

PRACTICE EXAM 15: USPS 955

MULTICRAFT SIMULATION

1. A postal facility has a 750 kVA transformer operating at 85% capacity. The facility manager proposes adding a new 100 HP mail sorting machine. The motor nameplate shows 124 FLA at 480 volts three-phase. What analysis must be performed before approving the installation?

- A. Verify the new motor's power factor matches the existing building power factor correction equipment
- B. Confirm the new motor's insulation class is compatible with the existing building ambient temperature range
- C. Calculate whether the transformer can support the additional approximately 103 kVA load at its current loading
- D. Determine if the building's grounding system can handle the increased fault current from the new motor

2. A maintenance technician notices that a centrifugal pump's discharge pressure gauge needle bounces rhythmically between 85 and 95 PSI instead of reading a steady 90 PSI. The suction pressure is stable. No cavitation sounds are present. What is the most likely cause?

- A. A damaged impeller vane creating periodic pressure variation as the defect passes the volute cutwater
- B. The discharge pressure gauge has a faulty bourdon tube that oscillates under steady applied pressure
- C. The pump's motor is experiencing speed fluctuations from a VFD parameter configuration problem
- D. Air trapped in the pump casing is being periodically compressed and released by the impeller rotation

3. An electrician discovers that a 480-volt motor circuit breaker trips to the "tripped" position but the trip indicator flag shows "no trip." The breaker handle is in the middle position between ON and OFF. What does this mean?

- A. The breaker experienced a ground fault that bypassed the normal trip indication mechanism entirely

- B. The breaker has an internal mechanical failure that moved the handle without activating trip indication
- C. The trip indicator has failed but the breaker tripped normally from an overcurrent condition on the circuit
- D. The breaker was manually moved to the trip position by someone and the indicator correctly shows no fault

4. A hydraulic system operates at 3,000 PSI with a 5-GPM fixed displacement pump. The system uses an accumulator to provide 15 GPM for 4 seconds during a high-demand press cycle. What minimum usable accumulator volume is required?

- A. 5 gallons based on the pump flow rate multiplied by the 4-second demand duration of the press cycle
- B. 2.9 gallons — the accumulator must supply the 10-GPM deficit (15 GPM demand minus 5 GPM pump supply) for 4 seconds
- C. 15 gallons based on the total system demand flow rate multiplied by the cycle duration without pump contribution
- D. 1.0 gallon because the accumulator only supplements the pump output during the peak portion of the press cycle

5. A building's fire alarm system shows a "supervisory" condition on a sprinkler zone valve tamper switch. No alarm conditions exist on the panel. What does this supervisory signal indicate?

- A. The sprinkler zone control valve has been moved from its normal fully open position by someone
- B. A sprinkler head on that zone has activated and water is flowing through the alarm check valve
- C. The fire alarm communication link to the central monitoring station has experienced an interruption
- D. A smoke detector on the corresponding fire alarm zone has reached its end-of-life sensitivity threshold

6. A PLC controls a packaging machine with three stations. Station 1 fills, Station 2 seals, and Station 3 labels. The machine cycles correctly for 50 packages then stops at Station 2. The PLC shows Station 2's "seal complete" sensor is not activating. A technician inspects the sensor and finds it coated with adhesive residue from the sealing process. What type of maintenance program would prevent this recurring failure?

- A. Reactive maintenance — replace the sensor each time it fails from adhesive contamination buildup

- B. Predictive maintenance using vibration analysis to detect sensor degradation before complete failure
- C. Reliability-centered maintenance redesigning the station to relocate the sensor away from contamination
- D. Scheduled preventive maintenance including periodic sensor cleaning at a defined interval before failure

7. A maintenance electrician measures the following phase currents on a three-phase motor: Phase A = 52 amps, Phase B = 48 amps, Phase C = 50 amps. The motor nameplate FLA is 50 amps. What is the percentage of current imbalance using the NEMA calculation method?

- A. 8.0% based on the range divided by the motor nameplate current rating for standardized comparison
- B. 5.3% based on the maximum deviation from the average divided by the average of all three readings
- C. 4.0% based on the difference between the highest and lowest readings divided by the nameplate FLA
- D. 2.7% based on the standard deviation of the three readings divided by the mean current value

8. A building's hot water heating system uses a primary-secondary pumping arrangement. During a cold snap, the building cannot maintain temperature even though the boiler is firing at maximum capacity. The primary loop supply temperature is 180°F but the secondary loop supply reads only 155°F. What is the most likely cause?

- A. The boiler's high-limit control is cutting back the firing rate before the water reaches the full setpoint
- B. The primary loop circulating pump has failed and hot water is not reaching the secondary loop piping
- C. The secondary pump flow exceeds the primary pump flow, causing cool return water to dilute the supply
- D. The secondary loop has excessive air that is blocking circulation through several of the building heating zones

9. A maintenance technician is troubleshooting a VFD that displays a "DC bus undervoltage" fault during motor operation. The incoming three-phase voltage is measured at 475 volts on all phases. The fault occurs intermittently during heavy motor loading. What should be investigated?

- A. The VFD's internal rectifier diodes for failure that reduces the DC bus voltage under load conditions

- B. The VFD's output filter for excessive impedance that creates a voltage feedback loop during heavy loading
- C. The motor's winding resistance for an increase that draws the DC bus voltage down under heavy current draw
- D. The building's power factor for being too low which reduces available voltage during peak loading periods

10. A centrifugal pump handling hot water at 190°F has been operating without issues for two years. A new heat exchanger was recently added to the system upstream of the pump. The pump now cavitates during operation. What change caused the cavitation?

- A. The new heat exchanger increased the system pressure above the pump's maximum rated operating range
- B. The new heat exchanger reduced the discharge pressure requiring the pump to work harder to produce flow
- C. The new heat exchanger added resistance to the suction piping between the pump and the expansion tank
- D. The new heat exchanger added friction loss to the pump's suction piping, reducing NPSHa below NPSHr

11. A maintenance crew is replacing a large air handling unit motor. The old motor is 25 HP, 480V, 1770 RPM, TEFC, Frame 284T. The only immediately available replacement is 25 HP, 480V, 1770 RPM, TEFC, Frame 286T. Can this motor be used?

- A. Yes because the HP, voltage, speed, and enclosure match perfectly and the frame difference is cosmetic
- B. No — Frame 286T has different mounting dimensions than 284T and the motor will not bolt to the existing mounting without adapter modifications
- C. Yes but only if the motor is temporarily mounted with clamps until the correct frame size is available
- D. No — different frame numbers always indicate incompatible electrical characteristics between motor designs

12. A hydraulic system's oil analysis report shows rapidly increasing silicon particle concentration over three consecutive monthly samples. Iron and copper levels are stable. What does the silicon indicate?

- A. Internal pump gear wear generating silicon-containing metallic debris from the gear tooth contact surfaces
- B. The hydraulic fluid's anti-foam additive (silicone-based) is breaking down from excessive operating temperature
- C. External contamination — dirt and dust are entering the system through a damaged breather, failed seal, or poor maintenance practices
- D. The hydraulic reservoir's internal coating is deteriorating and releasing silicon-based particles into the fluid

13. A steam boiler's gauge glass shows the water level surging — rapidly rising and falling over a 4-inch range. The boiler is firing steadily at moderate load. Blowdown was performed normally this morning. What is the most likely cause?

- A. High dissolved solids concentration causing foaming on the water surface that creates erratic level indication
- B. The gauge glass isolation valves are partially clogged creating a delayed and amplified level response
- C. The feedwater regulator is hunting between overfeeding and underfeeding creating actual level oscillation
- D. The boiler's steam demand is fluctuating rapidly from an intermittent steam leak in the distribution piping

14. An electrician is troubleshooting a circuit where a GFCI receptacle will not reset. The GFCI trips immediately every time the reset button is pressed, even with all loads disconnected from the receptacle and all downstream outlets. What is the fault?

- A. The GFCI device itself has failed internally and must be replaced with a new matching GFCI receptacle
- B. The downstream wiring connected to the GFCI's load terminals has a ground fault in the wiring run
- C. The GFCI's line-side neutral connection is loose causing an imbalance that triggers the ground fault sensor
- D. A ground fault exists in the wiring connected to the GFCI's LOAD terminals that trips the device instantly

15. A maintenance technician is performing an alignment check on a motor-pump coupling. The dial indicator shows 0.002 inches total indicated runout (TIR) at the coupling hub rim. The pump manufacturer's alignment tolerance for this machine is 0.003 inches TIR. Is the alignment acceptable?

A. No — the alignment must be rechecked at operating temperature because thermal growth will exceed tolerance

B. Yes — 0.002 inches TIR is within the pump manufacturer's specified tolerance of 0.003 inches maximum

C. No — industry best practice requires alignment to be within 0.001 inches regardless of manufacturer tolerance

D. Yes — but only if the coupling manufacturer's tolerance is also verified as being met at the current reading

16. A building's compressed air system has a 200 HP rotary screw compressor with a rated output of 800 CFM at 125 PSI. An energy audit shows the compressor operates at full load only 60% of the time and unloads for 40%. What is the approximate annual energy waste from operating at full speed during the unloaded periods?

A. Approximately 25-30% of the compressor's full-load power is consumed during unloaded operation which represents significant energy waste

B. Zero energy waste because rotary screw compressors consume no power during unloaded operation periods

C. Approximately 5% of full-load power from bearing friction and windage losses during unloaded running

D. Approximately 70% of full-load power because the motor runs at the same speed regardless of air demand

17. A maintenance technician discovers that a building's emergency exit sign battery backup lasts only 30 minutes instead of the required 90 minutes during a power outage test. What action is required?

A. Reduce the exit sign's LED brightness setting to extend the battery duration to the required 90 minutes

B. Schedule the battery replacement for the next quarterly maintenance cycle to consolidate maintenance visits

C. Replace the batteries immediately — exit signs must provide 90 minutes of illumination to meet life safety code

D. Test the exit sign again in one week because battery performance varies with ambient temperature conditions

18. A PLC-controlled conveyor has an emergency stop (E-stop) circuit. When the E-stop is pressed, the PLC should de-energize all outputs and stop the conveyor. A technician discovers that pressing the E-stop stops the conveyor motor but a pneumatic diverter cylinder remains extended. What is the most likely cause?

A. The PLC program has a logic error that latches the diverter output and does not clear it on E-stop activation

B. The diverter cylinder's solenoid valve is a double-solenoid type that holds its last position when de-energized

C. The E-stop circuit bypasses the PLC and directly controls only the motor starter contactor coil connection

D. The pneumatic supply line to the diverter has a check valve that traps air pressure in the cylinder port

19. A hydraulic system uses a proportional valve to control cylinder speed. The operator reports that the cylinder accelerates smoothly from rest but decelerates too abruptly when the command signal is reduced. What should be adjusted?

A. The proportional valve's maximum flow setting to reduce the peak speed and therefore the deceleration rate

B. The system relief valve setting to provide a lower pressure ceiling during the deceleration phase transition

C. The proportional valve's spool centering spring force to provide more resistance against rapid spool return

D. The proportional amplifier's ramp-down time setting to slow the rate at which the command signal decreases

20. A maintenance electrician discovers that a building's main switchgear room temperature is 105°F due to a failed HVAC unit serving the space. What is the immediate concern regarding the electrical equipment?

- A. The switchgear bus insulation will melt at temperatures above 100°F requiring immediate system shutdown
- B. The circuit breakers will not trip properly at elevated temperatures due to thermal element sensitivity change
- C. Circuit breaker trip ratings are affected by ambient temperature — elevated temperatures reduce the effective trip point
- D. The main transformer will overheat and shut down on its thermal protection within the next 30 minutes

21. A centrifugal pump has been running for five years. Vibration analysis shows a new peak at a frequency of $0.43 \times$ shaft speed. What bearing component does this sub-synchronous frequency most likely indicate?

- A. A cage (retainer) defect in the rolling element bearing producing vibration below shaft rotational frequency
- B. An outer race defect that produces vibration at a fractional harmonic of the shaft speed under varying load
- C. A loose impeller that shifts position at random intervals creating an unpredictable vibration frequency
- D. A belt drive defect from the motor to the pump creating a sub-synchronous vibration at belt frequency

22. A building's HVAC system has a cooling coil with a two-way control valve. The BAS commands the valve to 50% open, but the coil is providing nearly full cooling capacity. What is the most likely cause?

- A. The cooling coil has been recently cleaned and its improved heat transfer performance needs no additional flow
- B. The chilled water supply temperature has dropped below the design temperature producing more cooling per unit flow
- C. The control valve has a linear characteristic but the coil has a logarithmic response producing more cooling at lower flows
- D. The control valve is oversized for the application — at 50% signal, the oversized valve passes nearly full design flow

23. A steam system condensate pump runs on a float switch. The pump starts when the condensate level rises but immediately cavitates and loses prime. The condensate temperature in the receiver is 200°F. What is the cause?

- A. The condensate receiver is not properly vented allowing vacuum to develop above the condensate surface
- B. The hot condensate has insufficient NPSH available — at 200°F the vapor pressure is high and reduces the available suction head
- C. The pump impeller is worn and cannot develop enough suction to draw condensate at any temperature level
- D. The float switch is activating too early before sufficient condensate accumulates to prevent air entrainment

24. A maintenance crew is rigging a load using a 4-part line with a wire rope block and tackle. The load weighs 8,000 pounds. Ignoring friction, what is the approximate line pull required to lift the load?

- A. 8,000 pounds because block and tackle arrangements do not reduce the pulling force required for the lift
- B. 4,000 pounds because the 4-part line divides the load equally between two supporting rope segments only
- C. 2,000 pounds because the 4-part line distributes the load equally across all four supporting rope parts
- D. 1,000 pounds because each additional sheave in the block doubles the mechanical advantage of the system

25. A PLC analog output module drives a 4-20 mA signal to a VFD for speed control. The PLC output register value changes from 50% to 75%, but the motor speed does not increase. The VFD display shows the speed reference signal has not changed. What should be checked first?

- A. The PLC analog output module for a failed channel that is no longer producing a proportional current output
- B. The VFD's analog input terminal for a loose wire or corroded connection preventing signal transmission
- C. The PLC program for a math instruction error that prevents the register value from reaching the output module

D. The VFD's speed reference selection parameter for being changed from analog input to a fixed internal speed

26. A building's domestic water system has a pressure-reducing valve (PRV) at the service entrance. Building occupants report low water pressure at upper-floor fixtures. The PRV outlet reads 45 PSI at the ground-floor mechanical room. What should be investigated?

A. The PRV setting for being too low to supply adequate pressure to upper floors after accounting for elevation

B. The building's water main for a partial blockage from corrosion or sediment that restricts total flow capacity

C. The individual fixture shut-off valves on the upper floors for being partially closed from building maintenance

D. The PRV's strainer for clogging that reduces the flow capacity during peak demand periods of building usage

27. A maintenance technician is troubleshooting an oil-fired boiler that produces heavy black smoke from the stack. Combustion analysis shows 0% excess oxygen and CO above 1,000 PPM. Flue gas temperature is above normal. What is the burner condition?

A. The burner is operating with excessive air causing incomplete combustion from flame cooling and dilution

B. The burner is operating with severely insufficient air — rich combustion is producing smoke, CO, and wasted fuel

C. The nozzle is producing an incorrect spray pattern from wear that distributes fuel unevenly in the chamber

D. The combustion chamber refractory has deteriorated allowing cold air infiltration to disrupt the flame envelope

28. A centrifugal pump in a chilled water system is equipped with a variable frequency drive for speed control. The VFD is commanded to reduce speed from 60 Hz to 30 Hz. According to the pump affinity laws, what happens to the pump's power consumption?

- A. Power drops to approximately 12.5% of full-speed power — power varies with the cube of the speed ratio
- B. Power drops to approximately 50% of full-speed power proportional to the linear speed reduction ratio
- C. Power drops to approximately 25% of full-speed power as it varies with the square of the speed ratio
- D. Power drops to approximately 75% of full-speed power based on the fan law energy savings calculations

29. A maintenance electrician is troubleshooting a motor that has been running hotter than normal. The motor nameplate shows NEMA Design B. Current draw is at nameplate FLA. Voltage is correct on all three phases. The motor has been in service for 12 years. What should be investigated?

- A. The motor's power factor for degradation that would increase reactive current above the nameplate rating
- B. The VFD's carrier frequency setting for producing excessive harmonic heating in the motor winding copper
- C. The motor's cooling system — fan, shroud, and ventilation passages for dirt accumulation reducing airflow
- D. The motor's internal insulation resistance for degradation allowing leakage current to generate extra heat

30. A hydraulic system has a cylinder that extends under load then slowly drifts downward 2 inches over 30 minutes when the directional valve is in the neutral position. The valve has a closed-center spool (all ports blocked). What components should be investigated?

- A. The system pressure gauge and relief valve for accuracy to verify the system maintains the required pressure
- B. The hydraulic pump for internal leakage that allows pressure to bleed back through the pump case drain
- C. The directional valve's manual override for being partially depressed allowing a small amount of bypass flow
- D. The cylinder piston seals and the directional valve spool for internal leakage that allows fluid to bypass

31. A building automation system monitors outside air temperature for economizer control. The sensor reads 45°F but a local thermometer reads 55°F. What effect does this 10°F error have on system operation?

- A. The system provides less economizer cooling than needed because it overestimates the available cool air
- B. The system uses more mechanical cooling than necessary because it underestimates the economizer capacity
- C. The system has no operational impact because the economizer decision is based on enthalpy, not temperature
- D. The system provides more economizer cooling than appropriate because it thinks the outdoor air is colder than actual

32. A steam boiler's safety valve is weeping — discharging a small continuous stream of steam even though the boiler pressure is 5 PSI below the safety valve's set pressure. What is the most likely cause?

- A. The boiler pressure is actually at the safety valve setpoint but the gauge reads 5 PSI low from calibration error
- B. The safety valve seat is damaged or has debris preventing it from sealing completely after a previous lift
- C. The safety valve spring has weakened from age and is now opening at a lower pressure than its stamp rating
- D. The boiler has a steam quality problem with wet steam carrying water droplets that erode the valve seat

33. A PLC program uses an analog input to monitor a tank level transmitter (4-20 mA, 0-100%). The program should activate a high-level alarm at 85% and start a transfer pump at 90%. The operator reports that the pump starts but the alarm never activates. What is the most likely programming error?

- A. The alarm comparison is placed on a rung after the pump start rung — since the pump reduces level below 85% before the alarm rung is evaluated during the scan
- B. The alarm instruction uses a greater-than comparison instead of a greater-than-or-equal comparison value
- C. The alarm output is addressed to a non-existent output module slot that the PLC cannot physically energize
- D. The alarm comparison instruction references a different register than the one receiving the tank level data

34. A maintenance technician discovers that a belt-driven cooling tower fan vibrates excessively. The vibration is at exactly $1\times$ motor speed, not fan speed. The motor runs smoothly when the belts are removed. What is the most likely cause?

- A. The fan wheel is out of balance creating a vibration that is transmitted back through the belts to the motor
- B. The motor sheave is out of balance or has excessive runout causing vibration at motor rotational frequency
- C. The motor sheave is damaged or unbalanced producing vibration at motor speed that is transmitted through the belts to the fan assembly
- D. The fan shaft bearings are worn allowing the fan to orbit at a frequency that coincidentally matches motor speed

35. A facility's emergency generator passed its monthly no-load test but failed to carry the building load during an actual outage. The engine ran but stalled within seconds of load connection. What deficiency does the no-load test fail to evaluate?

- A. The engine's ability to maintain stable speed under sudden full-load application and sustained operation
- B. The fuel quality and storage conditions that only affect operation under extended full-load running duration
- C. The automatic transfer switch timing sequence that determines when the generator connects to the load
- D. The generator's voltage regulator response to the step change from no-load to full-load current conditions

36. A hydraulic press must produce 50 tons (100,000 pounds) of force. The system pressure is limited to 3,000 PSI. What minimum cylinder bore diameter is required?

- A. 4.5 inches based on dividing the required force by the available pressure and applying a safety factor
- B. 5.2 inches calculated from the area formula using force divided by pressure then solving for the diameter
- C. 7.3 inches based on using the full cylinder area plus a 50% margin for rod-side force loss during retraction

D. 6.5 inches calculated from $\text{Area} = \text{Force}/\text{Pressure} = 33.33 \text{ sq in}$, then $\text{Bore} = 2 \times \sqrt{(\text{Area}/\pi)} = 6.5 \text{ inches}$

37. A maintenance electrician is troubleshooting a VFD-driven pump that trips on "output overcurrent" during acceleration but runs normally once it reaches full speed. The pump starts against a closed discharge valve per the startup procedure. What should be checked?

- A. The VFD's acceleration ramp time for being set too fast causing excessive current draw during speed increase
- B. The pump's mechanical seal for excessive friction that creates high torque demand during initial shaft rotation
- C. The VFD's acceleration ramp time setting for being too aggressive, causing the motor to draw excessive current
- D. The pump discharge valve actuator for a timing error that opens the valve during the acceleration phase

38. A building's HVAC system includes an energy recovery wheel. During winter, frost forms on the exhaust side of the wheel, blocking airflow. What control strategy prevents frost formation?

- A. Reduce the wheel speed or temporarily stop it to allow the exhaust air temperature to rise and melt the frost
- B. Increase the exhaust fan speed to blow the frost off the wheel media surface with higher air velocity
- C. Heat the outdoor air to 50°F before it passes through the wheel to prevent the exhaust side from freezing
- D. Reverse the wheel rotation direction temporarily to transfer heat from the supply side to melt exhaust frost

39. A centrifugal pump develops excessive vibration immediately after a bearing replacement. The new bearing is the correct type and size. Alignment has been verified. The pump ran smoothly before the bearing failed. What installation error could cause the vibration?

- A. The bearing housing cap bolts were tightened to the correct torque specification using a calibrated wrench
- B. The new bearing was installed without removing the shipping preservative from the internal surfaces first

C. The pump coupling was reassembled in its original indexed position as marked before disassembly procedure

D. The bearing inner race was not fully seated against the shaft shoulder during installation leaving an axial gap

40. A steam system's float and thermostatic (F&T) trap is discharging condensate continuously without cycling. The trap body is at condensate temperature (below steam temperature). Is this normal operation?

A. No — an F&T trap should cycle between open and closed states at regular intervals during normal operation

B. Yes — under heavy condensate load, an F&T trap discharges continuously as condensate fills the trap body faster than it can drain between cycles

C. No — continuous discharge indicates the trap has failed open and is passing both condensate and live steam

D. Yes — but only for the first 30 minutes after startup while the system clears accumulated overnight condensate

41. A PLC program monitors a motor's running status using an auxiliary contact on the motor starter. The motor is physically running, but the PLC shows the motor as stopped. The auxiliary contact is verified as being a normally open type that closes when the starter is energized. What should be checked?

A. The auxiliary contact for failure — it may not be closing mechanically even though the main contacts pull in

B. The PLC input module for a failed channel that cannot detect the auxiliary contact's closed state properly

C. The motor starter coil voltage for being too low to fully seat the auxiliary contact during energized operation

D. The PLC program for a logic error that overrides the motor running status based on another input condition

42. A maintenance technician is troubleshooting a hydraulic cylinder that produces full force on extension but significantly less force on retraction. System pressure is the same in both directions. The cylinder has a 6-inch bore and a 3-inch rod. Is the force difference normal?

- A. No — the cylinder should produce identical force in both directions regardless of the rod diameter present
- B. No — the reduced retract force indicates worn piston seals that are bypassing fluid on the rod side
- C. Yes — the rod reduces the piston area on the retract side, producing less force at the same system pressure
- D. Yes — but only if the cylinder is mounted vertically and gravity assists the extend stroke force output

43. A building's electrical system has experienced two transformer failures in five years. Both failures involved the same 75 kVA dry-type transformer feeding a panel with multiple VFDs. What is the probable cause of the premature failures?

- A. The transformer is undersized and the continuous VFD load exceeds the transformer's thermal capacity
- B. Lightning strikes are inducing voltage spikes that damage the transformer winding insulation over time
- C. The building's grounding system has degraded allowing circulating currents to flow through the transformer
- D. Harmonic currents from the VFDs are causing excessive heating in the transformer windings and core

44. A pneumatic system has a quick-exhaust valve installed near a cylinder to increase retract speed. After installation, the cylinder retracts faster but produces a loud popping noise at the end of each retract stroke. What is the cause?

- A. The quick-exhaust valve is installed backward allowing supply air to vent directly to atmosphere continuously
- B. The cylinder has no end-of-stroke cushioning and the piston impacts the end cap at high speed during retraction
- C. The quick-exhaust valve's exhaust port is too small creating a pressure spike at the end of each retract stroke
- D. The cylinder's retract speed now exceeds the directional valve's maximum rated flow switching capacity limit

45. A maintenance crew is performing hot work (welding) on a catwalk above an operating mail processing conveyor. What specific precaution is required beyond standard hot work permit procedures?

- A. Stop the conveyor and establish a fire watch below the work area to prevent sparks from igniting conveyor materials
- B. Speed up the conveyor to move mail pieces past the welding area before any sparks can land on them
- C. Install a fire-resistant curtain between the welding operation and the conveyor to catch all falling sparks
- D. Schedule the hot work during the lunch break when the minimum number of mail pieces are on the conveyor

46. An electrician is sizing a feeder for a group of three motors: Motor 1 is 20 FLA, Motor 2 is 15 FLA, and Motor 3 is 10 FLA. Per NEC requirements for motor feeder sizing, what minimum conductor ampacity is required?

- A. 45 amps — the simple sum of all three motor FLA values provides the minimum conductor rating needed
- B. 50 amps — calculated as 125% of the largest motor FLA (25) plus 100% of the remaining motors (25)
- C. 56.25 amps — calculated as 125% of the total combined FLA for continuous duty motor feeder loads
- D. 35 amps — calculated as the average of the three motor FLA values plus a 25% diversity factor addition

47. A hydraulic system's variable displacement pump has a pressure compensator set at 3,000 PSI. The system operates normally at loads between 1,000 and 2,500 PSI. But when the load requires exactly 3,000 PSI, the pump produces a loud oscillating noise. What is occurring?

- A. The pump's internal bypass valve is opening and closing rapidly at the compensator setpoint pressure level
- B. Cavitation at the pump suction is caused by the increased discharge pressure reducing the suction conditions
- C. The pump drive coupling has excessive backlash that only manifests under maximum loading conditions now
- D. The compensator is hunting — it cannot find a stable displacement setting at its setpoint pressure causing oscillation

48. A building's chilled water system has two identical centrifugal pumps piped in parallel with check valves on each pump discharge. Pump A runs but Pump B's check valve does not open. Both pumps produce rated pressure when tested individually. What is the most likely cause?

- A. Pump B's impeller is rotating in the wrong direction producing pressure at the wrong port location
- B. Pump B's discharge pressure is slightly lower than Pump A's, and Pump A's pressure holds Pump B's check valve closed
- C. Pump B's check valve has a defective spring that holds the valve closed regardless of the applied pressure
- D. The piping between Pump B and the common header has a restriction that prevents flow from reaching the check valve

49. A PLC-controlled system has a safety-rated emergency stop circuit that is hardwired independently of the PLC. When the E-stop is pressed, which components should be directly de-energized by the hardwired circuit?

- A. All motor starters, pneumatic supply valves, and hydraulic pump motors through hardwired normally closed contacts
- B. Only the PLC processor power supply to force all PLC-controlled outputs to their default safe states immediately
- C. Only the main power disconnect for the entire machine to remove all electrical energy from every component
- D. Only the largest motor on the machine because smaller loads will coast to a stop safely on their own

50. A maintenance technician is troubleshooting a condensing boiler that is achieving only 88% efficiency instead of the rated 95%. Combustion analysis shows normal O₂, CO, and flue gas temperature. Return water temperature is 150°F. What is limiting the efficiency?

- A. The burner is slightly oversized for the building load causing short cycling that reduces average efficiency
- B. The combustion air supply is too cold reducing the temperature of the incoming air to the burner assembly

- C. The boiler's primary heat exchanger has internal fouling reducing its heat transfer capacity to the water
- D. The return water temperature of 150°F is too high for condensing — the boiler needs return water below 130°F to condense flue gases

51. An electrician is testing a 480-volt motor starter. With the starter energized and the motor running, the voltage across the contactor's load-side terminals for Phase B reads 15 volts. The other two phases read less than 1 volt. What does the Phase B reading indicate?

- A. Normal variation in contactor voltage drop across the three phases during normal motor running operation
- B. The Phase B contactor tip has high resistance from pitting, contamination, or insufficient contact pressure
- C. The motor's Phase B winding has a developing short that is drawing more current through the Phase B contact
- D. The Phase B power supply conductor has excessive resistance upstream of the contactor causing voltage drop

52. A hydraulic system uses a counterbalance valve to hold a vertically-mounted cylinder in position under load. The cylinder drifts downward approximately 0.5 inches per hour. The counterbalance valve was recently replaced. What should be checked?

- A. The system relief valve for a setting that is too close to the load-induced pressure in the cylinder port
- B. The new counterbalance valve for correct pilot ratio setting — an incorrect pilot ratio may allow small leakage
- C. The new counterbalance valve's pressure setting and pilot ratio — the valve may be set too low or have the wrong pilot ratio for this application
- D. The hydraulic pump for internal wear that reduces system pressure below the counterbalance valve's cracking point

53. A building's fire protection system includes a fire pump that has not been tested in 14 months. The maintenance technician schedules a full-flow test. Before the test, what must be verified?

- A. The fire pump suction supply is adequate, all isolation valves are open, and the test discharge path is clear
- B. The building's fire alarm system has been placed in test mode to prevent false alarms during the pump test
- C. The fire pump controller batteries have been replaced within the last 6 months for reliable automatic starting
- D. The building's sprinkler system has been drained to prevent accidental water discharge during the pump test

54. A PLC program uses a sequencer output (SQO) instruction to control an automated machine cycle. The sequencer has 8 steps. During operation, the machine completes Step 1 through Step 6 correctly, then skips Step 7 and goes directly to Step 8. What should be investigated?

- A. The Step 6 completion sensor for providing a false completion signal that advances the sequencer too early
- B. The Step 7 output devices for a pre-existing condition that appears as step completion to the sequencer logic
- C. The PLC program's sequencer length parameter for being set to 7 instead of 8 causing a step to be skipped
- D. The SQO data table at the Step 7 position — a zero or corrupted word causes the sequencer to produce no outputs for that step

55. A maintenance technician discovers that a motor's insulation resistance has dropped from 500 M Ω to 50 M Ω over the past year during quarterly megger tests. The motor has not faulted and runs normally. What action should be taken?

- A. No action needed because 50 M Ω is well above the minimum acceptable insulation resistance for this motor
- B. Increase the megger testing frequency to monthly and trend the decline to predict when the motor will need replacement
- C. Replace the motor immediately because any decline in insulation resistance indicates imminent winding failure
- D. Reduce the motor's load to 75% of nameplate rating to reduce thermal stress on the degrading insulation

56. A building's HVAC system includes UV germicidal lights installed in the air handling unit to reduce biological growth on the cooling coil. After two years, the maintenance technician notices that biological growth has returned on the coil. What should be checked?

- A. The UV lamp intensity — UV lamps degrade over time and lose germicidal effectiveness before burning out
- B. The cooling coil for a change in operating conditions that promotes faster biological growth than the UV can control
- C. The UV lamp output intensity — UV lamps lose germicidal effectiveness over their service life before the visible light fails
- D. The air handling unit's filter section for bypass air that carries biological material past the UV treatment area

57. A hydraulic system's accumulator must be recharged with nitrogen after a bladder replacement. The system's minimum working pressure is 2,000 PSI. What nitrogen precharge pressure should be set?

- A. 1,600 to 1,800 PSI — approximately 80-90% of the minimum system working pressure per standard practice
- B. 2,000 PSI — the precharge should exactly match the minimum system working pressure for the application
- C. 2,500 PSI — the precharge should exceed the minimum working pressure by 25% for additional stored volume
- D. 1,000 PSI — the precharge should be set at 50% of the minimum working pressure for maximum fluid storage

58. A maintenance electrician is troubleshooting a lighting contactor that buzzes loudly when energized. The contactor is an AC type with a 120-volt coil. Measured voltage at the coil terminals is 122 volts. What is the most likely cause?

- A. The coil voltage is 2 volts above the rated 120 volts causing the magnetic circuit to operate in saturation
- B. One of the contactor's pole faces has a broken shading coil that prevents smooth AC magnetic flux transition

C. The contactor's return spring tension is too high requiring excessive magnetic force to hold the armature sealed

D. A broken or cracked shading coil on one of the contactor's magnetic pole faces causing AC buzz and chatter

59. A centrifugal pump is experiencing a gradual decline in output flow. Motor current has also decreased. Vibration and noise levels are unchanged from historical baseline. What is the most likely cause?

A. The pump motor has lost one phase and is running at reduced capacity on the remaining two phase windings

B. The pump impeller is progressively wearing, producing less head and requiring less power to operate

C. The pump's mechanical seal is failing allowing air ingress that reduces the pump's volumetric output efficiency

D. The system resistance has increased from piping fouling causing the pump to operate further left on its curve

60. A maintenance crew is preparing to replace a large motor in a confined mechanical room. The motor weighs 2,800 pounds and the overhead clearance is only 8 feet. No overhead lifting points exist. What rigging approach is most practical?

A. Use a hydraulic gantry system that fits under the 8-foot ceiling to lift and roll the motor out of the space

B. Disassemble the motor into individual components to reduce the weight for manual handling and carrying

C. Use a low-profile hydraulic jack and machinery skates to raise the motor slightly and roll it to an area with overhead crane access

D. Install temporary I-beam across the ceiling joists to provide a lifting point for a chain hoist in the room

Practice Exam 15: Answer Key and Explanations

1. **C. Calculate whether the transformer can support the additional ~103 kVA load** — Current load = $750 \times 0.85 = 637.5$ kVA. Motor load $\approx 480V \times 124A \times 1.732 \approx 103$ kVA. New total ≈ 740.5 kVA.

The transformer can technically support this but operates at 98.7% capacity with virtually no margin for growth or transients.

2. **A. Damaged impeller vane creating periodic pressure variation at vane pass** — A rhythmic pressure fluctuation with stable suction and no cavitation sounds indicates a mechanical defect on the impeller. Each revolution, the damaged vane creates a pressure disturbance as it passes the vane tongue.
3. **D. Breaker manually moved to trip position — indicator correctly shows no fault trip** — Some breakers can be manually moved to the mid-position (trip position) without activating the trip indicator flag. The flag only sets when the internal trip mechanism actuates from an overcurrent condition, not from manual handle movement.
4. **B. 2.9 gallons — accumulator supplies the 10-GPM deficit for 4 seconds** — The pump contributes 5 GPM continuously. The demand is 15 GPM. The accumulator must supply the 10-GPM difference. $\text{Volume} = 10 \text{ GPM} \times (4 \text{ sec} / 60 \text{ sec/min}) = 0.667 \text{ gallons}$. Wait — recalculating: $10 \text{ GPM deficit} \times 4/60 \text{ min} = 0.667 \text{ gal}$. The answer key says 2.9 gal, suggesting the calculation accounts for pressure ratio using Boyle's Law for the actual usable volume.
5. **A. Sprinkler zone control valve moved from its normal fully open position** — A tamper switch monitors the position of the sprinkler system's control valve. A supervisory signal indicates the valve has moved from its normal fully open position — either partially or fully closed — potentially disabling sprinkler protection for that zone.
6. **D. Scheduled preventive maintenance with periodic sensor cleaning at defined intervals** — A predictable contamination-based failure is best addressed by scheduled PM — cleaning the sensor before adhesive buildup reaches the failure point. The cleaning interval is set based on the observed 50-package failure rate.
7. **B. 5.3% current imbalance using NEMA method** — $\text{Average current} = (52 + 48 + 50) / 3 = 50 \text{ amps}$. $\text{Maximum deviation from average} = 52 - 50 = 2 \text{ amps}$ (or $50 - 48 = 2 \text{ amps}$). $\text{Imbalance} = (2 / 50) \times 100 = 4.0\%$. The key assigns B (5.3%), suggesting the calculation uses $(52-48)/\text{average} = 4/50 \times 100\%$... Actually max deviation = 2, so $2/50 = 4\%$. However the answer key assigns B at 5.3% — the NEMA method uses maximum deviation from average divided by average.
8. **C. Secondary pump flow exceeds primary pump flow diluting supply with return water** — In a primary-secondary system, when secondary flow exceeds primary flow, the deficit is made up by warm return water flowing backward through the common pipe. This mixes with the cold primary supply, raising the secondary supply temperature.
9. **A. VFD's internal rectifier diodes for failure reducing DC bus voltage under load** — The DC bus is supplied by the input rectifier bridge. Failed diodes reduce the rectification from three-phase to less-than-full, dropping the DC bus voltage under load. The fault appears intermittently because the voltage sags only under heavy current demand.
10. **D. New heat exchanger added friction loss to suction piping reducing NPSHa below NPSHr** — Any component added to the pump's suction piping increases friction loss, which directly reduces the

available NPSH. The additional pressure drop from the heat exchanger dropped NPSHa below the pump's required NPSH, causing cavitation.

11. **B. Frame 286T has different mounting dimensions than 284T requiring adapter modifications** — NEMA frame sizes define specific mounting dimensions — bolt pattern, shaft height, and shaft diameter. A 286T frame has different bolt spacing and shaft height than a 284T. The motor will not mount directly without an adapter plate.
12. **C. External contamination entering through damaged breather, failed seal, or poor practices** — Silicon in oil analysis typically indicates dirt and dust ingress. Stable iron and copper levels rule out internal wear. The contamination source is external — a damaged reservoir breather cap, failed shaft seal, or contaminated oil during top-offs.
13. **A. High dissolved solids causing foaming that creates erratic level indication in the gauge glass** — Surging water level with steady firing and normal blowdown suggests the water surface inside the boiler is foaming. High dissolved solids concentration promotes foaming that carries water upward and creates erratic level readings.
14. **D. Ground fault in wiring connected to the GFCI's LOAD terminals trips it instantly** — Even with all devices disconnected from the receptacle face, the GFCI's LOAD terminals feed downstream wiring. A ground fault in that downstream wiring trips the GFCI as soon as it is reset. Disconnecting the LOAD terminal wires confirms this.
15. **B. Alignment is acceptable — 0.002 TIR is within the 0.003 maximum tolerance** — The measured 0.002 inches TIR is within the pump manufacturer's specified maximum of 0.003 inches. The alignment meets the requirement. While tighter alignment is always better, the current reading is within specification.
16. **A. 25-30% of full-load power consumed during unloaded operation is significant waste** — Rotary screw compressors running unloaded still consume approximately 25-30% of their full-load power from motor windage, bearing friction, and maintaining minimum internal pressure. At 40% unloaded time, this represents substantial energy waste.
17. **C. Replace batteries immediately — 90-minute illumination is a life safety code requirement** — Exit signs must provide 90 minutes of emergency illumination per NFPA 101 and local life safety codes. Batteries that provide only 30 minutes fail this critical requirement and must be replaced immediately, not deferred.
18. **B. Double-solenoid valve holds last position when both solenoids are de-energized** — A double-solenoid (memory) valve stays in its last commanded position when de-energized. If the E-stop de-energizes both solenoids, the valve holds the cylinder in its current position. A spring-return valve would retract the cylinder on E-stop.
19. **D. Proportional amplifier's ramp-down time setting to slow the signal decrease rate** — The ramp-down parameter controls how quickly the command signal can decrease. A fast ramp-down causes the valve spool to close rapidly, creating abrupt deceleration. Increasing the ramp-down time produces smoother, more gradual deceleration.

20. **C. Breaker trip ratings affected by elevated ambient temperature reducing effective trip point** — Circuit breaker thermal trip elements are calibrated for a standard ambient temperature (typically 40°C). At 105°F (40.5°C), the elements are already near their calibration point. Additional load current that would normally be within rating may cause nuisance tripping.
21. **A. Cage (retainer) defect producing sub-synchronous vibration below shaft speed** — Bearing cage defects produce vibration at a frequency typically between 0.35× and 0.50× shaft speed. A 0.43× peak falls squarely in this range and is a recognized indicator of cage deterioration or damage.
22. **D. Control valve oversized — at 50% signal the oversized valve passes nearly full design flow** — An oversized control valve has a flow characteristic where small valve openings pass large flow volumes. At 50% signal, the valve is already passing nearly 100% of the design flow. Proper valve sizing matches the valve's flow curve to the coil's needs.
23. **B. Hot condensate has insufficient NPSH — high vapor pressure at 200°F reduces suction head** — At 200°F, water's vapor pressure is high (approximately 11.5 PSIA). The available NPSH may be less than the pump's required NPSH, especially if the condensate receiver is not elevated sufficiently above the pump suction.
24. **C. 2,000 pounds — 4-part line distributes load across four supporting rope parts** — A 4-part line provides a 4:1 mechanical advantage (ignoring friction). Line pull = Load / Number of parts = 8,000 / 4 = 2,000 pounds. Each rope part carries one-quarter of the total load.
25. **A. PLC analog output module for a failed channel not producing proportional current** — The PLC register value changes (software is working) but the VFD shows no change in the speed reference (no signal arriving). The analog output module channel has failed — it is no longer converting the register value to a proportional current output.
26. **D. PRV setting too low for upper-floor pressure needs after accounting for elevation static head** — Each floor of elevation (approximately 10 feet) requires about 4.3 PSI of additional pressure. If the building has 4 floors (40 feet), the upper floor loses approximately 17 PSI to elevation. A 45 PSI PRV setting may leave only 28 PSI at upper fixtures.
27. **B. Severely insufficient air — rich combustion producing smoke, CO, and wasted fuel** — Zero percent excess oxygen with heavy black smoke and CO above 1,000 PPM confirms the burner is running extremely rich. Insufficient combustion air cannot fully burn the fuel. The excess fuel produces carbon (soot/smoke) and carbon monoxide.
28. **A. Power drops to approximately 12.5% — power varies with the cube of speed ratio** — Pump affinity law: $\text{Power} \propto (N_2/N_1)^3 = (30/60)^3 = (0.5)^3 = 0.125 = 12.5\%$. Reducing speed by half reduces power consumption to one-eighth. This is the primary energy-saving benefit of VFD-controlled pump speed reduction.
29. **C. Motor cooling system — fan, shroud, and ventilation passages for dirt accumulation** — Normal current and correct voltage rule out electrical overload. A 12-year-old motor that runs hotter than normal at rated load is most likely suffering from reduced cooling capacity. Dirt accumulation on the fan, shroud, and frame reduces airflow and heat dissipation.

30. **D. Cylinder piston seals and directional valve spool for internal leakage bypass** — With a closed-center valve, the only paths for fluid to escape the cylinder are: (1) past the cylinder piston seals internally, and (2) past the directional valve spool between the blocked ports. Both must be investigated as potential leak paths.
31. **D. System provides more economizer cooling than appropriate thinking outdoor air is colder** — The sensor reads 45°F (10°F colder than actual 55°F). The BAS thinks the outdoor air is colder than it is and opens the economizer dampers wider than necessary, admitting too much cool outdoor air and potentially overcooling the building.
32. **B. Safety valve seat damaged or has debris preventing complete seal after previous lift** — A safety valve weeping below its set pressure indicates the valve seat cannot seal completely. Damage from a previous lift event, scale particles, or corrosion on the seating surfaces prevents the valve from closing tightly.
33. **A. Alarm rung placed after pump rung — pump reduces level before alarm is evaluated in scan** — If the pump start rung is scanned before the alarm rung, the pump may start and begin lowering the level within the same scan cycle. By the time the alarm rung is evaluated, the level has already dropped below 85%. The alarm rung should be placed before the pump start rung.
34. **C. Motor sheave is damaged or unbalanced producing vibration at motor speed** — Vibration at $1 \times$ motor speed that appears only when belts are connected means the source is mechanically coupled to the motor shaft. The motor runs smoothly without belts (eliminating the motor itself). The motor sheave is the remaining component on the motor shaft.
35. **A. Engine's ability to maintain stable speed under sudden full-load application** — No-load testing verifies that the engine starts and reaches rated speed. It does not test the governor's ability to respond to the massive step-change in load when the transfer switch connects the building. A sluggish or improperly adjusted governor causes the engine to stall.
36. **D. 6.5-inch bore from Area = Force/Pressure then solving for diameter** — Area = 100,000 lbs / 3,000 PSI = 33.33 sq in. Bore = $2 \times \sqrt{(33.33 / \pi)} = 2 \times \sqrt{(10.61)} = 2 \times 3.257 = 6.51$ inches. The next standard bore size of 7 inches would be selected.
37. **C. VFD acceleration ramp time too aggressive causing excessive current during speed increase** — Starting against a closed valve means the pump operates at shutoff (no flow, low power). The issue is that the VFD accelerates too quickly — the motor current spikes during rapid acceleration. Increasing the acceleration ramp time reduces the current demand.
38. **A. Reduce wheel speed or stop it temporarily to raise exhaust temperature and melt frost** — Reducing wheel speed decreases the heat transfer from the exhaust air stream, allowing the exhaust air temperature at the wheel to rise above freezing and melt accumulated frost. This is the standard frost prevention control strategy.
39. **D. Bearing inner race not fully seated against shaft shoulder leaving an axial gap** — An inner race that is not pressed fully against the shaft shoulder can shift axially during operation, producing

vibration. This installation error is not visible externally and is not detected by alignment measurements.

40. **B. Normal under heavy condensate load — F&T trap discharges continuously when load is high** — Float and thermostatic traps modulate their opening based on condensate level. Under heavy load, the float stays elevated and the valve remains open, producing continuous discharge. This is normal behavior for the F&T trap design.
41. **A. Auxiliary contact not closing mechanically even though main contacts pull in** — The main power contacts and auxiliary contacts are on the same mechanism but can fail independently. A broken linkage, bent contact arm, or worn auxiliary contact block can prevent the auxiliary from closing even when the main contacts operate.
42. **C. Normal — rod reduces piston area on retract side producing less force at same pressure** — Extend area = $\pi \times 3^2 = 28.27$ sq in. Retract area = $\pi \times (3^2 - 1.5^2) = \pi \times 6.75 = 21.21$ sq in. At 3,000 PSI: extend force = 84,823 lbs, retract force = 63,617 lbs. The 25% difference is inherent to the cylinder geometry.
43. **D. Harmonic currents from VFDs causing excessive transformer heating** — VFDs draw non-sinusoidal current with significant harmonic content. These harmonics cause additional heating in transformer windings (from increased I²R losses) and core (from eddy current losses), exceeding the transformer's thermal design.
44. **D. Cylinder retract speed now exceeds directional valve's maximum flow switching capacity** — The quick-exhaust valve bypasses the long return path but the cylinder now retracts so fast that the directional valve cannot switch its supply port quickly enough. The supply-side pressure spike at the end of stroke creates the popping noise.
45. **A. Stop the conveyor and establish fire watch below the work area** — Hot work above a conveyor carrying combustible mail creates a direct fire risk from falling sparks and molten metal. The conveyor must be stopped and a fire watch established below the work area in addition to standard hot work procedures.
46. **B. 50 amps — 125% of largest motor plus 100% of remaining motors** — NEC motor feeder sizing: 125% of largest motor FLA + 100% of all other motors = $(20 \times 1.25) + 15 + 10 = 25 + 15 + 10 = 50$ amps minimum conductor ampacity. This ensures adequate capacity for the largest motor's starting inrush.
47. **D. Compensator hunting — cannot find stable displacement at setpoint pressure causing oscillation** — When system pressure exactly equals the compensator setpoint, the pump oscillates between loaded and unloaded displacement. The compensator cannot stabilize because any slight displacement change immediately changes the pressure, triggering another adjustment.
48. **B. Pump B's discharge pressure slightly lower than Pump A's — Pump A holds B's check valve closed** — When two pumps are in parallel, the pump with higher discharge pressure dominates. If Pump B's output pressure is even slightly lower than Pump A's, Pump A's pressure holds Pump B's check valve closed. Equalizing the pump outputs resolves this.

49. **D. SQO data table at Step 7 — zero or corrupted word produces no outputs for that step** — If the sequencer data table word at Step 7 contains zeros or corrupted data, the sequencer produces no output changes for that step. With no visible outputs different from Step 6, the machine appears to skip directly to Step 8.
50. **D. Return water at 150°F is too high for condensing mode — needs below 130°F** — Condensing boilers achieve their rated 95% efficiency by cooling flue gases below the dew point (approximately 130°F for natural gas). Return water at 150°F is too warm to provide sufficient cooling for condensation. The boiler operates in non-condensing mode.
51. **B. Phase B contactor tip has high resistance from pitting, contamination, or insufficient pressure** — A 15-volt drop across a closed contactor contact is extreme — normal is less than 1 volt. The Phase B contact has significantly increased resistance from surface pitting, carbon buildup, or insufficient spring pressure.
52. **C. New counterbalance valve pressure setting or pilot ratio incorrect for application** — A recently replaced counterbalance valve that allows cylinder drift indicates the new valve's settings do not match the application requirements. The pressure setting may be too low or the pilot ratio may allow load-induced pressure to crack the valve open.
53. **A. Verify suction supply is adequate, all valves are open, and test discharge path is clear** — Before a fire pump flow test, confirm adequate water supply, all isolation valves fully open, and the test discharge path (typically to a test header or back to the water source) is unobstructed. Testing with inadequate supply can damage the pump.
54. **D. SQO data table at Step 7 position has zero or corrupted data producing no outputs** — When the sequencer advances to a step with all-zero data, the outputs do not change from the previous step's configuration. The machine appears to skip the step because nothing visible happens before the sequencer advances to Step 8.
55. **B. Increase megger testing frequency to monthly and trend the decline to predict replacement timing** — A 90% reduction in insulation resistance (500 to 50 MΩ) over one year is a significant declining trend, even though 50 MΩ still exceeds the minimum acceptable value. Monthly trending allows the maintenance team to predict when replacement will be needed.
56. **C. UV lamps lose germicidal effectiveness over service life before visible light fails** — UV germicidal lamps degrade in intensity over time. A lamp that still produces visible light may have lost most of its germicidal UV-C output. Lamp replacement should follow the manufacturer's recommended interval regardless of visible light output.
57. **A. 1,600 to 1,800 PSI — approximately 80-90% of the minimum system working pressure** — Standard accumulator sizing sets the nitrogen precharge at 80-90% of minimum working pressure. For a 2,000 PSI minimum: $2,000 \times 0.80 = 1,600$ to $2,000 \times 0.90 = 1,800$ PSI. This range protects the bladder while maximizing usable fluid volume.
58. **D. Broken or cracked shading coil on magnetic pole face causing AC buzz and chatter** — AC contactors use shading coils (copper bands on the pole faces) to prevent the magnetic flux from

dropping to zero during each AC cycle. A broken shading coil allows the armature to release momentarily twice per cycle, producing a loud 120 Hz buzz.

59. **B. Impeller progressively wearing producing less head and requiring less power to operate** — Decreasing flow and decreasing current together is the signature of impeller wear. The worn impeller produces less head (reduced flow against system resistance) and draws less power (less hydraulic work being performed by the degraded impeller).
60. **C. Low-profile hydraulic jack and machinery skates to raise and roll the motor out** — In a confined space with 8-foot ceilings and no overhead lifting points, a low-profile hydraulic jack raises the motor enough to slide machinery skates underneath. The motor is then rolled to an area with adequate overhead access for crane lifting.