still be used with a safety factor
- C. The load chart must match the crane's current jib length, reeving configuration, counterweight arrangement, and tower height exactly
- D. Any chart for that crane model can be used regardless of jib length

8. What is the minimum number of dead wraps of wire rope required on the hoist drum when the hook is at its lowest point?

- A. Zero — the rope can be fully unwound if needed
- B. A minimum of two dead wraps must remain on the drum to maintain the friction that secures the rope anchor connection
- C. One wrap is sufficient for standard operations
- D. Five wraps are required for all tower crane configurations

9. The operator receives a radio message from a ground worker requesting a lift. The designated signalperson is not present. What should the operator do?

- A. Proceed with the lift using the ground worker as a temporary signalperson
- B. Begin the lift and have the signalperson join the operation in progress
- C. Proceed if the ground worker is wearing a hard hat and safety vest
- D. Refuse to begin the lift until a qualified, designated signalperson is in position to direct the operation

10. What is the primary function of the LMI system on a tower crane?

- A. It continuously monitors the load weight and radius, calculates the percentage of rated capacity being used, and warns the operator when the crane approaches its capacity limits
- B. It controls the crane's hoisting speed automatically
- C. It records the operator's daily work hours
- D. It monitors the weather conditions at the crane's location

11. What is the proper procedure when the crane's anti-two-block warning activates during hoisting?

- A. Override the warning and continue hoisting slowly
- B. Ignore the warning if the hook block is not visually close to the jib tip
- C. Stop hoisting immediately, lower the hook to restore safe clearance, and investigate why the warning activated at that point in the operation
- D. Switch to a different reeving configuration and continue

12. A heavy rainstorm has ended and the operator prepares to resume operations. What must be checked before lifting resumes?

- A. Only the anemometer needs to be checked for proper function

B. Verify ground conditions near the foundation, check for water accumulation, inspect the crane for any storm damage, confirm all safety devices are operational, and assess current weather conditions before resuming

C. Only verify that the rain has completely stopped

D. Resume operations immediately because rain does not affect tower crane performance

13. What unit conversion must the operator perform when a load is marked in kilograms but the load chart is in U.S. pounds?

A. Divide the kilogram value by 2.2

B. No conversion is needed because kilograms and pounds are equal

C. Multiply the kilogram value by 3.28

D. Multiply the kilogram value by 2.2 to obtain the weight in pounds

14. What is the operator's responsibility regarding the crane's obstruction lighting system?

A. Verify that all obstruction lights are functioning during the pre-operational inspection and report any failures immediately because inoperative lights may violate aviation safety regulations

B. Obstruction lights are only checked during annual inspections

C. Only the electrical contractor is responsible for obstruction lights

D. Obstruction lights are only required for cranes near airports

15. The crane's hoist brake is not holding the load consistently — the load slowly drifts downward when the hoist control is in neutral. What action is required?

A. Continue operations using the hoist motor to hold the load at the desired height

B. Adjust the brake while the crane is in operation

C. Stop operations immediately and take the crane out of service — a brake that does not hold the load is an imminent hazard requiring repair before any further lifting

D. Only report the condition if the drift rate exceeds 6 inches per minute

16. What is the purpose of the slewing limit switch on a tower crane?

A. It controls the maximum speed of the swing function

B. It monitors the wind direction for weathervaning

C. It measures the weight applied to the slewing ring

D. It prevents the upper structure from rotating beyond a predetermined arc, protecting power cables and other systems from damage due to excessive rotation

17. The operator must lift a load that partially blocks the view of the landing zone. What procedure must be followed?

A. Proceed slowly and estimate the load's position relative to the landing zone

B. A qualified signalperson must be positioned where they can see both the load and the landing zone, and must direct the operator through the entire placement using standard signals

C. Only use the crane's cameras to guide the placement

D. Have the rigging crew shout directions from the landing zone

18. What must the operator understand about the relationship between wind speed at ground level and wind speed at the jib height?

A. Wind speed at jib height is typically significantly higher than at ground level due to the absence of ground-level obstructions, and the anemometer at the jib provides the accurate reading for operational decisions

B. Wind speed is identical at all heights

C. Wind speed at ground level is always higher than at jib height

D. Wind speed only matters at ground level where workers are present

19. What is the purpose of the trolley limit switches at the inner and outer positions of the jib?

- A. They control the trolley motor speed at different positions
- B. They measure the load weight at the trolley position
- C. They prevent the trolley from traveling beyond the safe operating range of the jib, stopping the trolley before it reaches the jib tip or the mast
- D. They activate the LMI system when the trolley changes position

20. What factor primarily determines whether a tower crane requires tie-in connections to the building?

- A. The number of floors the building will have
- B. The weight of the heaviest load the crane will lift
- C. The distance from the crane to the nearest building
- D. Whether the crane's height exceeds its maximum freestanding height, requiring lateral support from the building to resist wind and operational forces

21. A crane component shows visible cracking during inspection. What action is required regardless of the crack's size?

- A. Monitor the crack during each shift to see if it grows
- B. Take the crane out of service and report the crack — any visible cracking in a structural component requires engineering evaluation before the crane can return to service
- C. Apply weld repair and return to service
- D. Only report cracks that are longer than 2 inches

22. What is the function of the hoist rope equalizing sheave?

- A. It distributes the wire rope tension evenly between multiple rope falls, ensuring each part of line carries an equal share of the load

- B. It measures the rope tension for the LMI system
- C. It prevents the rope from twisting during hoisting
- D. It controls the speed at which the rope pays out from the drum

23. What specific hazard does operating near other cranes present beyond the risk of crane-to-crane collision?

- A. Operating near other cranes only presents a visual distraction
- B. The only concern is the noise from multiple cranes operating simultaneously
- C. Other cranes only create a hazard during nighttime operations
- D. A load or rigging from one crane can collide with the mast, jib, or ropes of the other crane, and wind-induced swing of loads can extend the collision zone beyond the normal operating radius

24. The operator must use tag lines to control a load during placement. What are the requirements for tag line use?

- A. Tag lines can be any available rope or wire
- B. Tag lines should be attached to the crane's structure for better leverage
- C. Tag lines must be non-conductive when working near power lines, long enough to allow ground workers to control the load from a safe position, and handled only by personnel trained in their use
- D. Tag lines are optional and used only at the operator's preference

25. What is the purpose of the crane's free-slew mode?

- A. It increases the crane's lifting capacity during operations
- B. It allows the jib to rotate freely with the wind when the crane is not operating, reducing wind loading on the structure
- C. It allows faster swing speeds during active lifting
- D. It enables the crane to rotate continuously in one direction without limit

26. What must the operator verify about the crane's foundation before each shift?

- A. Check for visible signs of settlement, cracking, erosion, water accumulation, or any changes from the previous shift that could indicate foundation distress
- B. Foundation checks are only performed during erection
- C. Only the site engineer checks the foundation
- D. Foundation conditions only need monitoring during the first month after erection

27. What is the correct action when the operator discovers the load chart posted in the cab is illegible or damaged?

- A. Rely on memory of the chart values from previous shifts
- B. Use a load chart from a similar crane model
- C. Estimate capacity based on the LMI readings alone
- D. Stop operations and obtain a legible, correct replacement chart — the operator must be able to read and verify capacity values for every lift

28. What is the correct procedure for performing a trial lift?

- A. A trial lift is only required for loads exceeding 90% of rated capacity
- B. Trial lifts are the rigger's responsibility, not the operator's
- C. Lift the load a few inches off the ground, hold the position to verify brake function, check load stability and balance, confirm the crane's response, and verify the LMI readings before proceeding with the full lift
- D. Quickly hoist the load to working height to test all systems simultaneously

29. What must the operator understand about the crane's electrical power requirements?

- A. The crane can operate on any available electrical supply

B. The electrical supply must provide the correct voltage, phase, and amperage for the crane's systems, and inadequate power can cause reduced function speeds, motor overheating, and system failures

C. Electrical requirements are only the electrician's concern

D. The crane adjusts automatically to any power supply variation

30. What is the purpose of the crane's horn or audible warning device?

A. It provides an audible warning to alert ground personnel of crane movements, load transit, and potential hazards, and the operator must sound it before initiating any movement that could endanger workers

B. It is only used to signal the beginning and end of the shift

C. It is only used during emergency stop situations

D. It signals the signalperson to give the next hand signal

31. The operator observes ice forming on the wire rope during cold weather operations. What hazard does this present?

A. Ice on the rope only affects its appearance

B. Ice only affects the rope if operations continue for more than 4 hours

C. Ice improves the rope's grip on the drum and sheaves

D. Ice increases the rope's diameter causing it to jam in sheave grooves, adds weight that must be included in capacity calculations, and can mask visual indicators of rope damage during inspection

32. What is the operator's responsibility when working near buildings with occupied spaces?

A. Occupied buildings have no effect on crane operations

B. Only the building owner needs to be concerned about crane proximity

C. The operator must be aware that loads must not be swung over occupied areas, increased vigilance is required for load control near occupied spaces, and the crane's operating plan must account for the safety of building occupants

D. Only swing loads over occupied spaces during non-business hours

33. What information does the crane's anemometer provide to the operator?

A. The anemometer measures the load weight on the hook

B. The anemometer measures the current wind speed at the crane's jib height, providing the data the operator needs to compare against the manufacturer's operational wind speed limits

C. The anemometer measures the air temperature for weather forecasting

D. The anemometer measures the crane's swing speed

34. A lift requires the load to pass through a floor opening in the building. What specific planning is required?

A. Verify the opening dimensions are adequate for the load with clearance on all sides, establish clear communication with workers at every level, ensure no personnel are positioned below the opening during the lift, and plan for the restricted visibility during the transit through the opening

B. Floor opening lifts require no special planning beyond normal procedures

C. Only verify that the opening is large enough for the load to fit through

D. Only the rigging crew needs to plan for floor opening lifts

35. What must the operator do if they experience sudden dizziness or illness while operating the crane with a suspended load?

A. Continue operating until the current lift is complete

B. Ask a ground worker to climb up and take over operations

C. Wait 10 minutes to see if symptoms improve before taking action

D. Carefully set the load down using the safest available method, secure the crane, notify site personnel of the condition, and do not attempt to climb down until it is safe to do so

36. What is the maximum allowable wind speed for crane operations determined by?

- A. A universal speed limit that applies to all crane types
- B. The specific crane manufacturer's engineering analysis for the crane model and configuration being operated
- C. The site superintendent's assessment of wind conditions
- D. The general weather forecast for the construction area

37. What is the function of the counterweight on a tower crane?

- A. It provides additional lifting capacity at maximum radius
- B. It protects the counter jib from wind damage
- C. It balances the overturning moment created by loads on the jib side, providing the crane with stability against tipping
- D. It serves as storage space for maintenance equipment

38. The crane's electrical disconnect switch trips during operations. What is the correct response?

- A. Verify the load is secure on the ground or held by the brake, do not attempt to re-energize the circuit without determining the cause of the trip, and report the condition for electrical investigation
- B. Immediately reset the switch and resume operations
- C. Reset the switch up to three times before reporting
- D. Only report the trip if it happens more than once in the same shift

39. What is the correct procedure for securing the crane at the end of the work day?

- A. Simply turn off the power and exit the cab
- B. Lower the hook to the ground and leave all controls in their operating position

C. Only engage the swing brake and exit

D. Position the hook at a safe height clear of obstructions, release the swing brake to allow weathervaning, place all controls in neutral, engage all appropriate brakes, follow the manufacturer's complete shutdown procedure, and exit using proper fall protection

40. A load's center of gravity is off-center. What effect does this have on the lift?

A. An off-center center of gravity only affects the load's appearance during the lift

B. The load will tilt toward the heavy side when lifted, creating unequal sling tensions, potential sling failure, and difficulty controlling the load's orientation and swing

C. An off-center center of gravity has no effect if proper slings are used

D. Only loads weighing more than 10,000 pounds are affected by off-center gravity

41. What must the operator verify about the rigging before any lift?

A. Only the color of the rigging needs to be verified

B. Only the rigging crew verifies rigging — the operator has no responsibility

C. The rigging must be appropriate for the load weight, properly configured, free from visible damage, and all connections must be secure before the operator takes tension on the load

D. Rigging verification is only required for lifts exceeding 50% of rated capacity

42. What does a tower crane's load chart tell the operator about capacity at different radii?

A. It provides the maximum allowable load at each specific radius, with capacity values decreasing as radius increases due to the increasing overturning moment

B. It shows only the crane's maximum capacity regardless of radius

C. It provides the speed at which loads should be hoisted at each radius

D. It shows the minimum load required to maintain crane stability at each radius

43. The crane's LMI system malfunctions during operations. What action is required?

- A. Continue operations using the load chart for manual capacity calculations
- B. Continue operations at 75% of rated capacity
- C. Only stop operations if the malfunction causes false alarms
- D. Stop lifting operations — the LMI is a required safety device, and the crane must not be used for lifting until the system is repaired and functioning properly

44. What is the proper response when the operator observes ground settlement near one corner of the crane's foundation?

- A. Settlement near the foundation is normal and requires no action
- B. Stop operations and report the settlement immediately — uneven foundation settlement can cause the mast to go out of plumb and may indicate a developing foundation failure
- C. Only report the settlement if it exceeds 6 inches
- D. Add gravel to the settled area and continue operations

45. What is the operator's responsibility when a lift plan specifies a designated landing zone?

- A. The landing zone designation is a suggestion, not a requirement
- B. Only the signalperson is responsible for the landing zone
- C. Place the load precisely within the designated zone, ensuring the area is clear of personnel, the load path avoids overhead obstructions, and the ground or surface can support the load's weight
- D. The operator only needs to get the load close to the designated zone

46. How does a luffing jib crane change its operating radius?

- A. By raising or lowering the angle of the jib relative to the horizontal — raising the jib decreases the radius while lowering the jib increases the radius

- B. By moving a trolley along the jib
- C. By extending or retracting a telescoping jib section
- D. By rotating the entire crane on its base

47. What is the purpose of the crane's travel rail system on a rail-mounted tower crane?

- A. It provides a pathway for maintenance vehicles to reach the crane base
- B. It supports the crane's electrical cables along the ground
- C. It serves as a drainage system around the crane's foundation
- D. It allows the crane to reposition along a defined path, extending its effective working range beyond what a fixed-base crane could cover from a single position

48. What must the operator do when they observe an unauthorized person climbing the crane?

- A. Continue operations and let site security handle the situation
- B. Stop all crane operations immediately, attempt to warn the person through the horn or radio, and notify site supervision and safety personnel
- C. Only stop operations if the person reaches the jib level
- D. Unauthorized climbing is the responsibility of site management only

49. What is the correct conversion of 50 meters to feet?

- A. 100 feet
- B. 250 feet
- C. Approximately 164 feet
- D. 50 feet

50. What distinguishes a critical lift from a routine lift?

- A. A critical lift typically involves a load that approaches the crane's rated capacity, requires a written lift plan, engineering review, and enhanced verification procedures because the reduced margin for error demands more rigorous planning
- B. Critical lifts are only those that involve personnel platforms
- C. Any lift over 10 feet high is classified as critical
- D. Critical lifts are defined solely by the load's dollar value

51. What specific hazard do self-erecting tower cranes present that does not apply to larger fixed-base tower cranes?

- A. Self-erecting cranes cannot operate in wind
- B. Self-erecting cranes have no load charts
- C. Self-erecting cranes are not subject to OSHA regulations
- D. Self-erecting cranes may travel on wheels, requiring assessment of travel path ground conditions, and their lighter weight makes them more susceptible to overturning from wind forces or uneven ground

52. What is the operator's responsibility regarding communication systems during crane operations?

- A. Communication equipment is the signalperson's responsibility only
- B. Only radio communication is acceptable for tower crane operations
- C. The operator must ensure a reliable communication system — whether hand signals, radio, or other method — is established and tested before beginning operations, and must stop work if communication is lost
- D. Communication systems are only needed during critical lifts

53. The crane's swing function responds erratically — sometimes fast, sometimes slow, with occasional jerking. What action is required?

- A. Continue operations because variable swing speed is normal in windy conditions
- B. Stop slewing operations and report the erratic behavior — inconsistent swing response indicates a potential electrical, mechanical, or control system fault that could result in loss of load control
- C. Only report the condition if the jerking is severe enough to swing the load
- D. Adjust the swing speed controls and continue operations

54. What is the operator's final responsibility at the end of every shift?

- A. Complete the shift log documenting the crane's condition, any operational issues, maintenance needs, and safety concerns, and ensure the crane is properly secured for the unattended period
- B. Only log the number of lifts completed during the shift
- C. Only report conditions that prevented operations during the shift
- D. Shift documentation is optional if no problems occurred

55. What overarching principle should guide every decision the tower crane operator makes?

- A. Meeting the construction schedule is the operator's primary obligation
- B. The crane's productivity output determines the quality of the operator's decisions
- C. The operator should defer all safety decisions to site supervision
- D. The safety of all personnel on and around the site takes absolute priority over every other consideration, and no schedule pressure, production demand, or instruction from supervision can justify compromising safety

# FULL-LENGTH SIMULATED EXAM 2: ANSWER KEY WITH EXPLANATIONS

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- 1. C. Crane height may require coordination with aviation authorities regarding airspace restrictions, marking, and lighting** — Tower cranes near airports extend into airspace that may be used by aircraft during approach, departure, or pattern flight. The Federal Aviation Administration requires notification when structures exceed certain height thresholds or are located within specified distances from airports. This notification triggers an aeronautical study that determines whether the crane poses a hazard to air navigation and what mitigation measures are required. Obstruction marking — typically painting the jib and mast in alternating orange and white bands — makes the crane visible during daylight. Obstruction lighting — red or white beacons — provides visibility at night and during reduced visibility conditions. These requirements must be addressed during the planning phase because they affect the crane's configuration, erection timeline, and ongoing operational requirements.
- 2. A. Investigate the condition during the pre-operational inspection before any lifting operations** — The previous operator's log entry serves as a direct communication to the incoming operator about a condition that may affect crane safety. A sluggish trolley response could indicate a drive cable problem, motor malfunction, gearbox issue, track obstruction, or electrical fault — any of which could worsen and lead to loss of trolley control during operations. The incoming operator must investigate this reported condition as part of their pre-operational inspection, testing the trolley function and evaluating whether the condition has changed since it was reported. Beginning lifting operations without investigating a known reported condition means accepting an unknown risk that the previous operator specifically flagged as abnormal.
- 3. D. Stop climbing and resolve the alignment issue per manufacturer's procedures before continuing** — Every bolt hole in a tower crane mast section is precisely located by the manufacturer to align with its mating section. When holes do not align, it indicates that the sections are not properly seated, the wrong sections are being joined, a section is rotated incorrectly, or a component has been damaged or distorted. Forcing a bolt through a misaligned hole — by hammering, enlarging the hole, or bending the connection — damages the structural integrity of the joint and may create a connection that cannot carry its design loads. Omitting the bolt leaves the remaining bolts overloaded. The climbing operation must stop while the erection crew identifies the cause of the misalignment and resolves it according to the manufacturer's procedures, which may involve repositioning the section, checking for damage, or consulting the manufacturer's engineering support.

4. **B. Stop all crane movements immediately and wait until the signalperson returns or a qualified replacement is in position** — The signalperson serves as the operator's eyes on the ground, providing critical visual information about the load, the landing zone, and the safety of personnel in the work area. When the signalperson leaves their position, the operator loses this essential information link and cannot safely continue the operation. The operator has no reliable way to verify ground conditions, personnel positions, or load clearances without the signalperson's guidance. Continuing based on the last signal received ignores the possibility that conditions may have changed — workers may have entered the load zone, the landing area may have become obstructed, or a new hazard may have developed. All crane movements must cease until qualified signal direction is restored.
5. **A. If time between lightning and thunder is 30 seconds or less, cease operations; do not resume until 30 minutes after last lightning or thunder** — The 30-30 rule provides a practical, field-applicable method for making lightning safety decisions. Sound travels approximately one mile in five seconds, so a 30-second interval between lightning and thunder indicates the strike occurred approximately six miles away — within the range where the next strike could reach the crane's location. Tower cranes are typically the tallest structures on a construction site, making them extremely attractive targets for lightning strikes. The 30-minute waiting period after the last observed lightning or thunder accounts for the well-documented tendency of lightning to strike from seemingly clearing skies after the main storm has passed. Premature resumption of operations during this period has resulted in fatalities on construction sites.
6. **D. Carefully set the load down, stop operations, and report unusual vibration for investigation** — Abnormal mast vibration during lifting indicates that the crane's structural system is responding differently than designed. Possible causes include foundation settlement creating an unstable base, loose mast connections allowing relative movement between sections, tie-in connection problems reducing lateral support, structural member damage changing the mast's stiffness, or resonance conditions where the operational forces excite the mast's natural frequency. Any of these conditions represents a potentially serious structural concern that could worsen rapidly under continued loading. The operator should carefully set the load down to remove the operational forces contributing to the vibration, stop operations to prevent further stress on the affected components, and report the condition so qualified personnel can investigate the cause.
7. **C. Load chart must match current jib length, reeving, counterweight, and tower height exactly** — The load chart is calculated for one specific crane configuration, and every variable affects the capacity values. A chart for a 200-foot jib shows different capacities than a chart for a 165-foot jib because the jib's weight, the pendant line geometry, and the structural loading all change with jib length. The reeving configuration affects the maximum capacity each part of the rope system can support. The counterweight arrangement affects the crane's stability against overturning. The tower height affects the mast's structural loading. When any of these elements changes, a new chart corresponding to the actual configuration must be posted and used. Operating with the wrong chart means every capacity determination is based on incorrect values.

8. **B. Minimum of two dead wraps to maintain friction securing the rope anchor connection** — The dead wraps are the wraps of rope that remain on the drum when the hook is at its lowest operational position. Their primary function is to generate friction between the rope and the drum surface that holds the rope's anchor termination in place. The rope end is attached to the drum through a clamp or wedge, but this termination is designed as a secondary retention — the friction from the dead wraps provides the primary holding force. Without adequate dead wraps, the full load tension would act directly on the termination, which could slip or fail under loads well below the crane's rated capacity. Two wraps provide sufficient friction under all normal loading conditions.
9. **D. Refuse to begin the lift until a qualified, designated signalperson is in position** — OSHA regulations and safe crane operating practices require a qualified signalperson to direct crane operations whenever the operator cannot see the load, the landing zone, or the path of travel, or whenever conditions warrant signal direction for safety. The signalperson must be qualified — trained in standard OSHA hand signals and knowledgeable about crane operations — and designated — formally assigned to direct the specific crane for the specific operation. A ground worker who happens to be nearby does not meet these requirements. Beginning a lift without proper signal direction puts workers at risk because the operator has no reliable means of receiving the ground-level safety information essential for safe load handling.
10. **A. Continuously monitors load weight and radius, calculates percentage of rated capacity, and warns when approaching limits** — The Load Moment Indicator is the crane's primary electronic safety system that provides continuous, real-time information about the crane's loading condition. The LMI measures or calculates the total load weight — typically through tension sensors on the rope or structural load cells — and determines the current radius from the trolley position or jib angle. It multiplies these values to calculate the current load moment, compares this against the crane's rated capacity at that radius, and displays the result as a percentage of rated capacity. When this percentage approaches the limit — typically triggering a warning at around 90% and a cutoff at 100% — the LMI activates audible and visual alarms to alert the operator.
11. **C. Stop hoisting immediately, lower the hook to restore clearance, and investigate why the warning activated** — The anti-two-block warning indicates the hook block is approaching dangerous proximity to the jib tip sheaves. Continued hoisting beyond this point would cause the hook block to contact the sheaves — a two-blocking condition that generates enormous forces capable of breaking the wire rope and dropping the load from full height. The operator must stop hoisting the instant the warning activates and lower the hook to restore safe clearance. Investigation is important because if the warning activated at an unexpected point — when the hook was not near maximum height — it may indicate a problem with the anti-two-block device, a change in rope length from reeving modifications, or a drum spooling issue that has effectively shortened the available rope.

12. **B. Verify ground conditions, check for water, inspect for storm damage, confirm safety devices, and assess current weather** — Resuming operations after a severe storm requires a comprehensive evaluation because the storm may have affected multiple aspects of the crane and site. Heavy rain can erode or saturate the soil near the foundation, reducing its bearing capacity. Wind during the storm may have damaged crane components, shifted rigging, or displaced safety barriers. Lightning may have damaged electrical systems or safety devices. Standing water near the foundation indicates drainage problems that threaten long-term stability. All safety devices must be tested because electrical surges or water intrusion during the storm could have caused malfunctions. Current weather conditions must be assessed because additional storms may be approaching.
13. **D. Multiply kilograms by 2.2 to obtain pounds** — This is one of the most critical unit conversions in crane operations. One kilogram equals approximately 2.2 pounds, so a load marked at any weight in kilograms must be multiplied by 2.2 to determine its weight in pounds for comparison against a U.S. customary load chart. For example, a load marked at 5,000 kilograms weighs approximately 11,000 pounds. Failing to perform this conversion — or performing it incorrectly — creates a dangerous discrepancy between the operator's assumed load weight and the actual weight. Using the kilogram value directly on a pound-based chart would underestimate the actual weight by more than half, potentially causing a catastrophic overload.
14. **A. Verify all obstruction lights are functioning during pre-operational inspection and report failures immediately** — Obstruction lights warn aircraft of the crane's presence in the airspace, and their proper function is a regulatory requirement that the operator verifies during each pre-operational inspection. Inoperative lights mean the crane is invisible to pilots during darkness or reduced visibility, creating a collision hazard that could result in fatalities both in the air and on the ground. The verification is straightforward — the operator confirms that all required lights are illuminated and functioning correctly. Any failure must be reported immediately because the regulatory implications extend beyond the construction site to aviation safety. Alternative measures — such as issuing a Notice to Airmen — may need to be implemented while repairs are made.
15. **C. Stop operations immediately and take the crane out of service — a brake that does not hold is an imminent hazard** — The hoist brake is the most critical safety component on the tower crane because it is the sole device that prevents a suspended load from falling when the hoist motor is not actively running. When the brake drifts — allowing the load to slowly descend without the operator commanding downward movement — it means the brake is not generating sufficient clamping force to hold the load against gravity. This condition will only worsen as the brake surfaces continue to deteriorate. A complete brake failure would result in an uncontrolled load drop from whatever height the load has reached. No amount of operational caution can compensate for a defective hoist brake — the crane must be immediately taken out of service until the brake is repaired and tested.

16. **D. Prevents the upper structure from rotating beyond a predetermined arc, protecting power cables and other systems** — The slewing limit switch restricts the crane's rotation to a defined arc, preventing the upper structure from rotating beyond the point where the power cables, control cables, and any other connections between the rotating upper structure and the fixed mast would be twisted beyond their capacity. These cables are typically arranged with enough slack to accommodate the crane's normal operating arc, but unlimited rotation in one direction would progressively twist and ultimately break these connections. The slewing limit switch stops the swing before the rotation limit is reached, and the operator must swing in the opposite direction to continue operations in the restricted zone.
17. **B. A qualified signalperson must be positioned to see both the load and landing zone, directing the operator with standard signals** — When the load blocks the operator's view of the landing zone, the operator cannot see the critical information needed for safe placement — the exact position of the load relative to the target, the presence of workers in the area, the clearance from obstructions, and the readiness of the landing surface. A qualified signalperson positioned where they have a clear view of both the load and the landing zone provides this essential visual link. The signalperson guides the operator through the entire placement sequence using standard hand signals, maintaining continuous communication until the load is safely on the ground. This requirement applies to any situation where the operator's direct view is obstructed, not just large loads.
18. **A. Wind speed at jib height is significantly higher than ground level, and the jib-mounted anemometer provides the accurate reading** — Wind speed increases with height because ground-level obstructions — buildings, terrain, vegetation — create friction that slows the wind near the surface. At the jib height of a tower crane — often 200 to 400 feet above ground — these obstructions have no effect, and the wind flows at significantly higher speeds. The difference can be substantial — wind speed at jib height may be 50% or more higher than at ground level. The anemometer is mounted at the jib specifically to measure the wind speed at the height where the crane operates. Ground-level wind observations are unreliable for crane safety decisions because they significantly underestimate the forces the crane and load are actually experiencing.
19. **C. Prevent trolley from traveling beyond the safe operating range of the jib** — The trolley limit switches are positioned at the inner and outer extremes of the trolley's travel path to prevent the trolley from running off either end of the jib. If the trolley traveled past the outer limit, it could reach the jib tip where the structural support transitions to the pendant line connection — an area not designed for the concentrated trolley wheel loads. If it traveled past the inner limit, it could collide with the mast or slewing unit. The limit switches stop the trolley motor before these positions are reached, and the operator must reverse direction to continue. These switches also serve as backup protection if the operator misjudges the trolley's position or if a control malfunction causes unintended trolley movement.

20. **D. Whether crane height exceeds maximum freestanding height, requiring lateral support from the building** — The maximum freestanding height is the tallest the crane can safely stand without external lateral support. When the project requires the crane to extend beyond this height, tie-in connections must be installed between the mast and the building's structural frame. These tie-ins transfer the lateral forces on the mast — from wind pressure and operational loads — into the building's structure, which is massively more rigid and heavy than the crane's mast alone. The decision to install tie-ins is based solely on the crane's engineering limits, not on general factors like building floor count or load weight. Each crane model has a specific maximum freestanding height determined by the manufacturer's structural analysis.
21. **B. Take crane out of service and report — any visible cracking requires engineering evaluation** — Visible cracking in any structural component of a tower crane is an extremely serious finding because it indicates the material has failed locally and the crack will propagate under continued loading. Cracks in structural steel grow under cyclical loading — every lifting cycle, every wind gust, and every crane movement applies stress that drives the crack deeper into the material. The rate of crack growth accelerates as the crack lengthens because the remaining cross-section carries more stress. What begins as a small surface crack can propagate to complete fracture under normal operating loads. The crane must be immediately taken out of service because no field assessment can reliably determine the crack's depth, its growth rate, or the component's remaining capacity. Only a qualified engineer using appropriate inspection methods can evaluate the condition.
22. **A. Distributes wire rope tension evenly between multiple rope falls** — In multi-part reeving systems, the wire rope passes through multiple sheaves at the jib tip and hook block, creating several parallel rope falls that share the load. Ideally, each fall carries an equal share, but in practice, friction in the sheaves causes the falls nearest the hoist drum to carry slightly more tension than those farther away. The equalizing sheave compensates for this imbalance by allowing the rope to adjust between the falls, distributing the tension more evenly. This equalization reduces the peak tension in any single fall, extends the rope's service life by preventing one section from wearing faster than others, and ensures the reeving system achieves its designed mechanical advantage.
23. **D. Load or rigging from one crane can collide with the other crane's structure, and wind-induced swing extends the collision zone** — The hazard from multiple cranes extends well beyond the visible crane structures themselves. Suspended loads swing in response to wind, crane movement, and operational dynamics, and this swing carries the load — and its rigging — outward from the crane's normal operating position. A load swinging from one crane can reach well beyond the expected radius and contact the mast, jib, ropes, or load of an adjacent crane. This collision can damage structural components, cut wire ropes, dislodge loads, or create chain-reaction failures affecting both cranes. The effective collision zone is therefore larger than the simple geometric overlap of the cranes' swing radii, and anti-collision planning must account for load swing amplitudes under expected wind conditions.

24. **C. Non-conductive near power lines, long enough for safe control distance, handled only by trained personnel** — Tag lines serve a critical load control function by allowing ground workers to guide a suspended load's rotation and swing without directly contacting the load at height. When operating near power lines, tag lines must be made of non-conductive material — typically polypropylene or similar synthetic rope — because a conductive tag line could transmit electrical current from a power line contact through the load to the person holding the tag line. The tag line must be long enough to allow the handler to maintain a safe distance from the load during all phases of the lift. Only personnel trained in proper tag line handling should use them because improper technique — wrapping the line around hands, attaching it to the body, or pulling against the crane's movement — can drag the handler off their feet or into the load's path.
25. **B. Allows jib to rotate freely with wind when not operating, reducing wind loading** — Free-slew mode disengages the slewing brake and slewing drive, allowing the crane's upper structure to rotate freely under wind force. When the jib is free to rotate, it naturally aligns with the wind direction — presenting its narrow profile rather than its broad side — dramatically reducing the wind force on the crane. This reduced loading decreases the stress on the mast, foundation, and tie-in connections during unattended periods when the operator is not present to monitor conditions. Free-slew mode must be engaged whenever the crane is left unattended — whether for the night, weekends, or any extended period — because wind conditions can change unpredictably and a locked jib caught broadside by strong winds can generate forces far exceeding the crane's design limits.
26. **A. Check for visible settlement, cracking, erosion, water accumulation, or changes indicating foundation distress** — The foundation transfers every force the crane generates into the ground, and any deterioration of the foundation or the soil beneath it compromises the crane's safety. The operator's daily check is a visual assessment that looks for changes from the previous day — new cracks in concrete, settlement that has progressed, erosion from water flow, standing water indicating drainage problems, or any other visible change in the foundation's condition. These visual indicators provide early warning of developing problems that can be addressed before they progress to dangerous levels. The check takes only minutes but provides critical daily monitoring of the structure that supports the entire crane.
27. **D. Stop operations and obtain a legible, correct replacement chart** — The load chart is the operator's primary reference for every capacity determination, and it must be readable and verifiable for every lift. An illegible or damaged chart means the operator cannot confirm the rated capacity at specific radii, cannot verify that the chart matches the crane's configuration, and cannot make reliable capacity comparisons. Relying on memory, using a chart from a different crane, or estimating from LMI readings alone are all unacceptable because each introduces the risk of error in the one calculation that must be correct for every lift. Operations must stop until a legible chart that matches the crane's exact current configuration is obtained and posted in the cab.

28. **C. Lift a few inches, hold to verify brake, check stability and balance, confirm crane response, verify LMI before proceeding** — The trial lift is a controlled test that verifies multiple safety factors before the load is raised to working height and transported to the landing zone. Lifting just a few inches — enough to take the full weight on the crane but close enough to the ground for a safe set-down — allows the operator to verify the hoist brake holds the load without drift, confirms the load is stable and balanced on the rigging, checks that the crane responds normally to the load, and verifies the LMI reading matches the expected values. If any of these checks reveals a problem — brake drift, load tilt, unexpected crane response, or LMI readings that don't match the calculated load — the load can be safely set back down from a few inches rather than from working height.
29. **B. Electrical supply must provide correct voltage, phase, and amperage, and inadequate power causes reduced speeds, overheating, and failures** — Tower cranes are designed for specific electrical supply characteristics — voltage, phase configuration, and available amperage. The motors, controls, and safety systems all depend on receiving power within the specified parameters. Low voltage causes motors to draw more current to maintain their output, generating excess heat that damages windings. Incorrect phase configuration can cause motors to run backward or not start at all. Insufficient amperage limits the power available for simultaneous functions, causing reduced speeds during combined operations and potential overheating of supply cables and connections. The operator must understand these requirements to recognize symptoms of power supply problems — sluggish performance, tripping breakers, or overheating motors — that indicate the electrical supply is inadequate.
30. **A. Provides audible warning to alert ground personnel of crane movements, load transit, and potential hazards** — The crane's horn is the operator's primary means of communicating warnings to ground personnel who may not be looking at the crane. The operator sounds the horn before initiating any movement that could endanger workers — starting a swing, beginning a hoist, moving the trolley, or transiting a load over areas where workers may be present. The horn alerts workers to look up, assess the situation, and move to safety if necessary. On busy construction sites where multiple activities occur simultaneously, workers may be focused on their own tasks and unaware that the crane is about to move a load over their area. The horn provides the audible warning that cuts through the ambient noise and redirects their attention to the overhead hazard.
31. **D. Ice increases diameter causing sheave jamming, adds weight to capacity calculations, and masks rope damage indicators** — Ice formation on wire rope creates multiple hazards that compound each other. The increased diameter from ice buildup can cause the rope to jam in sheave grooves that were sized for the rope's nominal diameter, creating point loads that damage both the rope and the sheave. The weight of ice accumulation on the rope adds to the total suspended weight, and on a long rope length, this added weight can be significant. Ice coating the rope surface conceals visual indicators of rope damage — broken wires, corrosion, and deformation become invisible beneath the ice layer, preventing the operator from conducting an effective visual

inspection. Additionally, ice on the rope can shed unpredictably during operations, creating falling ice hazards for ground personnel.

32. **C. Operator must be aware loads must not swing over occupied areas, with increased vigilance and operating plans accounting for occupant safety** — Operating near occupied buildings adds a layer of responsibility because the people inside those buildings are exposed to risk from crane operations without the awareness, training, or protective equipment that construction workers have. A dropped load, fallen rigging, or any debris striking an occupied building could injure or kill people who had no knowledge of the crane operations occurring outside. The operator must plan every lift to avoid swinging loads over occupied spaces, must maintain enhanced load control to prevent swing toward the building, and must recognize that the consequences of any crane malfunction are amplified by the presence of unprotected occupants. The crane's operating plan should include specific restrictions on operations near occupied structures.
33. **B. Measures current wind speed at jib height, providing data for comparison against manufacturer's operational limits** — The anemometer is the operator's objective measurement tool for the one environmental condition that most directly affects tower crane safety — wind speed. Mounted at or near the jib, it measures the wind speed at the height where the crane operates, which is significantly higher than wind speed at ground level. The operator compares the anemometer reading against two critical thresholds — the manufacturer's maximum operational wind speed for normal lifting and any reduced limits for specific operations like climbing or handling high-windage loads. This comparison is not a judgment call — when the anemometer reading reaches the manufacturer's limit, operations must cease regardless of how conditions appear from the cab or how the crane seems to be handling the wind.
34. **A. Verify opening dimensions with clearance, establish communication at every level, clear personnel below, and plan for restricted visibility** — Lifting loads through floor openings is one of the most challenging tower crane operations because it combines restricted clearance, limited visibility, and multiple exposure zones. The opening must provide adequate clearance on all sides of the load to prevent the load from contacting the edges — which could damage the building structure, snag the load, or create an uncontrolled situation. Workers must be cleared from every level below the opening because a dropped load or displaced debris would fall through to the lowest level. Communication must be established with spotters at the opening level who can see the load's position relative to the edges. The operator's visibility is severely restricted during the transit through the opening, making the signalperson's guidance essential for safe placement.
35. **D. Carefully set load down, secure the crane, notify personnel, and do not attempt descent until safe** — Sudden illness or dizziness while operating a crane at height presents two immediate dangers — the risk of making an error that causes a crane incident, and the risk of falling during descent. The operator's first priority is to safely manage the suspended load by carefully placing it on the ground or a stable surface. Once the load is secure, the operator secures the crane with all

controls in neutral and brakes engaged. Notification allows ground personnel to arrange assistance — whether medical response, an escort for descent, or an alternative plan if the operator cannot safely climb down. Attempting to descend the crane while dizzy or disoriented creates a severe fall hazard even with fall protection equipment, because impaired coordination can lead to missteps on the ladder and improper engagement with the safety climb system.

36. **B. Specific crane manufacturer's engineering analysis for the crane model and configuration** — Maximum operational wind speed is not a universal value that applies to all tower cranes — it is determined by each manufacturer for each crane model based on structural engineering analysis. The analysis considers the wind forces on the crane's specific structure — jib length and type, mast cross-section, counter jib configuration — and the additional forces from wind acting on a suspended load. Different crane models and different configurations of the same model may have different wind speed limits. The manufacturer's analysis also accounts for the dynamic effects of gusting wind, the reduced stability at maximum radius, and the combined loading from wind and operational forces. The operator must know and comply with the specific limit for their crane's actual configuration.
37. **C. Balances the overturning moment created by loads on the jib side, providing stability against tipping** — Counterweights serve a precise engineering function — they create a stabilizing moment on the counter jib side that opposes the overturning moment created by loads on the jib side. When a load is lifted at radius, it creates a moment that tends to tip the crane toward the load. The counterweights, positioned at a specific distance behind the mast on the counter jib, create an opposing moment that resists this tipping tendency. The counterweight configuration is calculated to provide adequate stability across the full range of the crane's operating conditions — from maximum load at minimum radius to lighter loads at maximum radius. The specified counterweight for each jib configuration represents the precise balance between adequate stability and acceptable structural loading.
38. **A. Verify load is secure, do not re-energize without determining the cause, and report for electrical investigation** — An electrical disconnect trip during operations indicates that a protective device has detected an abnormal condition — overcurrent, ground fault, short circuit, or other electrical anomaly. The trip is a safety response, not a nuisance event. The operator's first concern is the load — if a load was suspended, the spring-applied brakes should have engaged automatically, but this must be verified. Re-energizing the circuit without determining the cause of the trip may re-expose the system to the same fault, potentially causing equipment damage, fire, or electrical shock to personnel. The cause must be diagnosed by a qualified electrician before power is restored. Repeated resetting of a tripped disconnect without investigation can damage equipment and create increasingly dangerous conditions.
39. **D. Position hook clear of obstructions, release swing brake for weathervaning, neutralize controls, engage brakes, follow manufacturer's procedures, exit with fall protection** — The end-of-shift securing procedure is a comprehensive sequence that addresses every aspect of

leaving the crane safely unattended. Positioning the hook at a safe height ensures it does not interfere with ground-level activities. Releasing the swing brake allows weathervaning to reduce wind forces during unattended periods. Placing all controls in neutral prevents inadvertent function activation. Engaging appropriate brakes — hoist and trolley — secures these functions against drift. Following the manufacturer's complete procedure ensures model-specific requirements are met. Using proper fall protection during the descent is the final safety consideration — the operator must be protected against falls during every descent, including the last one of the day when fatigue may affect coordination.

40. **B. Load tilts toward heavy side, creating unequal sling tensions, potential sling failure, and difficulty controlling orientation and swing** — When a load's center of gravity is not centered beneath the hook, the load tilts when lifted because gravity pulls the heavy side downward. This tilt creates unequal forces in the rigging — the sling on the heavy side carries more than its share of the load while the sling on the light side carries less. If the sling on the heavy side is loaded beyond its capacity, it can fail, causing the load to fall or shift violently. The tilted load is also more difficult to control because its asymmetric weight distribution makes it more susceptible to swing and rotation. Proper rigging for off-center loads requires positioning the hook point directly above the center of gravity, which may mean using unequal sling lengths or adjustable rigging to achieve a level lift.
41. **C. Rigging must be appropriate for load weight, properly configured, free from damage, and all connections secure** — The rigging is the critical link between the crane and the load, and its integrity directly determines whether the load can be safely lifted and transported. The operator's verification begins with confirming the rigging is rated for the load weight — every sling, shackle, and hardware component has a rated capacity that must exceed the forces it will experience. The configuration must be correct for the load — proper sling angles, appropriate hitch types, and adequate load distribution. All components must be visually inspected for damage — cuts, abrasion, deformation, corrosion, or any condition that reduces capacity. All connections must be secure — pins fully seated, safety latches closed, shackle pins tight, and hooks properly engaged. The operator performs this verification before taking tension on the load.
42. **A. Maximum allowable load at each specific radius, with capacity decreasing as radius increases** — The load chart is the definitive reference that tells the operator the maximum load the crane can safely lift at every operating radius. The chart is organized with radius values along one axis and corresponding capacity values — representing the maximum allowable total suspended weight at each radius. The fundamental pattern is decreasing capacity with increasing radius, reflecting the load moment relationship — as the load moves farther from the mast, the overturning moment increases for the same weight, requiring the allowable weight to decrease to keep the moment within the crane's structural and stability limits. The operator must be able to quickly locate the capacity for any radius and compare it against the planned lift's total suspended weight.

43. **D. Stop lifting operations — LMI is a required safety device that must be functional** — The LMI is the crane's primary electronic system for preventing overloading, and it is classified as a required safety device that must be operational during lifting operations. Without the LMI, the operator loses continuous, real-time monitoring of the crane's loading condition — the percentage of rated capacity, the automatic warning when approaching limits, and the capacity cutoff that prevents exceeding rated values. While the operator can make manual capacity calculations using the load chart, these calculations cannot replicate the LMI's continuous monitoring as conditions change during a lift — radius changes, load swing, and dynamic effects all cause moment-by-moment variations that only the LMI can track in real time. Operations must cease until the LMI is repaired and verified.
44. **B. Stop operations and report immediately — uneven settlement can cause mast lean and may indicate foundation failure** — Foundation settlement at one corner means the crane's base is no longer level, and the mast is tilting toward the settled corner. This tilt changes the crane's geometry — the effective radius shifts, the load chart values become unreliable, and the mast may exceed its out-of-plumb tolerance. More critically, progressive settlement at one corner often indicates that the soil beneath that corner is failing — either from inadequate bearing capacity, water erosion, or lateral soil movement. This type of failure tends to accelerate because the tilt concentrates more load on the already-failing corner, increasing the settlement rate. The crane must be taken out of service immediately so the foundation can be evaluated by a qualified engineer before the settlement progresses to a catastrophic failure.
45. **C. Place load precisely within the zone, ensure area is clear, verify load path avoids obstructions, and confirm surface can support the weight** — The designated landing zone represents the planned, engineered location for the load, and the operator's responsibility extends beyond simply setting the load down in the general area. Precise placement ensures the load ends up where the construction plan intended, supported by a surface or structure that has been verified to carry its weight. The area must be clear of all personnel because a load being set down can shift, tip, or settle unexpectedly. The load path — the entire route from pickup to landing — must be clear of overhead obstructions that could snag the load or rigging. The landing surface must be capable of supporting the load's concentrated weight without failure.
46. **A. By raising or lowering the jib angle — raising decreases radius, lowering increases radius** — The luffing jib crane changes its operating radius through a fundamentally different mechanism than the hammerhead crane. Instead of moving a trolley along a fixed horizontal jib, the luffing jib crane raises or lowers the entire jib structure by changing the angle between the jib and the horizontal plane. When the jib is raised to a steeper angle, the jib tip moves inward and upward, decreasing the horizontal distance from the mast to the load — decreasing the radius. When the jib is lowered to a shallower angle, the jib tip moves outward, increasing the radius. This mechanism allows the luffing jib crane to dramatically reduce its footprint by raising the jib to a near-vertical position, making it ideal for congested sites where the crane's reach must be controlled in specific directions.

47. **D. Allows the crane to reposition along a defined path, extending effective working range beyond a fixed position** — A rail-mounted tower crane sits on a travel base that rides along a pair of steel rails installed at the construction site. This travel capability allows the crane to reposition itself along the rail path, effectively extending its working range to cover areas that a fixed-base crane at a single location could not reach. This is particularly valuable for long, linear structures — such as extended buildings, bridge approaches, or industrial facilities — where a single crane position cannot provide adequate coverage for the entire structure. The rails must be properly installed on a prepared foundation, maintained level and at the correct gauge, and equipped with end stops and anchoring systems to prevent the crane from running off the rails.
48. **B. Stop all operations immediately, warn the person through horn or radio, and notify site supervision and safety** — An unauthorized person on the crane structure is in extreme danger — they have no fall protection, no knowledge of the crane's hazards, and no communication with the operator. If the crane operates while someone is on the structure, they could be struck by moving components, caught in rotating machinery, electrocuted by crane electrical systems, or thrown from the structure by sudden movements. The operator must stop all operations immediately to eliminate the risk of crane movement while the person is on the structure. Warning through the horn alerts the person that they have been noticed. Notification of site supervision and safety personnel initiates the response needed to safely remove the person from the crane and address the security failure that allowed unauthorized access.
49. **C. Approximately 164 feet** — Converting meters to feet requires multiplying by 3.28. A distance of 50 meters equals  $50 \times 3.28 = 164$  feet. This conversion is necessary when working with international equipment specifications, metric site plans, or loads with metric dimension markings. The operator must perform this conversion accurately because incorrect distance values feed directly into capacity calculations — using a radius of 50 when the chart is in feet would indicate a capacity far higher than what the crane actually has at 164 feet. Mental approximation — rounding 3.28 to 3.3 — provides sufficient accuracy for quick field estimates ( $50 \times 3.3 = 165$  feet), but precise calculations should use the full conversion factor.
50. **A. Approaches rated capacity, requires written lift plan, engineering review, and enhanced verification due to reduced margin** — Critical lifts are distinguished from routine lifts by their proximity to the crane's capacity limits and the corresponding reduction in margin for error. While there is no single universal definition, most organizations define critical lifts as those exceeding a specified percentage of rated capacity — typically 75% to 90%. At these loading levels, the margin between the planned load and the crane's maximum capacity becomes small enough that normal operational variables — weight estimation errors, radius measurement uncertainty, wind effects, and dynamic loading — could push the crane beyond its limits. The enhanced planning requirements — written lift plan, engineering review, independent weight verification, and additional supervisory oversight — address this reduced margin by eliminating as many variables as possible before the lift begins.

51. **D. Self-erecting cranes may travel on wheels requiring travel path assessment, and lighter weight increases susceptibility to overturning** — Self-erecting tower cranes have unique characteristics that create hazards not present with larger fixed-base tower cranes. Many self-erecting models are designed to travel on wheels, requiring assessment of the ground conditions along the entire travel path — soft spots, slopes, underground voids, and surface obstructions can all cause the crane to tilt or settle during travel. Their relatively light weight — compared to large fixed-base tower cranes with massive central ballast — means they have less resistance to overturning forces. Wind that would have minimal effect on a heavy fixed-base crane can create a significant overturning risk for a lighter self-erecting crane, requiring more conservative wind speed limits and more careful attention to ground conditions and leveling.
52. **C. Operator must ensure reliable communication is established and tested before operations, and must stop work if communication is lost** — Communication between the operator and ground personnel is as essential to safe crane operations as any mechanical or structural system on the crane. The operator cannot safely move loads without knowing the conditions on the ground — where workers are positioned, whether the landing zone is clear, whether the load is clear of obstructions, and what the signalperson is directing. Before operations begin, the communication system — whether hand signals, radio, or other method — must be established, tested, and confirmed working by both parties. If communication fails during operations, the operator loses the information needed to operate safely and must stop all movements until communication is restored.
53. **B. Stop slewing and report erratic behavior — inconsistent response indicates potential fault that could cause loss of control** — Erratic swing behavior — varying speed, intermittent response, and jerking — indicates a malfunction in the slewing system that could worsen unpredictably. Possible causes include a failing variable frequency drive, intermittent electrical connections, a deteriorating slewing motor, a gearbox problem, or a control system fault. Any of these conditions can progress from erratic behavior to complete loss of swing control — either inability to swing or, more dangerously, uncontrolled swing that the operator cannot stop. The jerking motion creates dynamic forces that stress the crane's structure and can cause the load to swing unpredictably. Continuing to operate with a known control malfunction accepts the risk that the next malfunction episode could result in a loss of control during a critical phase of a lift.
54. **A. Complete shift log documenting crane condition, operational issues, maintenance needs, and safety concerns, and ensure crane is properly secured** — The end-of-shift documentation is the operator's final professional act for the day and serves as a direct communication to the next operator about everything they need to know. The log should document the crane's current condition — any changes from the beginning of the shift, any unusual observations, any developing concerns. Operational issues — functions that did not respond normally, sounds or vibrations that were unusual, any difficulties encountered — must be recorded so the next operator is aware and can monitor these conditions. Maintenance needs and safety concerns must be clearly

stated so the maintenance team and incoming operator can address them before operations resume. The log combined with proper securing of the crane ensures a safe handoff to the next shift.

55. **D. Safety of all personnel takes absolute priority over every other consideration** — This principle is the foundation upon which every other aspect of tower crane operations is built. Every procedure, every inspection, every communication protocol, every capacity check, and every operational decision exists to protect human life. The construction schedule, production targets, financial pressures, and supervisor instructions are all subordinate to safety because no project milestone, delivery deadline, or cost saving justifies risking a human life. The operator is the final authority on whether a lift proceeds safely, and this authority exists because the operator is uniquely positioned to assess the complete picture — the crane's condition, the loading, the environment, and the operational situation. When safety and production conflict, safety prevails without exception.