PRACTICE EXAM 8: USPS 955 MULTICRAFT SIMULATION

1. A maintenance technician measures the current on a 240-volt single-phase motor circuit. Phase A reads 28 amps and Phase B reads 28 amps. The motor nameplate shows 25 FLA. The motor has been running continuously for 4 hours. What is the operational assessment?

A. The current readings are normal because single-phase motors always draw above nameplate

B. The current imbalance between phases indicates an imminent winding failure condition

C. The motor is drawing 12% above nameplate FLA and should be investigated for overload

D. The motor is operating within its service factor range and no action is required

2. A hydraulic system uses a kidney loop (offline) filtration system that runs independently from the main hydraulic circuit. What is the primary advantage of this arrangement?

A. Continuous fluid cleaning without creating pressure drop in the main working circuit

B. Elimination of the need for suction strainers and return line filters in the system

C. Automatic water removal from the hydraulic fluid through centrifugal separation forces

D. Reduction of system operating temperature by circulating fluid through an external cooler

3. An electrician is testing a 480-volt circuit with a voltmeter. Phase A to B reads 480V, Phase B to C reads 480V, but Phase A to C reads 280V. What does this indicate?

A. Normal voltage readings for a high-leg delta transformer configuration and connection

B. A faulty voltmeter connection on the Phase C terminal causing an incorrect reading

C. A blown fuse on Phase A that is causing unequal voltage distribution across phases

D. An open neutral conductor in the three-phase supply causing a floating voltage condition

4. A rooftop air handling unit's supply fan vibrates excessively only when the outdoor air dampers are open. When the dampers close, vibration drops to normal levels. What is the most likely explanation?

A. The outdoor air intake has a partial obstruction creating turbulent airflow patterns

B. The damper actuator is transmitting mechanical vibration through the ductwork connection

C. Opening the dampers changes the system static pressure and airflow volume on the fan

D. Wind entering through the open outdoor air dampers creates aerodynamic buffeting that excites the fan wheel or housing into resonance

5. What is the primary purpose of a shaft grounding ring installed on a motor driven by a variable frequency drive?

A. To provide a low-impedance path for VFD-induced shaft currents to ground, protecting bearings from electrical discharge damage

B. To connect the motor frame to the building's main grounding electrode system

C. To dissipate static electricity buildup on the motor shaft from belt drive friction

D. To provide an additional ground fault return path for the motor's power supply circuit

6. A PLC program uses a sequencer output (SQO) instruction to control an 8-step machine cycle. The machine completes steps 1 through 5 normally but stops at step 6. What should be checked?

A. The PLC processor battery for low voltage causing memory data corruption during operation

B. The step 5 output device for a feedback signal that overrides the sequencer advancement

C. The input condition that triggers the sequencer to advance from step 5 to step 6

D. The PLC program for a missing rung between the step 5 and step 6 output instructions

7. A compressed air system has a rated capacity of 500 CFM. An energy audit reveals the system is producing 500 CFM but the facility only uses 350 CFM. The remaining 150 CFM is lost to leaks. What percentage of the compressor's output is wasted?

A. 15% of the total compressor output based on the ratio of leaks to total capacity

B. 30% of the total compressor output is wasted through system air leaks throughout facility

C. 50% of the useful air demand based on the ratio of leaks to actual consumption

D. 70% of the total system demand including both productive use and wasteful leakage

8. A maintenance technician discovers that a steam trap on a large air handling unit heating coil is cycling very rapidly — opening and closing several times per minute. What does this rapid cycling indicate?

A. The trap has failed closed and is vibrating against the seat from upstream pressure

B. The heating coil has a tube leak allowing condensate and steam to mix unpredictably

C. The steam supply pressure exceeds the trap's maximum rated operating pressure range

D. The trap is operating correctly under a light condensate load with small batches draining

9. During an alignment check on a motor-pump assembly, the technician discovers that loosening one of the motor's four hold-down bolts causes the dial indicator reading on the coupling to shift by 0.008 inches. What condition does this indicate?

A. Soft foot at that motor mounting location requiring shimming correction before alignment

B. Excessive coupling backlash requiring replacement of the coupling's flexible element insert

C. Thermal growth that has already shifted the motor position beyond acceptable alignment limits

D. A cracked motor foot or baseplate that must be repaired by welding before further alignment

10. A 120-volt single-phase circuit is wired with 14 AWG copper conductors. The NEC ampacity rating for 14 AWG at 60°C is 15 amps. A continuous load of 12 amps is connected. Does this installation comply with the NEC continuous load rule?

A. Yes because 12 amps is below the 15-amp conductor rating with 3 amps of spare capacity

B. Yes because the NEC does not have a separate requirement for continuous loads on conductors

C. No because continuous loads must not exceed 80% of the conductor ampacity (15 × 0.80 = 12 amps exactly at the limit)

D. No because 14 AWG wire cannot be used on any circuit exceeding 10 amps regardless of loading

11. A hydraulic cylinder has been leaking oil from the rod gland seal. The seal was replaced two months ago. The rod surface appears smooth with no visible scoring or damage. What should be investigated?

A. The cylinder bore for internal corrosion that is contaminating the fluid with abrasive particles

B. The rod surface for microscopic damage not visible to the naked eye using a magnifying glass or surface roughness tester

C. The hydraulic pump for excessive pulsation that is hammering the seal at high frequency

D. The directional valve for internal leakage that is allowing pressure spikes to reach the gland

12. What safety device on a centrifugal pump prevents the pump from operating without adequate water flow through the system?

A. A pressure relief valve on the pump discharge piping set at the maximum operating pressure

B. A temperature switch on the pump casing that trips when the pump overheats from friction

C. A vibration sensor on the pump bearing housing that trips on excessive bearing vibration levels

D. A flow switch installed in the discharge piping that interlocks with the pump motor control

13. A three-phase transformer bank has one transformer that is significantly hotter than the other two. All three transformers are the same size and carry similar loads. What is the most likely cause?

A. The hot transformer has higher internal losses from shorted turns or degraded core laminations

B. The building ventilation system is directing all airflow away from the hot transformer location

C. The hot transformer is a newer replacement unit with tighter internal clearances than originals

D. The three transformers are not equally loaded despite carrying similar nameplate current values

14. A maintenance technician is troubleshooting a gas furnace that fires normally but the supply air temperature never exceeds 90°F. The thermostat is set to 72°F and the return air temperature is 68°F. The combustion flame appears normal. What should be checked?

A. The gas valve for a stuck-open high-fire position preventing modulated heat output

B. The thermostat calibration for an offset that is sending incorrect temperature readings

C. The blower speed setting or blower motor — excessive airflow across the heat exchanger reduces the supply air temperature rise

D. The flue damper for a stuck-closed position that is recirculating combustion gases back through

15. A digital logic circuit has three inputs (A, B, C) feeding a combination of gates. The output is HIGH only when A is HIGH, B is LOW, and C is HIGH. Which Boolean expression represents this circuit?

A. $Y = A \cdot \bar{B} \cdot C$ — requiring A true, B inverted (NOT B), and C true simultaneously

B. $Y = A + \bar{B} + C$ — requiring any one of A, NOT B, or C to be true for output

C. $Y = \bar{A} \cdot B \cdot \bar{C}$ — requiring NOT A, B true, and NOT C for the output condition

D. $Y = A \cdot B \cdot C$ — requiring all three inputs to be true simultaneously for the output

16. A maintenance technician is replacing a globe valve in a steam piping system. The old valve was installed with the flow entering from below the disc. The replacement valve has an arrow on the body indicating flow direction. What is the significance of this flow direction?

A. Globe valves work equally well in either flow direction so the arrow is only advisory

B. Correct installation per the arrow ensures the valve seats properly and operates against flow as designed

C. The arrow indicates the direction of maximum flow capacity for sizing the replacement valve

D. The flow direction arrow only applies to control valves and not to manual isolation globe valves

17. A PLC-controlled sorting machine has a reject station that activates when a quality sensor detects a defective package. The reject cylinder fires late, missing the defective package. The sensor, PLC input, and PLC output all respond within specification. What is the most likely cause?

A. The PLC program has a timing error in the reject delay calculation instruction block

B. The quality sensor is detecting the defect after the package has passed the optimal reject point

C. The photoeye at the reject station is misaligned and not detecting package position correctly

D. The pneumatic response time from valve shift to cylinder extension is too slow for the line speed

18. A maintenance electrician needs to install a new 480-volt, 3-phase, 30-horsepower motor. The motor nameplate shows 40 FLA. What overcurrent protection device rating should the branch circuit use?

A. 70-amp dual-element time-delay fuse — calculated at 175% of FLA per NEC motor branch circuit protection rules

B. 40-amp circuit breaker matching the motor's exact nameplate full-load current rating

C. 100-amp fuse providing 250% safety margin above the motor's full-load current draw

D. 50-amp breaker sized at 125% of the motor FLA for continuous duty load protection

19. A hydraulic system operates at 3,000 PSI. The pump's case drain flow has increased from 0.5 GPM to 3.5 GPM over the past six months. What does this trend indicate?

A. The system relief valve has been gradually adjusted upward causing increased bypass flow

B. The hydraulic fluid viscosity has decreased due to contamination with a lighter-weight solvent

C. Internal pump wear has increased clearances allowing more fluid to leak from the pressure side to the case

D. The case drain filter has become clogged and is creating elevated back-pressure in the pump housing

20. In a three-phase power system, what instrument is used to measure the power factor of the electrical load?

A. A watt-hour meter that integrates real power consumption over a measured time period

B. A power factor meter that measures the phase angle between voltage and current waveforms

C. A frequency meter that measures the supply frequency deviation from the standard 60 Hz

D. A demand meter that records the peak power consumption during each utility billing period

21. A maintenance crew is replacing a section of Schedule 40 carbon steel pipe in a compressed air system. The original pipe was joined by threading. The replacement section is too long to thread in the field. What is the most appropriate joining method?

A. Use a flanged connection at each end of the replacement section for future serviceability

B. Braze the replacement section using silver brazing alloy with appropriate flux application

C. Use compression couplings (Dresser-type) that clamp over the pipe ends with gaskets

D. Weld the replacement section to the existing pipe using appropriate welding procedures and electrodes

22. A centrifugal pump handling chilled water has been operating for five years. The maintenance technician notices that the pump motor's amperage has gradually increased by 8% while the flow rate has remained constant. What is the most likely cause?

A. Increased system resistance from scale or fouling in the piping and coils is forcing the pump to work harder

B. The pump impeller has worn and is now spinning faster to maintain the same flow output

C. The chilled water temperature has decreased making the water more viscous and harder to pump

D. The motor windings have degraded causing increased current draw from higher winding resistance

23. A building's emergency lighting system uses battery-powered emergency fixtures. During a monthly test, several fixtures fail to illuminate. What is the most likely cause?

A. The building's transfer switch did not operate properly during the monthly testing sequence

B. The emergency generator is not reaching rated voltage within the required 10-second window

C. The individual fixture batteries have reached end of life and require replacement with matching units

D. The normal power supply to the building has a ground fault affecting the emergency circuit

24. A maintenance technician is troubleshooting a hydraulic press that will not build pressure. The pump is running and the relief valve is verified at the correct setting. Oil is flowing from the pump, but the pressure gauge reads near zero. What is the most likely cause?

A. The hydraulic reservoir level is too high causing the pump to cavitate from excess fluid

B. A directional valve is stuck in a position that routes pump flow directly back to tank

C. The pressure gauge has failed and is not displaying the actual system operating pressure

D. The pump is running backward due to incorrect motor rotation direction after maintenance

25. A variable frequency drive displays a "ground fault" alarm on a motor circuit. The motor was running normally until the alarm occurred. What should be checked first?

A. The VFD's internal control board for a firmware error requiring a factory reset procedure

B. The motor winding insulation for breakdown using a megger test after the circuit is isolated

C. The VFD's DC bus capacitors for degradation causing internal ground leakage current paths

D. The motor power cables and connections for insulation damage, moisture, or contamination

26. A steam boiler is operating at normal pressure, but the feedwater pump is running continuously and the boiler water level is slowly dropping. The condensate return system appears normal. What should be checked?

A. The blowdown valve for a leak — a partially open or leaking blowdown valve continuously drains water from the boiler

B. The steam safety valve for visible discharge that would indicate it is venting steam continuously

C. The feedwater pump's discharge pressure for adequacy to push water into the boiler against steam pressure

D. The boiler's steam pressure control for a setting that is too high causing excessive steam generation

27. A PLC analog input module receives a 4-20 mA signal from a temperature transmitter calibrated for 0-1000°F. The PLC register shows a raw count of 2048 on a 12-bit (0-4095) analog input module. What temperature does this represent?

A. 250°F because the raw count is one-quarter of the full 4095 scale maximum value

B. 750°F because the raw count corresponds to 75% of the temperature transmitter's full range

C. 500°F because 2048 is exactly 50% of the 4095 full-scale count corresponding to 50% of the temperature range

D. 1000°F because 2048 is the midpoint count on a 12-bit module corresponding to full scale

28. A maintenance technician discovers that a bearing grease fitting is completely plugged and will not accept grease from the grease gun. What is the correct repair procedure?

A. Increase the grease gun pressure by using a pneumatic grease gun until the blockage clears

B. Remove the fitting, clean or replace it, and verify the passage to the bearing is clear before installing the new fitting

C. Drill out the grease fitting with a small drill bit and reinstall the same fitting body

D. Leave the fitting plugged and apply grease through an alternate entry point on the housing

29. A 208-volt three-phase motor is connected to a 240-volt supply. The motor runs but draws higher current than nameplate and operates at elevated temperature. Why does this occur?

A. The motor's power factor decreases at higher voltage causing increased reactive current draw

B. The higher voltage causes the motor to run faster than design speed increasing mechanical friction

C. The motor's magnetic core saturates at the higher voltage increasing magnetizing current and losses

D. The motor's insulation system breaks down at voltages above nameplate causing leakage current flow

30. A technician is troubleshooting a pneumatic system where multiple actuators are running slower than normal during peak demand periods but operate normally during low-demand periods. What is the most likely system-level cause?

A. The individual actuator seals are all wearing at the same rate causing simultaneous degradation

B. The compressor or distribution system cannot deliver adequate volume during peak demand periods

C. The FRL units on each actuator circuit have identical contamination blocking flow simultaneously

D. The PLC is throttling all outputs during peak periods to reduce electrical demand on the facility

31. An electrician is installing a new motor circuit and must select the correct overload relay heater elements. What information is needed to select the proper heater size?

A. The motor's locked rotor current and the supply voltage measured at the motor terminals

B. The circuit breaker size and the conductor ampacity rating from the NEC wire table

C. The motor's service factor and the insulation class rating from the motor nameplate data

D. The motor's full-load amperage (FLA) from the nameplate and the overload relay manufacturer's selection table

32. A cooling tower fan motor trips on overload after several hours of operation on a hot, humid day. The motor has been running reliably for years without issues. What is the most likely cause?

A. The motor's internal thermal protector has degraded and is now tripping at a lower temperature

B. The fan blade pitch was adjusted recently increasing the air volume and motor load above design

C. Elevated ambient temperature and humidity reduce the motor's cooling capacity causing it to overheat at normal load

D. The motor's bearing lubrication has dried out from heat exposure causing increased mechanical friction

33. A hydraulic system has a pressure-compensated variable displacement pump. During operation, the pump makes a loud knocking noise that increases with system pressure. What is the most likely cause?

A. The pump compensator is set too high above the relief valve setting causing pressure spikes

B. Cavitation at the pump inlet — insufficient suction flow due to a restricted inlet line, clogged strainer, or high fluid viscosity

C. The pump's internal bypass valve is opening and closing rapidly at the compensator setting

D. The pump drive coupling has worn and is producing mechanical backlash noise at each revolution

34. A maintenance technician finds that an electric unit heater's fan runs but the contactors for the heating elements are not pulling in. The thermostat is calling for heat. Control voltage is measured at 24 VAC at the transformer secondary. What should be checked next?

A. The control circuit path from the thermostat through safety switches to the heating element contactor coil for an open

B. The heating elements for continuity to determine if they are burned out and need replacement

C. The fan motor's overload relay for a trip condition that has disabled the heating circuit

D. The building's main electrical panel for a tripped breaker on the heater's power supply circuit

35. A maintenance crew is rigging a load for a tandem lift using two cranes. What is the most critical safety consideration for this type of lift?

A. Both cranes must be the same manufacturer and model to ensure identical performance characteristics

B. Both cranes must use the same type and size of wire rope sling for load distribution

C. The lift must be supervised by a single qualified signal person visible to both crane operators

D. A detailed lift plan must be developed specifying load weight, each crane's capacity at the working radius, load distribution, and coordinated communication procedures

36. In a PLC ladder logic program, an output instruction OTE (Output Energize) is addressed to O:2/0. On a separate rung, another OTE is also addressed to O:2/0. What is the result of this dual addressing?

A. The PLC generates a programming fault and refuses to execute the program in run mode

B. The second (lower) rung controls the output — the last rung evaluated in the scan cycle determines the output state

C. Both rungs must be true simultaneously for the output to energize as an automatic AND condition

D. The output alternates between the two rung states on successive scan cycles creating an oscillation

37. A maintenance technician is inspecting fire dampers in a postal facility's HVAC ductwork. What triggers a fire damper to close?

A. A signal from the building fire alarm panel activating the damper's electric actuator motor

B. High airflow velocity through the duct that exceeds the damper's maximum rated flow speed

C. A fusible link that melts at a predetermined temperature when hot gases from a fire pass through the duct

D. A smoke detector in the duct that sends a signal to the building automation system controller

38. A centrifugal pump's mechanical seal begins leaking within one week of installation. The seal was new, the correct type, and installed by an experienced technician. What should be investigated?

A. The shaft sleeve surface for a groove worn by the previous seal that prevents the new seal from seating

B. The pump's discharge pressure for exceeding the seal's rated maximum pressure capacity

C. The impeller for an imbalance that is causing excessive shaft deflection at the seal location

D. The pump's operating conditions — dry running during startup, cavitation, or thermal shock that damaged the new seal faces

39. In a building electrical system, the term "demand factor" refers to what calculation?

A. The ratio of the maximum demand of a system to the total connected load of the system

B. The percentage of time that a piece of equipment operates during a standard billing period

C. The ratio of reactive power to real power in the building's electrical distribution system

D. The multiplier applied to conductor ampacity to account for ambient temperature derating

40. A maintenance technician observes that a belt-driven exhaust fan is producing noticeably less airflow than normal. The motor runs at normal speed and the belts appear properly tensioned. What should be checked?

A. The motor's power factor for a decrease that would reduce the shaft torque output at normal speed

B. The motor's electrical supply for a voltage imbalance between phases causing reduced motor torque

C. The fan wheel and housing interior for dirt or debris buildup that reduces aerodynamic performance

D. The VFD parameter settings for a frequency reduction that would lower the fan operating speed

41. A PLC counter instruction (CTU) has a preset value of 100 and the accumulated value shows 100. The counter's done bit is ON. A new item is counted, bringing the accumulated value to 101. What is the state of the done bit?

A. The done bit remains ON because the accumulated value exceeds the preset — it stays on until the counter is reset

B. The done bit turns ON because the accumulated value still equals or exceeds the preset value of 100

C. The done bit turns OFF because the accumulated value has exceeded the preset by more than one count

D. The done bit pulses ON for one scan cycle then turns OFF until the next reset and recount sequence

42. A hydraulic system uses a bladder-type accumulator precharged with nitrogen. During routine maintenance, the nitrogen precharge pressure reads zero. What does this indicate?

A. The accumulator bladder has ruptured and the nitrogen has escaped into the hydraulic fluid

B. The nitrogen precharge was consumed by the hydraulic fluid through normal absorption over time

C. The accumulator's gas valve has a slow leak that allowed the nitrogen to escape over time

D. Normal condition — accumulators lose their precharge when the system is not pressurized and running

43. A maintenance technician is troubleshooting a motor that trips its overload relay only during startup. The motor starts against full load every time. Once running, the motor operates within normal current range. What is the most likely cause?

A. The motor's starting torque is inadequate for the connected load requiring a higher-torque motor design

B. The power supply voltage is low during startup reducing the motor's available starting torque capability

C. The motor's stator windings have a developing inter-turn short that manifests only under starting current stress

D. The overload relay's trip class is too fast for the motor's starting characteristics and the connected load inertia

44. A building's hot water heating system has an automatic air vent that is continuously discharging water instead of air. What is the most likely cause?

A. The system pressure exceeds the air vent's maximum operating pressure rating causing mechanical failure

B. The expansion tank is properly charged and maintaining correct system pressure at all operating temperatures

C. The air vent's float mechanism has failed in the open position allowing water to discharge continuously

D. The system temperature is too high causing the water to flash to steam at the air vent discharge point

45. What is the correct procedure for measuring the insulation resistance of a motor winding using a megohmmeter?

A. Disconnect the motor from all power sources and other equipment, connect the megger between each winding and ground, and record the resistance readings

B. Connect the megger while the motor is energized to test insulation under actual operating voltage

C. Connect the megger between two phase leads to measure the resistance between adjacent windings

D. Apply the megger test voltage for exactly 5 seconds and record the instantaneous peak reading

46. A maintenance technician discovers that a set of sprockets on a chain drive shows a pronounced hooked or pointed tooth profile. What does this tooth shape indicate?

A. The sprockets are severely worn and must be replaced along with the chain to prevent accelerated wear on the new chain

B. The sprockets are a heavy-duty industrial grade designed with pointed teeth for aggressive chain engagement

C. The chain tension has been set too tight causing the teeth to deform under excessive loading stress

D. The sprockets were manufactured with an incorrect tooth profile and should be returned for warranty replacement

47. A facility's compressed air system includes a refrigerated air dryer. The dryer's outlet air temperature reads 55°F instead of the normal 38°F. What is the consequence of this malfunction?

A. The compressed air will contain less moisture because warmer air holds more water in suspension

B. No significant impact because the 17-degree difference does not affect downstream equipment operation

C. More moisture will remain in the compressed air because the higher temperature provides less condensation

D. The air compressor will cycle more frequently to compensate for the reduced dryer cooling performance

48. A maintenance electrician is replacing a motor. The old motor is a 10 HP, 480V, 3-phase, 1760 RPM, TEFC enclosure. The available replacement is a 10 HP, 480V, 3-phase, 1760 RPM, ODP enclosure. Can the ODP motor be used in the same application?

A. Yes because both motors have identical electrical ratings that match the circuit and load requirements

B. Yes but only temporarily until a TEFC replacement motor can be obtained from the supplier

C. No because ODP motors must always be installed in indoor clean-room environments with HEPA filtration

D. It depends on the environment — ODP (Open Drip-Proof) motors are not suitable for dusty, wet, or outdoor locations where TEFC (Totally Enclosed Fan-Cooled) motors are required

49. A PLC program monitors a tank level using a 4-20 mA transmitter scaled 0-100%. The program includes a high-level alarm at 90% and a high-high alarm at 95%. The tank level reads 92%. What should be the alarm status?

A. Both high-level and high-high alarms should be active because the level exceeds both setpoints

B. Only the high-level alarm should be active — the level exceeds 90% but has not reached 95%

C. Neither alarm should be active because the level is below the 95% high-high alarm threshold

D. The high-high alarm should be active but the high-level alarm should automatically clear above 91%

50. A maintenance technician is troubleshooting an intermittent ground fault on a 480-volt feeder. The fault trips the ground fault protection but cannot be found with a standard megger test. What diagnostic approach should be used?

A. A continuous insulation monitoring device installed on the feeder to detect the ground fault when it occurs under operating conditions

B. A standard clamp-on ammeter measuring each phase conductor for current imbalance indications

C. A high-potential (hipot) test applied to each conductor at twice the rated voltage for extended duration

D. Replacing all conductors in the feeder circuit as a precautionary measure to eliminate the fault

51. A hydraulic system's return line filter has a bypass indicator that is permanently triggered. The maintenance technician replaces the filter element, but the bypass indicator remains triggered. What should be checked?

A. The hydraulic fluid for contamination that is immediately clogging the new filter element upon installation

B. The filter bypass valve for a mechanical failure that holds it in the bypass position regardless of element condition

C. The bypass indicator mechanism itself for a stuck or failed condition giving a false bypass indication

D. The pump output for excessive flow that exceeds the filter housing's maximum rated flow capacity

52. An emergency generator's automatic transfer switch (ATS) fails to transfer when utility power is lost. The generator starts and reaches rated voltage and frequency. What component has failed?

A. The generator's voltage regulator since it must signal the ATS that stable power is available

B. The generator's governor since the ATS requires stable frequency before allowing the transfer

C. The utility power monitoring relay since it must sense the power loss before the ATS can act

D. The ATS itself — either the transfer mechanism, the control logic, or the transfer signal path has failed

53. A maintenance technician is selecting a welding electrode for repairing a structural steel support beam in a postal facility. The weld must have high strength, low hydrogen content, and crack resistance. Which electrode is most appropriate?

A. E7018 low-hydrogen electrode stored in a heated oven to prevent moisture absorption

B. E6013 general-purpose electrode with a rutile coating for smooth arc characteristics

C. E6010 deep-penetrating electrode with a cellulosic coating for dirty metal applications

D. E6011 all-position electrode with an AC-compatible cellulosic coating for field portability

54. A cooling tower's makeup water valve is stuck open, continuously adding fresh water to the tower basin. The overflow drain is handling the excess water. What is the operational consequence?

A. The conductivity drops below treatment levels wasting water treatment chemicals and increasing water consumption

B. The cooling tower water temperature drops significantly reducing the building's cooling system capacity

C. The tower fan motor overloads because the additional water weight increases the fan's resistance to airflow

D. The basin water level rises above the overflow and floods the mechanical room below the cooling tower

55. What is the purpose of a motor space heater (anti-condensation heater) installed in a large motor that operates intermittently?

A. To preheat the motor windings to operating temperature before startup to reduce inrush current draw

B. To maintain rotor bearing temperature above ambient to prevent lubricant from becoming too viscous

C. To provide supplemental heating during cold weather when the motor is running under light load conditions

D. To keep the motor interior warm when idle, preventing moisture condensation on the winding insulation

56. A maintenance technician is troubleshooting a three-way mixing valve on a hot water heating system. The valve is supposed to modulate between full hot water and full bypass, but it only operates at the two extreme positions with no intermediate modulation. What is the most likely cause?

A. The hot water supply temperature is fluctuating too rapidly for the valve actuator to track accurately

B. The mixing valve body has internal scale buildup preventing smooth stem travel between positions

C. The valve actuator is receiving an on/off signal instead of the modulating signal it requires for proportional control

D. The system circulating pump is oversized causing excessive velocity through the mixing valve body

57. A maintenance crew must lift a 5,000-pound load using a two-leg sling arrangement. Each sling leg makes a 60-degree angle with the horizontal. Each sling is rated at 4,000 pounds in a vertical hitch. Is this arrangement adequate?

A. Yes — at 60 degrees, each leg carries approximately 2,887 pounds which is within the 4,000-pound sling rating

B. No — at 60 degrees, each leg carries approximately 5,000 pounds which exceeds the individual sling rating

C. Yes — the total sling capacity of 8,000 pounds exceeds the 5,000-pound load with adequate safety margin

D. No — two-leg sling arrangements are never permitted for loads exceeding 3,000 pounds regardless of angle

58. In a PLC program, what is the difference between a retentive timer (RTO) and a standard on-delay timer (TON)?

A. An RTO can only be used with analog input signals while a TON works with discrete inputs only

B. An RTO retains its accumulated time when the rung goes false and resumes timing when the rung goes true again

C. A TON provides more precise timing resolution than an RTO at intervals below one second duration

D. An RTO counts down from its preset while a TON counts up from zero to its preset value setting

59. A building's electrical system experiences repeated tripping of a specific branch circuit breaker. The breaker has been replaced twice with the same result. An insulation resistance test on the circuit wiring shows acceptable readings. What should be investigated next?

A. The electrical panel bus bars for heat damage or loose connections at the breaker mounting clips

B. The circuit's connected loads for an intermittent fault that only occurs during certain operating conditions

C. The building's grounding electrode system for inadequate ground resistance causing fault current issues

D. The actual current draw of the circuit under full operating load to determine if the total connected load exceeds the breaker rating

60. A maintenance technician needs to drain a hydraulic system for a cylinder repair. The system has been operating at 150°F fluid temperature. What safety precaution is most important during the draining process?

A. Wear chemical-resistant gloves because hydraulic fluid at any temperature is a severe skin irritant

B. Drain the fluid into an open container to allow it to cool faster before handling or disposal

C. Allow the system to cool to a safe handling temperature before draining to prevent burns from hot oil

D. Drain the fluid through the system's pressure filter to capture any contaminants before disposal

Practice Exam 8: Answer Key and Explanations

1. **C. Motor drawing 12% above nameplate FLA requires investigation** — At 28 amps versus 25 FLA, the motor draws 112% of its rated current. Unless the motor has a service factor of 1.15 or higher, this sustained overcurrent will overheat the windings. Investigate the driven load for binding or overload.
2. **A. Continuous cleaning without affecting the main working circuit** — A kidney loop system circulates and filters reservoir fluid independently. It does not create pressure drop or flow restriction in the main hydraulic circuit while continuously maintaining fluid cleanliness to the highest filtration standards.
3. **B. Faulty voltmeter connection on Phase C terminal** — In a balanced three-phase system, all three line-to-line voltages should be equal. Two normal readings and one abnormal reading most likely indicate a poor meter probe contact rather than an actual system fault requiring further verification.
4. **D. Wind creates aerodynamic buffeting exciting the fan into resonance** — Outdoor air entering through open dampers can create turbulent airflow patterns that excite the fan wheel or scroll housing at its natural frequency. Closing the dampers eliminates the turbulence source and the vibration stops.
5. **A. Grounding ring protects bearings from VFD-induced shaft currents** — VFDs produce common-mode voltage that induces current on the motor shaft. Without a discharge path, this current arcs through the bearings, causing pitting damage called fluting. A grounding ring provides the low-impedance discharge path.
6. **C. Check the input condition that advances the sequencer from step 5 to 6** — The sequencer advances one step each time its input condition transitions. If the machine stops at step 5, the condition that triggers advancement to step 6 is not being met. Check the sensor, switch, or timer that provides this signal.

7. **B. 30% of compressor output is wasted through leaks** — Leak volume (150 CFM) divided by total output (500 CFM) = 30%. Industry studies confirm that 20-30% leak rates are common in poorly maintained systems. Leak repair provides immediate energy savings.

8. **D. Trap cycling correctly under light condensate load** — Rapid cycling indicates the trap is receiving small batches of condensate and functioning normally — opening to discharge condensate, closing when steam arrives, then reopening as more condensate accumulates. This is expected under light load conditions.

9. **A. Soft foot requiring shimming correction before alignment** — A 0.008-inch shift when loosening one bolt means the motor frame deflects when that bolt is tightened. This is soft foot — the mounting surface is not flat or coplanar. Shimming corrects the condition before meaningful alignment can begin.

10. **C. At the exact 80% limit — continuous loads must not exceed 80% of ampacity** — NEC requires that continuous loads (3 hours or more) not exceed 80% of the conductor and overcurrent device rating. 15A × 0.80 = 12A. The installation is exactly at the limit — any increase would violate the rule.

11. **B. Check rod surface for microscopic damage with magnification** — Rod surface damage invisible to the naked eye — fine scratches, chrome flaking, or corrosion pitting — can destroy dynamic seals rapidly. A magnifying glass or profilometer reveals damage that visual inspection alone cannot detect.

12. **D. Flow switch interlocks with pump motor control circuit** — A flow switch in the discharge piping verifies that water is actually flowing. If flow stops (from a closed valve, failed pipe, or air lock), the flow switch opens and the interlock shuts down the pump to prevent damage.

13. **A. Hot transformer has higher internal losses from shorted turns or core degradation** — With equal loading and the same size, one transformer running significantly hotter indicates increased internal losses. Shorted turns increase circulating current and core lamination damage increases eddy current heating.

14. **C. Blower speed too high — excessive airflow reduces temperature rise** — The temperature rise across the heat exchanger equals heat input divided by airflow mass. Excessive airflow (too high blower speed or incorrect speed setting) distributes the same heat across more air, reducing the supply temperature.

15. **A. $Y = A \cdot \bar{B} \cdot C$ requires A true, NOT B, and C true** — The output is HIGH only when A=1, B=0, C=1. The Boolean expression uses AND operations with B inverted ($\bar{B}$). All three conditions must be simultaneously true for the output to be HIGH.

16. **B. Correct installation ensures proper valve seating and operation** — Globe valve flow direction affects disc seating, shutoff capability, and stem packing load. Installing against the arrow can prevent proper shutoff or cause stem damage. Always install per the manufacturer's flow direction arrow.

17. **D. Pneumatic response time too slow for the conveyor line speed** — With sensor, PLC input, and PLC output all responding within specification, the delay is in the physical actuation system. Long air supply tubing, undersized tubing, or a slow-shifting valve adds pneumatic lag that misses the package.

18. **A. 70-amp time-delay fuse per NEC motor branch circuit rules** — NEC allows time-delay fuses up to 175% of motor FLA for branch circuit protection. 40 FLA × 1.75 = 70 amps. Time-delay fuses accommodate motor starting inrush while protecting the branch circuit conductors.

19. **C. Internal pump wear increasing clearances and bypass leakage** — Case drain flow represents fluid leaking past internal clearances from the high-pressure side to the pump case. A sevenfold increase over six months indicates accelerating wear that will eventually require pump rebuild or replacement.

20. **B. Power factor meter measures phase angle between voltage and current** — The power factor meter directly indicates the cosine of the phase angle between voltage and current waveforms. This ratio of real power to apparent power reveals how efficiently the load converts electrical energy to useful work.

21. **D. Weld the replacement section using appropriate procedures** — For permanent carbon steel pipe joints in a compressed air system where threading is not feasible, welding provides the strongest and most reliable connection. Proper welding procedures and qualified welders ensure joint integrity.

22. **A. Increased system resistance from fouling forces the pump to work harder** — Scale and fouling in piping and coils increase system resistance. The pump operating point shifts left on its curve — lower flow at higher head. The motor draws more current because the pump works against greater resistance.

23. **C. Individual fixture batteries have reached end of life** — Emergency lighting fixtures contain internal batteries that power the lamps during outages. Batteries have a finite lifespan (typically 3-5 years). Failed fixtures during testing indicate dead batteries requiring replacement.

24. **B. Directional valve stuck in a position routing pump flow to tank** — If a directional valve spool is stuck in a position that connects the pump's output directly to the tank return, all flow bypasses the working circuit. The pump runs freely but no pressure builds because there is no flow resistance.

25. **D. Check motor cables and connections for insulation damage or contamination** — A ground fault on a running motor most commonly originates in the power cabling — damaged insulation from vibration, heat, moisture, or physical damage. The cables and connections between the VFD and motor are the first inspection target.

26. **A. Blowdown valve leaking and continuously draining boiler water** — A partially open or seeping blowdown valve continuously removes water from the boiler. The feedwater pump runs constantly trying to keep up, but if the leak rate exceeds the pump's makeup capacity, the level drops.

27. **C. 500°F at 50% of the 12-bit scale range** — 2048 is exactly half of 4095 (full scale). At 50% of scale, the signal represents 50% of the 0-1000°F range = 500°F. Linear scaling maps the 0-4095 count directly to the 0-1000°F range proportionally.

28. **B. Remove, clean or replace the fitting, and verify the passage is clear** — A plugged fitting means contamination has blocked the grease path. Forcing grease under high pressure risks blowing out seals or pushing contamination into the bearing. Remove the fitting, clear the passage, and install a clean fitting.

29. **C. Core saturation at higher voltage increases magnetizing current and losses** — Operating above nameplate voltage drives the magnetic core into saturation. Saturated iron cannot absorb additional magnetic flux efficiently, causing a sharp increase in magnetizing current, core heating, and total losses.

30. **B. Compressor or distribution system cannot supply adequate volume at peak demand** — When multiple actuators operate simultaneously during peak periods, the total air demand exceeds the supply capacity. System pressure drops, and all actuators slow proportionally. The compressor or piping is undersized for peak demand.

31. **D. Motor FLA from nameplate and manufacturer's heater selection table** — Overload relay heater elements are selected by matching the motor's nameplate full-load current to the relay manufacturer's heater selection table. The table cross-references FLA to the correct heater catalog number.

32. **C. Elevated ambient temperature and humidity reduce motor cooling capacity** — Hot humid air provides less cooling than cool dry air. The motor generates normal heat at normal load, but the reduced cooling capacity allows the winding temperature to rise above the overload relay's trip threshold.

33. **B. Cavitation at the pump inlet from restricted suction flow** — A loud knocking noise that increases with pressure is the signature of pump cavitation. Restricted inlet flow (clogged strainer, kinked suction hose, high viscosity) starves the pump, creating vapor bubbles that collapse destructively.

34. **A. Check control circuit path from thermostat to contactor coil for an open** — The fan runs (power is available) but the heating contactors do not pull in (control circuit problem). Trace the 24-volt control path from thermostat through safety switches and interlocks to the contactor coil for an open contact.

35. **D. Detailed lift plan with load weight, crane capacities, load distribution, and communication** — Tandem lifts are among the most hazardous crane operations. A detailed lift plan ensures both cranes operate within their rated capacity at the actual working radius with coordinated communication throughout the lift.

36. **B. The last rung evaluated determines the output state** — When two rungs address the same output, the PLC evaluates both during each scan. The last rung scanned (lower in the program) overwrites the result of the first. The output reflects only the last evaluation — a common programming error.

37. **C. Fusible link melts at a preset temperature from fire-heated gases** — Fire dampers use a fusible link (typically rated at 165°F) that holds the damper blade open. When hot gases from a fire pass through the duct, the link melts and the spring-loaded damper blade snaps closed.

38. **D. Operating conditions damaged the new seal faces after installation** — A correctly installed new seal that fails within a week points to operating conditions — dry running during startup, cavitation creating pressure spikes, or thermal shock from rapid temperature changes that crack or distort the seal faces.

39. **A. Ratio of maximum demand to total connected load** — Demand factor recognizes that not all connected loads operate simultaneously. A building with 1,000 kW of connected load but a peak

demand of 600 kW has a demand factor of 0.60 (60%). This ratio is used for sizing service entrance equipment.

40. **C. Fan wheel and housing interior fouled with dirt or debris buildup** — Dirt accumulation on fan blades changes their aerodynamic profile, reducing efficiency and airflow. Internal housing buildup restricts the scroll passage. Cleaning restores the fan to its original performance level.

41. **B. Done bit remains ON because accumulated value still meets or exceeds preset** — The CTU done bit turns ON when accumulated value equals or exceeds the preset and remains ON regardless of how far the count exceeds the preset. Only a reset (RES) instruction returns the accumulated value to zero and clears the done bit.

42. **A. Accumulator bladder has ruptured allowing nitrogen to escape** — Zero precharge pressure means all nitrogen has escaped. The most common cause is a ruptured bladder allowing nitrogen to mix with and dissolve into the hydraulic fluid. The accumulator must be rebuilt with a new bladder.

43. **D. Overload relay trip class too fast for the motor's starting characteristics** — Different motors require different amounts of time to accelerate to running speed depending on the load inertia. If the overload relay's trip class does not allow enough time for the motor to complete its start, it trips during acceleration.

44. **C. Air vent float mechanism failed in the open position** — The float inside the automatic air vent rises with water level to close the vent orifice after air is expelled. A failed or stuck float remains in the low position, keeping the orifice open and allowing water to discharge continuously.

45. **A. Disconnect motor, connect megger between each winding and ground** — Proper megger testing requires complete de-energization, isolation from other equipment, and measurement between each winding phase and the motor frame (ground). Record readings at 1 minute and 10 minutes for PI calculation.

46. **A. Severely worn sprockets requiring replacement with the chain** — Hooked or pointed sprocket teeth are the result of chain elongation wearing the teeth unevenly. New chain on worn sprockets wears rapidly because the tooth profile no longer matches the chain's roller spacing.

47. **C. More moisture remains in compressed air due to less condensation** — A refrigerated dryer works by cooling air to condense moisture. At 55°F instead of 38°F, less moisture condenses and more remains in the air stream. Downstream equipment may experience water damage and corrosion.

48. **D. Depends on environment — ODP motors are not suitable for dusty or wet locations** — TEFC motors have sealed enclosures protecting against dust, moisture, and outdoor weather. ODP motors have ventilation openings that allow environmental contamination to enter. The replacement is acceptable only if the environment is clean and dry.

49. **B. Only the high-level alarm is active at 92% tank level** — The level at 92% exceeds the 90% high-level setpoint (alarm active) but has not reached the 95% high-high setpoint (alarm inactive). Each alarm operates independently at its own threshold.

50. **A. Install continuous insulation monitoring to capture the intermittent fault** — An intermittent ground fault that clears before a megger test can detect it requires continuous monitoring. An insulation monitoring device detects the fault in real time when it occurs under actual operating conditions.

51. **C. Check the bypass indicator mechanism for a stuck or failed condition** — If the bypass indicator remains triggered after a new filter element is installed, the indicator mechanism itself may be stuck or defective. Verify by checking the actual differential pressure across the new element with a gauge.

52. **D. The ATS itself has failed in its transfer mechanism or control logic** — The generator is running at rated voltage and frequency — it has done its job. The utility monitoring function worked (the generator started). The failure is in the ATS's ability to physically transfer the load contacts from utility to generator.

53. **A. E7018 low-hydrogen electrode for structural high-strength applications** — E7018 provides 70,000 PSI tensile strength, low-hydrogen deposit for crack resistance, and excellent mechanical properties. Heated oven storage prevents moisture absorption that would compromise the low-hydrogen characteristics.

54. **A. Conductivity drops wasting treatment chemicals and increasing water consumption** — Continuous fresh water addition dilutes the treatment chemicals below effective concentrations and flushes them out through the overflow. Water consumption increases dramatically while treatment effectiveness decreases.

55. **D. Prevents moisture condensation on windings when the motor is idle** — When a warm motor cools during idle periods, moisture from ambient air condenses on the winding surfaces. Space heaters keep the motor interior above the dew point, preventing condensation that degrades winding insulation over time.

56. **C. Actuator receiving on/off signal instead of modulating signal** — A modulating actuator requires a proportional control signal (4-20 mA or 0-10V) to position the valve at intermediate points. An on/off signal drives the actuator to one extreme or the other with no intermediate positioning capability.

57. **A. Adequate — each leg carries approximately 2,887 pounds at 60 degrees** — At 60° from horizontal, each leg carries: (5,000/2) / sin(60°) = 2,500 / 0.866 = 2,887 pounds. This is within each sling's 4,000-pound vertical rating with adequate margin for the lift.

58. **B. RTO retains accumulated time when rung goes false and resumes when rung goes true** — A retentive timer preserves its progress when the enabling condition drops out. It resumes counting from where it left off when the condition returns. A standard TON resets to zero when its input goes false.

59. **D. Measure actual current draw under full operating load conditions** — Acceptable insulation resistance eliminates wiring faults as the cause. The next investigation should verify whether the total connected load draws more current than the breaker rating when all devices operate simultaneously.

60. **C. Allow system to cool to safe handling temperature before draining** — Hydraulic fluid at 150°F can cause burns on contact. Allowing the system to cool before opening drain connections and handling the fluid prevents thermal burn injuries. Hot oil is also more likely to spray under residual pressure.