PRACTICE EXAM 10: USPS 955 MULTICRAFT SIMULATION

1. A postal facility maintenance technician is called to investigate a conveyor drive motor that stalls intermittently under normal load. The motor runs fine when uncoupled from the conveyor. The gearbox oil level and condition are normal. What is the most likely cause?

A. An intermittent mechanical bind in the conveyor system downstream of the gearbox

B. A VFD parameter error causing random torque limit faults during normal operation

C. The motor's internal thermal protector is cycling from borderline winding temperature

D. The power supply voltage is sagging intermittently during peak facility electrical demand

2. A 120/240-volt single-phase service panel has a measured voltage of 124 volts on Line 1 to neutral and 108 volts on Line 2 to neutral. Line 1 to Line 2 reads 232 volts. What is the most likely cause of this imbalance?

A. The main breaker contacts are worn on one phase causing increased resistance

B. The utility transformer has a defective tap changer stuck between positions

C. A high-resistance neutral connection between the service panel and the utility transformer

D. An oversized main breaker allowing excessive current to flow on the high-voltage leg

3. A hydraulic system has a directional valve with a tandem-center spool. During maintenance, a technician mistakenly replaces it with an identical valve that has an open-center spool. What operational difference will the operator notice?

A. The system pressure will increase because the open center blocks flow to the reservoir

B. The actuators will respond faster because the open center provides higher flow to the cylinders

C. The system will overheat because the open center dumps pressure continuously to the reservoir

D. The actuators will not hold position in neutral because both cylinder ports are connected to tank

4. A building's HVAC system includes a variable air volume (VAV) terminal unit with a hot water reheat coil. The space is overcooled even though the VAV damper is at minimum position. What should the maintenance technician check?

A. The main air handler supply fan speed for operating above the design maximum airflow

B. The reheat coil control valve for failure in the closed position preventing hot water flow

C. The space thermostat for a setpoint that has been lowered below the system's minimum supply temperature

D. The VAV box minimum airflow setting for being programmed higher than the space heat gain requires

5. An electrician is troubleshooting a motor that hums loudly but does not rotate. The motor is a three-phase 480-volt induction type. Voltage at the motor terminals reads 480V on Phase A-B and Phase B-C, but 0V on Phase A-C. What is the cause?

A. Phase A or Phase C is missing — a blown fuse or open conductor is preventing that phase from reaching the motor

B. The motor has an internal winding short between Phase A and Phase C at the stator connection

C. The motor bearings have seized and are preventing the rotor from turning against the magnetic field

D. The motor's internal thermal overload has tripped and is blocking current on one phase conductor

6. A maintenance technician is performing a boiler water chemistry test. The test shows pH has dropped from the target of 11.0 to 8.5 over the past two weeks. What is the primary concern?

A. Scale formation will accelerate because lower pH promotes mineral precipitation in the boiler

B. The boiler water will foam excessively causing carryover of water into the steam distribution piping

C. Corrosion will accelerate because the lower pH creates an acidic environment that attacks boiler metal

D. The low-water cutoff probe will malfunction because pH affects the electrical conductivity of the water

7. A PLC ladder logic rung uses an XIO instruction on output address O:2/0. On another rung, an OTE instruction controls the same O:2/0 output. Under what condition is the XIO instruction true?

A. When the OTE rung is true and the output bit is set to 1 by the program logic

B. When the PLC is in program mode and all outputs are forced to the off state

C. When the physical output terminal voltage exceeds the module's rated maximum level

D. When the OTE rung is false and the output bit is 0 — the XIO evaluates as true when the addressed bit is off

8. A centrifugal pump has been in service for 8 years. The maintenance records show a gradual decline in efficiency — the pump consumes the same power but delivers less flow at the same head. What is the most likely cause?

A. The motor has lost one phase of its three-phase supply reducing its output power capacity

B. Internal wear on the impeller and wear rings has increased clearances and internal recirculation losses

C. The suction strainer has been gradually clogging over eight years restricting the inlet flow volume

D. The pump foundation has settled causing misalignment that reduces hydraulic performance gradually

9. During an oxy-fuel cutting operation on a 3/4-inch steel plate, the technician cannot achieve a clean cut — the torch cannot pierce through the material. Oxygen and acetylene pressures are set per the tip chart. What should be checked?

A. The cutting tip orifices for blockage from spatter or debris that restricts the oxygen jet

B. The steel plate composition for stainless steel content that resists oxy-fuel cutting oxidation

C. The torch handle mixing chamber for a leak that dilutes the cutting oxygen concentration

D. The acetylene cylinder for low gas volume that reduces preheat flame temperature output

10. A facility has installed a new variable frequency drive on a 50 HP supply fan motor. After installation, nearby sensitive electronic equipment experiences intermittent malfunctions. What is the most likely cause?

A. The VFD is drawing more current than the original motor starter and overloading the circuit

B. The VFD's cooling fan is creating airborne vibration that disturbs the nearby electronic equipment

C. The new VFD is producing excessive audible noise that interferes with equipment microphone inputs

D. Electromagnetic interference (EMI) from the VFD's high-frequency switching is disrupting nearby electronics

11. A maintenance technician is replacing a pressure relief valve on a hot water boiler rated at 30 PSI MAWP. Which replacement valve specification is correct?

A. A relief valve rated at 45 PSI to provide additional margin above normal operating pressure

B. A relief valve rated at 25 PSI to ensure it opens well before the boiler reaches its maximum rating

C. A relief valve rated at 30 PSI to match the boiler's maximum allowable working pressure exactly

D. Any available relief valve can be installed temporarily until the correct specification is obtained

12. A PLC-controlled mail sorting system uses proximity sensors to detect metal trays on a conveyor. Several sensors have begun producing false signals. The sensors are inductive proximity type. What environmental change could cause this?

A. Increased ambient lighting from new overhead LED fixtures installed along the conveyor path

B. Metal debris or shavings accumulating near the sensor faces from nearby grinding operations

C. Increased conveyor belt speed that exceeds the sensor's maximum detection frequency rating

D. Higher ambient temperature in the sorting area from seasonal HVAC system changeover operation

13. A maintenance electrician discovers that a motor's terminal box connections are discolored and show signs of overheating. The motor current is within nameplate rating. What is the most probable cause?

A. Loose terminal connections creating high resistance and localized heating at the junction points

B. The motor's internal winding temperature is conducting heat through the leads to the terminal box

C. The terminal box ventilation openings are blocked by paint or debris restricting airflow cooling

D. The supply conductor insulation type is rated below the motor's normal operating temperature range

14. A hydraulic accumulator is being precharged with nitrogen using a gas charging kit. What must be verified before connecting the charging kit to the accumulator?

A. The hydraulic system must be running at full pressure to compress the bladder during precharging

B. The accumulator's hydraulic port must be open to the reservoir to allow fluid displacement outward

C. The nitrogen supply cylinder regulator must be set above the accumulator's maximum rated pressure

D. All hydraulic pressure must be relieved from the accumulator before connecting the nitrogen charging kit

15. A steam boiler's stack temperature has increased by 75°F over the past year while the firing rate remains constant. What does this indicate?

A. The combustion air damper has drifted open adding excess air that carries heat up the stack

B. The burner fuel-air ratio has shifted rich causing incomplete combustion and higher exhaust temperature

C. The boiler's fire-side heat transfer surfaces are fouled with soot or scale reducing heat absorption

D. The feedwater temperature has decreased requiring more fuel to generate the same amount of steam

16. A maintenance crew is rigging a load using a two-leg wire rope sling. Each sling leg makes a 30-degree angle with the horizontal. Compared to a 60-degree sling angle, how does the 30-degree angle affect the tension in each sling leg?

A. Tension in each leg is reduced by half because the lower angle spreads the load more broadly

B. Tension is the same at both angles because the total load weight has not changed between configurations

C. Tension increases slightly at 30 degrees but remains within the sling's rated capacity for most loads

D. Tension in each leg approximately doubles because the mechanical disadvantage increases dramatically at shallow angles

17. A maintenance technician is testing a motor circuit with a megger. Between Phase A and ground, the reading is 5,000 MΩ. Between Phase B and ground, the reading starts at 500 MΩ and slowly rises to 2,000 MΩ over 10 minutes. What does the Phase B behavior indicate?

A. The megger battery is weak and cannot maintain a stable test voltage on the Phase B winding

B. Normal dielectric absorption — the insulation is absorbing charge over time causing resistance to increase progressively

C. A partial ground fault that is intermittently clearing and re-establishing under the test voltage

D. Moisture in the Phase B winding insulation that is gradually being driven out by the test voltage

18. A facility's chilled water system has three chillers piped in parallel. During summer peak cooling, all three chillers run at full capacity but the building temperature remains above setpoint. The chilled water supply temperature is correct. What should be investigated?

A. The chilled water distribution pumps and piping for insufficient flow rate to the building air handlers

B. The chiller compressor staging for an error that is not bringing all three units to full capacity

C. The cooling tower fans for reduced airflow that is limiting the chillers' condenser heat rejection

D. The building's lighting and occupancy loads for an increase that has exceeded the cooling system design

19. In a standard control circuit, a maintained selector switch is in the "AUTO" position. What does this typically mean for the controlled equipment?

A. The equipment operates under full manual control with the operator making all start/stop decisions

B. The equipment is disabled and cannot be started from any control point until the switch position changes

C. The equipment is controlled by automatic inputs such as sensors, timers, or the building automation system

D. The equipment runs continuously at full speed regardless of the demand signal from any control source

20. A pneumatic cylinder that was recently rebuilt with new seals extends at full speed but retracts very slowly. Both meter-out flow controls are set identically. Air supply pressure is correct. What is the most likely cause?

A. The new rod-side piston seal is oversized creating excessive friction against the cylinder bore wall

B. The directional valve's retract solenoid is not shifting fully due to low control voltage at the coil

C. The retract-side air supply line has a partial restriction from a kinked hose or crushed tubing fitting

D. The new rod seal was installed backward, causing it to grip the cylinder bore during retraction

21. An electrician is measuring the resistance between two adjacent terminals in a motor terminal box. The reading shows 150 MΩ. What does this measurement represent?

A. The winding resistance of the motor phase connected between those two terminal connection points

B. The insulation resistance between two separate phase windings of the motor at the terminal box

C. The capacitive reactance between the motor windings measured at the operating frequency value

D. The contact resistance of the terminal connections requiring cleaning for better electrical conductivity

22. A maintenance technician discovers that a gear reducer is leaking oil from its shaft seal. The oil level has dropped below the minimum mark on the sight glass. What is the immediate priority?

A. Restore the oil level to the correct mark before operating the reducer to prevent gear and bearing damage

B. Replace the shaft seal immediately to stop the leak before adding any additional oil to the reducer

C. Switch to a higher-viscosity oil that is less likely to leak past the worn shaft seal surface

D. Monitor the leak rate over the next week to determine if the seal needs immediate or scheduled replacement

23. A PLC controls a batch weighing system. The scale's analog signal (4-20 mA representing 0-2,000 lbs) feeds a PLC analog input. The PLC should close a fill valve when the weight reaches 1,500 lbs. At what milliamp value should the comparison instruction be set?

A. 15 mA because 1,500 lbs divided by 100 equals the milliamp setpoint for the comparison instruction

B. 12 mA because 1,500 is 75% of 2,000 and 75% of the 4-20 mA span equals 12 mA signal

C. 18 mA because 1,500 lbs divided by 2,000 lbs equals 0.75 times the 20 mA maximum signal output

D. 16 mA — calculated as 4 mA + (1,500/2,000 × 16 mA) since the 4-20 mA span is 16 mA total

24. A building's main switchgear has an infrared viewing window installed on the panel cover. What is the purpose of this window?

A. To allow visual inspection of the bus bars and connections without opening the energized panel

B. To provide ventilation for heat dissipation from the switchgear's internal components during operation

C. To allow infrared thermographic scanning of internal connections without removing the energized panel cover

D. To permit the installation of permanent temperature sensors through the panel without penetrating the cover

25. A hydraulic system uses a flow divider to synchronize two cylinders that must extend at the same rate. One cylinder is extending faster than the other despite the flow divider. What is the most likely cause?

A. The flow divider spool or gears are worn allowing unequal flow distribution to the two outlet ports

B. The flow divider has internal wear or bypass allowing unequal flow to the two cylinder circuits

C. The faster cylinder has a larger bore diameter than the slower cylinder creating different speed outputs

D. The slower cylinder has a higher back-pressure from a restricted return line reducing its effective speed

26. A maintenance technician is troubleshooting an electric overhead door that will not open. The motor contactor pulls in and the motor runs, but the door does not move. What should be checked?

A. The chain or belt drive between the motor and the door mechanism for a broken link or stripped gear

B. The door's safety edge sensor for activation that is sending a stop signal to the motor controller

C. The motor contactor's auxiliary contacts for a feedback signal error to the building automation system

D. The door track alignment for a bent or obstructed section preventing the door panels from moving

27. A 480-volt three-phase motor has been running for several years. Vibration analysis now shows a prominent peak at exactly the motor's slip frequency multiplied by the number of rotor bars. What condition does this indicate?

A. Stator winding insulation failure developing between adjacent coil groups in the motor winding

B. Excessive bearing clearance allowing the rotor to orbit inside the stator at a variable frequency

C. Coupling misalignment producing vibration at a frequency that coincidentally matches the rotor bar calculation

D. Broken or cracked rotor bars producing a characteristic vibration signature at rotor bar pass frequency

28. A building's steam condensate return system includes both gravity return and pumped return sections. A section of the gravity return piping shows signs of severe internal corrosion. What is the most likely cause?

A. Excessive steam trap blowthrough sending live steam into the gravity condensate return piping lines

B. The condensate return piping material is incompatible with the chemical treatment used in the boiler

C. Carbonic acid formed by carbon dioxide dissolving in the condensate is attacking the pipe walls

D. Galvanic corrosion from dissimilar metals where the condensate piping connects to the boiler fittings

29. A PLC-controlled packaging machine has a counter (CTU) that counts packages and triggers a case-packing operation every 24 packages. The counter accumulated value currently shows 36 but no case-packing trigger has occurred since the last reset. What is the most likely fault?

A. The PLC program has a math instruction error that is incrementing the counter by 2 instead of 1

B. The reset instruction (RES) is not executing after each case-packing cycle causing the count to exceed the preset

C. The sensor counting packages is double-counting each package as it passes the detection point

D. The counter preset value has been changed from 24 to a higher number in the PLC data table

30. A maintenance technician is selecting a replacement coupling for a pump that experiences significant torsional shock loads during startup. Which coupling type is most appropriate?

A. A grid coupling that absorbs shock loads by flexing its serpentine grid spring element progressively

B. A rigid coupling that transmits all torque directly without any flexibility or shock absorption capability

C. A disc coupling that provides zero backlash and precise angular positioning between the connected shafts

D. An Oldham coupling that accommodates large parallel offset between the driver and driven shaft centers

31. A facility's electrical system includes a 480-volt to 208Y/120-volt step-down transformer. The primary voltage measures 490 volts. What is the approximate secondary line-to-neutral voltage?

A. 120 volts because the transformer automatically regulates its output to the nameplate rated voltage

B. 126 volts because the output voltage is higher than nominal by the same percentage as the elevated input

C. 122.5 volts — calculated by applying the transformer ratio to the measured primary voltage input

D. 115 volts because the internal impedance of the transformer drops more voltage at the higher primary level

32. A hydraulic system's pressure gauge reads 2,500 PSI at the pump discharge. The gauge at the actuator reads only 2,100 PSI. The system uses a pressure filter between the pump and actuator. What does the 400 PSI difference indicate?

A. Excessive pressure drop across the filter element indicating it needs replacement due to contamination loading

B. Normal pressure loss for the distance between the pump discharge and the actuator work port location

C. The actuator gauge is out of calibration and should be replaced with a new calibrated pressure gauge

D. A partially closed directional valve that is restricting flow to the actuator and creating additional resistance

33. A maintenance technician is troubleshooting a condensing furnace that is producing less heat than normal. The furnace flame appears normal and the blower operates correctly. The condensate drain line is dry — no condensate is draining. What does the lack of condensate indicate?

A. The condensate drain pump has failed and needs replacement with a new pump and check valve

B. The furnace is operating normally because condensing furnaces do not always produce visible condensate

C. The secondary (condensing) heat exchanger has cracked allowing condensate to leak internally or externally

D. The secondary heat exchanger is fouled or bypassed — the furnace is not extracting enough heat to condense flue gases

34. A maintenance crew is installing new piping and needs to connect a 6-inch carbon steel pipe to an existing flanged valve. What must be verified about the flange bolt pattern before assembly?

A. The bolt grade must match the pipe schedule number for proper pressure-temperature compatibility rating

B. The flange rating, bolt circle diameter, and number of bolt holes must match between the new flange and the existing valve

C. The flange bolts must be installed from the same direction on all connections for uniform appearance

D. The flange gasket must be installed dry without any sealant to allow future removal for valve maintenance

35. A building automation system shows that an air handling unit's mixed air temperature is 95°F when the outdoor air temperature is 65°F and the return air temperature is 75°F. What does this abnormal mixed air temperature suggest?

A. The return air temperature sensor is malfunctioning and reading much higher than actual return air conditions

B. The outdoor air damper actuator has failed in the closed position blocking fresh air intake completely

C. The supply fan is running backward drawing air through the return duct and heating it by friction compression

D. The mixed air temperature sensor has failed and is not providing accurate readings to the building system

36. A PLC program uses a sequencer output (SQO) instruction that advances through 6 steps to control a machine cycle. The machine suddenly begins skipping step 4 and goes directly from step 3 to step 5. What should be investigated?

A. The step 3 output devices for a malfunction that is preventing step 3 completion before advancing

B. The power supply voltage to the output modules for a sag during step 4 causing the output to drop

C. The SQO data table file for a corrupted or cleared word at the step 4 position containing incorrect data

D. The sequencer length parameter for being changed from 6 to 5 in the instruction configuration settings

37. A centrifugal pump in a chilled water system is producing abnormally high vibration after a bearing replacement. The new bearings are the correct type and size. Alignment has been verified. What installation error could cause this vibration?

A. The bearing housing cap bolts were tightened in a circular pattern instead of a cross pattern sequence

B. The new bearings were not cleaned of shipping preservative before installation in the pump housing

C. The coupling spacer was reinstalled 180 degrees from its original indexed position during reassembly

D. The bearing inner race was not fully seated against the shaft shoulder leaving a gap that allows movement

38. A steam trap testing program identifies a trap that is cold on the inlet side and cold on the outlet side. Steam pressure is available in the main upstream of the trap. What does this condition indicate?

A. The trap is operating correctly and efficiently discharging all condensate with minimal steam loss

B. The trap's inlet is blocked or the isolation valve upstream of the trap is closed preventing steam from reaching the trap

C. The trap is blowing live steam so fast that the body temperature cannot be measured with a contact thermometer

D. The trap's internal mechanism has seized in the open position allowing continuous flow that cools the body

39. In a three-phase power system, what is the effect of a high-resistance connection on one phase at the main service entrance?

A. Voltage drops on the affected phase while current increases on that phase as loads attempt to maintain power

B. Voltage increases on the affected phase because the resistance creates a voltage divider effect increasing potential

C. All three phases experience equal voltage drop because the three-phase system distributes the loss equally

D. The neutral conductor carries the excess current from the affected phase to balance the system automatically

40. A maintenance technician is troubleshooting a VFD that displays "undervoltage" on the DC bus. The incoming three-phase supply voltage measures correctly at 480V on all three phases. What should be checked?

A. The VFD's output motor leads for a short circuit that is pulling the DC bus voltage down under load

B. The VFD's cooling fan for failure causing the power electronics to thermally derate the DC bus output

C. The PLC speed command signal for a value that exceeds the VFD's maximum programmable speed setting

D. The VFD's internal rectifier section for failed diodes that are not converting all three AC phases to DC

41. A maintenance technician is preparing to weld a repair on a piece of equipment that contains a hydraulic cylinder. What safety precaution is specific to welding near hydraulic components?

A. Ensure the welding ground clamp is attached directly to the hydraulic cylinder rod for best grounding

B. Verify that the hydraulic system is at maximum pressure to prevent oil from absorbing welding heat

C. Depressurize and drain hydraulic fluid from nearby components to prevent fire or explosion from heated oil

D. Cover the hydraulic lines with wet rags to keep them cool during the welding operation near them

42. A building's electrical system has a 225-amp main breaker panel. The total connected load is 300 amps, but the facility demand factor indicates that maximum simultaneous demand is only 180 amps. Is the 225-amp panel adequate?

A. Yes — the panel is sized for the expected maximum demand of 180 amps with margin per the NEC demand factor provisions

B. No — the panel must be sized for the total connected load of 300 amps regardless of the demand factor

C. Yes — but only if a load management system prevents more than 225 amps from being drawn simultaneously

D. No — the panel must be sized for 125% of the maximum demand to account for the continuous load rule

43. A hydraulic press cylinder extends smoothly but makes a loud banging noise at the end of each extend stroke. What is the most likely cause?

A. The system pressure spikes when the cylinder reaches full extension and the pressure relief valve chatters

B. The cylinder has no cushion or its adjustable cushion is set too open, allowing the piston to slam into the end cap

C. The directional valve is shifting to the retract position before the cylinder reaches full extension stroke

D. The press frame is flexing under load and snapping back when the cylinder reaches its maximum stroke

44. A maintenance electrician is testing a suspected defective circuit breaker. The breaker is in the ON position but no voltage is present on the load side. The line-side terminals read full voltage. What test confirms the breaker is defective?

A. Measure the current through the breaker with a clamp-on ammeter to verify zero current flow through it

B. Measure the temperature of the breaker handle to check for internal overheating causing thermal trip

C. Cycle the breaker OFF and then ON while monitoring load-side voltage for recovery of power output

D. Measure the resistance through the breaker from line to load — a good breaker reads near-zero ohms while open indicates internal failure

45. A postal facility has a rooftop HVAC unit with an economizer that uses outdoor air for free cooling when conditions are favorable. The building is overcooling during mild spring weather. What is the most likely cause?

A. The economizer damper is stuck in the full-open position continuously admitting excessive cool outdoor air

B. The economizer's high-limit lockout has been set too high allowing outdoor air entry when conditions are too warm

C. The chilled water valve is stuck open and the chiller continues running during economizer operation mode

D. The return air temperature sensor is reading incorrectly high causing the system to call for more cooling

46. A maintenance technician is troubleshooting a pneumatic system where one specific cylinder operates correctly sometimes but fails to extend other times. The valve, air supply, and cylinder have all been individually tested and found functional. What intermittent fault could cause this behavior?

A. The PLC program has a race condition where two outputs conflict on alternating scan cycles of the processor

B. A loose wire on the solenoid valve coil that makes and breaks contact with vibration from nearby equipment

C. The cylinder bore has a worn spot that causes the piston to stick only when it reaches that specific position

D. The air supply pressure fluctuates below the cylinder's minimum operating pressure during peak facility demand

47. A steam boiler has been operating at its normal pressure of 15 PSI. The operator notices the pressure gauge reading is gradually climbing above 15 PSI even though the burner has cycled off. What should be checked?

A. The steam header isolation valve for a partially closed condition causing pressure to back up in the boiler

B. The gauge glass for accuracy by comparing it to the pressure gauge reading during normal steady conditions

C. The pressure gauge for calibration error by installing a temporary test gauge for comparison during operation

D. The steam supply piping for blockage or a closed valve that is trapping steam in the boiler and allowing pressure to rise

48. A PLC ladder logic program has three rungs. Rung 1: XIC I:1/0 controls OTE B3:0/0. Rung 2: XIC I:1/1 controls OTE B3:0/1. Rung 3: XIC B3:0/0 AND XIC B3:0/1 controls OTE O:2/0. For output O:2/0 to energize, what input conditions are required?

A. Only I:1/0 needs to be true because B3:0/0 provides sufficient logic for the output activation

B. Only I:1/1 needs to be true because B3:0/1 is the primary input controlling the final output

C. Both I:1/0 AND I:1/1 must be true simultaneously to energize both internal bits required for the output

D. Either I:1/0 OR I:1/1 must be true because the internal bits are wired in parallel on Rung 3

49. A newly installed belt-driven exhaust fan vibrates excessively. The motor and fan are properly aligned and the belts are correctly tensioned. The motor runs smoothly when the belts are removed. What should be checked on the fan?

A. The fan wheel for balance — shipping damage, accumulated material, or a manufacturing defect causing imbalance

B. The fan housing for proper clearance between the wheel and the inlet cone or cutoff plate edges

C. The fan shaft bearings for proper lubrication type and fill level in the bearing housings at installation

D. The fan discharge ductwork for excessive back-pressure that creates turbulence and transmitted vibration

50. A facility's fire alarm system includes heat detectors in the mechanical room. What type of heat detector responds to both a fixed temperature threshold and a rapid rate of temperature rise?

A. A bimetallic fixed-temperature detector that trips at a specific temperature setpoint only

B. A rate-of-rise detector that responds only to rapid temperature changes regardless of the actual temperature

C. A pneumatic line-type heat detector that uses air expansion in a tube to trigger the alarm condition

D. A rate-compensated or combination fixed-temperature and rate-of-rise detector that responds to either condition

51. A maintenance technician is troubleshooting a hydraulic system where the pump makes excessive noise and the system operates erratically. The reservoir fluid appears foamy with visible air bubbles. What is the most likely cause and what should be checked first?

A. The relief valve is set too low causing the pump to continuously bypass fluid and create turbulence

B. Air is entering the suction side of the system through a loose fitting, cracked hose, or low fluid level

C. The pump's internal gears are worn creating excessive clearances that allow fluid to cavitate and foam

D. The hydraulic filter bypass valve is stuck open allowing unfiltered fluid to circulate through the system

52. An electrician needs to add a new 20-amp branch circuit to an existing electrical panel. The panel has spaces available, but the sum of all breaker ratings already installed exceeds the panel's bus rating. Can the new breaker be added?

A. Yes — if the calculated demand load using NEC demand factors shows the total demand does not exceed the bus rating

B. No — the sum of all breaker ratings must never exceed the panel bus ampere rating under any conditions

C. Yes — but only if the new circuit serves a non-continuous load that operates less than 3 hours at a time

D. No — a panel upgrade to a larger bus rating is required before any additional circuits can be installed

53. A maintenance crew is preparing for a confined space entry into a large underground vault containing steam piping. Atmospheric testing shows 20.8% oxygen, 0 PPM hydrogen sulfide, and 0% LEL combustible gas. The space temperature is 135°F. Is entry permitted?

A. Yes — all atmospheric readings are within acceptable limits and no additional precautions are required

B. No — the oxygen level exceeds the safe maximum of 20.5% indicating an oxidizer-enriched atmosphere present

C. Entry is permitted atmospherically, but heat stress precautions including work-rest cycles and hydration must be implemented

D. No — the 135°F temperature exceeds the OSHA maximum permissible temperature for any confined space entry

54. A centrifugal pump's mechanical seal is weeping slightly — producing a very slow drip at the gland. The pump handles clean water at ambient temperature. Is this an acceptable condition?

A. Yes — mechanical seals on clean water service commonly weep slightly and this rate is within normal limits

B. No — any visible leakage from a mechanical seal indicates the seal has failed and must be replaced immediately

C. Yes — but only if the drip rate is less than 5 drops per minute as specified for this seal type application

D. No — a properly functioning mechanical seal should have zero visible leakage during normal operation conditions

55. A building's 480-volt electrical system has a 400-amp main breaker. An electrician measures 410 amps on Phase A, 395 amps on Phase B, and 405 amps on Phase C using a clamp-on ammeter. The main breaker has not tripped. What is the assessment?

A. The system is operating at or very near the main breaker's rating and load reduction should be planned

B. The clamp-on ammeter readings are inaccurate because the main breaker would have tripped at 400 amps

C. The main breaker is defective and should be replaced because it should have tripped above its 400-amp rating

D. Phase A is overloaded while Phases B and C are within limits and the loads need to be rebalanced immediately

56. A hydraulic system has a proportional valve controlling cylinder speed. The operator reports that the cylinder speed is inconsistent — sometimes fast, sometimes slow — with the same command signal. System pressure is stable. What should be checked?

A. The proportional valve coil for correct voltage and consistent electrical signal from the controller

B. The proportional valve's spool for contamination causing intermittent sticking at different positions

C. The system relief valve for a setting that is too close to the proportional valve's operating pressure range

D. The cylinder rod seal for an intermittent leak that changes the effective piston area during each stroke

57. A maintenance electrician is installing a new motor on a VFD-driven application. The motor cable run is 350 feet. What concern must be addressed with long cable runs between a VFD and motor?

A. The motor's nameplate voltage must be increased to compensate for voltage drop in the long cable run

B. A harmonic filter must be installed at the motor to prevent reflected harmonics from reaching the VFD

C. The VFD's carrier frequency must be increased to compensate for signal degradation over the cable distance

D. A load reactor or output filter should be installed to reduce voltage spikes from reflected waves at the motor terminals

58. A building has two identical boilers connected to a common steam header. Boiler A is running and maintaining 12 PSI. When Boiler B is brought online, the header pressure initially drops to 8 PSI before recovering. What causes this temporary pressure drop?

A. Boiler B's safety valve is opening briefly during the startup sequence reducing header pressure temporarily

B. Boiler B's feedwater pump is drawing steam from the header for its turbine drive during the startup process

C. The cold piping and equipment associated with Boiler B absorb heat from the header steam causing condensation and temporary pressure loss

D. Boiler A's firing rate automatically reduces when Boiler B comes online causing the temporary pressure drop

59. A maintenance technician finds that a motor's vibration at 1× RPM has increased by 40% since the last quarterly measurement. No maintenance has been performed on the motor or driven equipment since the last reading. What is the most likely developing condition?

A. Progressive imbalance from material buildup, erosion, or a developing crack on the rotating element

B. Foundation settling that has caused misalignment between the motor and the driven equipment shaft

C. Bearing wear that has increased the clearance allowing the shaft to orbit at the running speed frequency

D. Supply voltage imbalance that has developed since the last measurement causing electromagnetic vibration

60. A facility's compressed air system has a dew point monitor on the main distribution header. The monitor shows the dew point has risen from -40°F to +35°F over the past month. What does this indicate?

A. The air compressor's intake filter is clogged and drawing in moisture-laden air from an alternate source

B. The air dryer is failing to remove moisture from the compressed air requiring inspection and service

C. The dew point monitor has drifted out of calibration and needs to be replaced with a calibrated unit

D. Normal seasonal variation as higher ambient humidity during warmer months increases moisture content

Practice Exam 10: Answer Key and Explanations

1. **A. Intermittent mechanical bind in the conveyor system** — The motor runs normally when uncoupled, eliminating the motor and electrical supply as causes. The gearbox is normal. The intermittent stall under normal load points to a mechanical bind downstream — a jammed roller, misaligned section, or debris in the conveyor path.

2. **C. High-resistance neutral connection between panel and utility** — In single-phase 120/240V systems, a loose or corroded neutral causes voltage imbalance between the two legs. Line-to-line voltage remains relatively stable while line-to-neutral voltages shift in opposite directions — one high, one low.

3. **D. Actuators will not hold position with open-center spool in neutral** — An open-center spool connects all ports to tank when centered. Both cylinder ports are open to tank, allowing the load to push fluid freely out of the cylinder. Tandem center blocks the actuator ports to hold position.

4. **B. Reheat coil control valve failed closed preventing hot water flow** — When the VAV damper is at minimum position but the space is still overcooled, the reheat coil should be adding heat but is not. A failed-closed control valve blocks hot water to the reheat coil, eliminating the heating capability.

5. **A. Phase A or C is missing — blown fuse or open conductor** — Zero voltage between Phase A and C means those two phases are at the same potential — one of them is not energized. A blown fuse or open conductor on either Phase A or Phase C eliminates that phase from the circuit.

6. **C. Lower pH increases corrosion rate in the boiler environment** — Boiler water is maintained at high pH (10.5-11.5) to create a protective oxide layer on metal surfaces. A drop to 8.5 removes this protection and creates mildly acidic conditions that accelerate corrosion of boiler tubes and shell.

7. **D. XIO is true when the addressed bit is 0 (output de-energized)** — XIO (Examine If Open) evaluates as TRUE when the addressed bit equals 0. When the OTE rung controlling O:2/0 is false, the output bit is 0, and the XIO instruction on that address evaluates as TRUE.

8. **B. Internal wear on impeller and wear rings increased recirculation losses** — Over 8 years, the clearances between the impeller and wear rings gradually increase from erosion and wear. More fluid recirculates internally from discharge to suction, reducing net output while the pump consumes the same power.

9. **A. Cutting tip orifices blocked by spatter or debris restricting oxygen** — If pressures are correctly set per the tip chart but the cut fails, the tip itself is the likely problem. Blocked orifices reduce the oxygen jet velocity and volume, preventing a clean pierce and cut through the material.

10. **D. EMI from VFD high-frequency switching disrupting nearby electronics** — VFDs use rapid pulse-width modulation switching (typically 2-16 kHz) that generates electromagnetic interference. Without proper shielding, output filters, or cable management, this EMI radiates to nearby sensitive electronic equipment.

11. **C. Relief valve rated at 30 PSI matching the boiler's MAWP exactly** — The pressure relief valve must be set at or below the boiler's maximum allowable working pressure. A 30 PSI valve matches the 30 PSI MAWP. Higher ratings would allow dangerous overpressure before the valve opens.

12. **B. Metal debris accumulating near inductive proximity sensor faces** — Inductive proximity sensors detect metallic objects. Metal shavings or debris from nearby grinding operations accumulating on or near the sensor face triggers false detection signals as the sensor reads the debris as a target.

13. **A. Loose terminal connections creating high resistance and localized heating** — Current within nameplate rating eliminates overload as the cause. Discolored terminals with signs of heating indicate high-resistance connections — loose bolts, corroded surfaces, or damaged lugs generating localized heat.

14. **D. All hydraulic pressure must be relieved before connecting nitrogen charging kit** — Precharging an accumulator with residual hydraulic pressure can damage the bladder, blow the gas valve fitting, or cause the charging fixture to fail violently. Always depressurize the hydraulic side completely before nitrogen charging.

15. **C. Fire-side surfaces fouled with soot or scale reducing heat absorption** — Higher stack temperature means more heat is going up the flue instead of being absorbed by the boiler water. Soot or scale on the fire-side surfaces insulates them, reducing heat transfer and raising exhaust gas temperature.

16. **D. Tension approximately doubles at 30 degrees compared to 60 degrees** — At 60° from horizontal, tension per leg = (load/2) / sin(60°) = load/2 / 0.866. At 30°, tension = (load/2) / sin(30°) = load/2 / 0.50. The tension at 30° is approximately 1.73 times the tension at 60° — nearly double.

17. **B. Normal dielectric absorption causing resistance to increase over time** — Good insulation absorbs the applied DC charge over time, causing the measured resistance to rise progressively. This is normal behavior and is the basis for the Polarization Index test — a rising reading indicates healthy insulation.

18. **A. Chilled water distribution pumps and piping for insufficient flow to air handlers** — Correct chilled water supply temperature confirms the chillers are working. If the building is still warm, the chilled water is not reaching the air handlers in sufficient volume — check pumps, valves, and piping for flow restrictions.

19. **C. Equipment controlled by automatic inputs such as sensors and timers** — The AUTO position on a selector switch places the equipment under automatic control — sensors, timers, PLCs, or building automation systems determine when the equipment starts and stops based on process conditions.

20. **D. New rod seal installed backward causing it to grip during retraction** — Directional lip seals must be oriented correctly — the sealing lip faces the pressure side. An inverted seal acts like a brake during movement in one direction, gripping the bore wall and dramatically slowing the retraction stroke.

21. **B. Insulation resistance between two separate phase windings** — A reading of 150 MΩ between two terminals in a motor junction box represents the insulation resistance between two phase windings. Winding resistance (conductor resistance) reads in ohms or fractions of ohms, not megohms.

22. **A. Restore oil level immediately before operating the reducer** — Low oil level means the gears and bearings are not fully lubricated. Operating with insufficient oil causes accelerated wear and potential catastrophic failure. Restore the level first, then plan the seal replacement to stop the leak.

23. **D. 16 mA calculated from 4 mA offset plus 75% of the 16 mA span** — The 4-20 mA signal has a 16 mA span. 1,500 lbs is 75% of the 2,000 lb range. 75% of 16 mA span = 12 mA. Add the 4 mA offset: 4 + 12 = 16 mA. This accounts for the live zero that many calculations miss.

24. **C. Infrared viewing window allows thermographic scanning without opening the panel** — IR viewing windows are transparent to infrared radiation but opaque to visible light and provide a physical barrier. Technicians can perform thermal scans of internal bus connections and components without exposing themselves to energized parts.

25. **B. Flow divider has internal wear allowing unequal flow distribution** — A worn flow divider cannot maintain equal output to both ports. Internal bypass within the divider allows more flow to one outlet than the other, causing the cylinders to extend at different rates despite equal demand.

26. **A. Chain or belt drive between motor and door for a broken or stripped component** — The motor runs (confirmed by the contactor pulling in and motor operation) but the door does not move. The mechanical connection between the motor and the door mechanism — chain, belt, gear, or clutch — has failed.

27. **D. Broken or cracked rotor bars producing characteristic vibration signature** — Rotor bar pass frequency (number of bars × slip frequency) is the definitive vibration indicator of broken or cracked rotor bars. This electrical fault develops over time as bars crack from thermal cycling and mechanical stress.

28. **C. Carbonic acid from dissolved CO_2 attacking condensate return piping** — Carbon dioxide from the combustion process dissolves in condensate, forming carbonic acid. This acid attacks carbon steel piping from the inside, causing the severe internal corrosion commonly found in gravity condensate return lines.

29. **B. Reset instruction not executing after each case-packing cycle** — The counter incremented past 24 to 36 without triggering (or after triggering, it was not reset). A failed or missing RES instruction allows the accumulated value to continue climbing past the preset without resetting for the next cycle.

30. **A. Grid coupling absorbs shock loads through progressive spring flexing** — Grid couplings use a serpentine metallic grid spring that flexes under torsional load. Under shock conditions, the grid progressively deflects, absorbing and damping the shock before it reaches the driven equipment bearings.

31. **C. 122.5 volts calculated from the transformer ratio and measured primary voltage** — The transformer ratio is 480:120 = 4:1. With 490V primary: secondary line-to-line = 490/4 × (208/120) =

approximately 212.7V. Line-to-neutral = 490/4 = 122.5V. The output scales proportionally with the input.

32. **A. Excessive pressure drop across the filter indicating contamination loading** — A 400 PSI pressure drop across a filter element is excessive and indicates the element is heavily loaded with contamination. Normal filter pressure drop is typically 15-50 PSI. The element needs immediate replacement.

33. **D. Secondary heat exchanger fouled or bypassed — not condensing flue gases** — A condensing furnace should produce visible condensate whenever it operates. No condensate means the secondary heat exchanger is not cooling the flue gases below the dew point — either fouled, cracked, or bypassed.

34. **B. Flange rating, bolt circle, and bolt hole count must match** — Flanges must match in pressure rating (150#, 300#, etc.), bolt circle diameter, and number of bolt holes to mate correctly. Mismatched flanges cannot be safely bolted together and may leak or fail under pressure.

35. **D. Mixed air temperature sensor has failed giving inaccurate readings** — A mixed air temperature of 95°F is impossible when mixing 65°F outdoor air with 75°F return air — the mixture must be between these two values. The 95°F reading indicates a failed or miscalibrated sensor.

36. **C. SQO data table file corrupted or cleared at the step 4 position** — The sequencer output instruction reads data from a file for each step. If the word at step 4 contains incorrect data (cleared to zero or corrupted), the outputs for step 4 match step 5 or produce no output, effectively skipping step 4.

37. **D. Bearing inner race not fully seated against shaft shoulder leaving a gap** — An inner race that is not fully pressed against the shaft shoulder can spin on the shaft or shift axially, producing vibration. This installation error is not detectable by alignment measurement but manifests immediately at startup.

38. **B. Inlet blocked or upstream isolation valve closed preventing steam flow** — A cold trap on both inlet and outlet means no steam or condensate is reaching the trap. The steam supply is available in the main, so the blockage is between the main and the trap — a closed valve or plugged inlet strainer.

39. **A. Voltage drops on affected phase while current increases on that phase** — A high-resistance connection acts as a series resistor, dropping voltage. The connected loads attempt to maintain their power consumption by drawing more current through the remaining impedance, further heating the bad connection.

40. **D. Internal rectifier section with failed diodes not converting all phases to DC** — The VFD's input rectifier converts three-phase AC to DC bus voltage. Failed diodes reduce the rectification, causing DC bus voltage to drop below the VFD's minimum threshold and triggering the undervoltage fault.

41. **C. Depressurize and drain hydraulic fluid from nearby components before welding** — Hydraulic fluid is combustible. Welding heat conducted through metal to pressurized oil-filled components can cause the oil to ignite or the component to rupture. Depressurize and drain before any hot work.

42. **A. Yes if calculated demand load does not exceed the bus rating per NEC** — The NEC recognizes that not all connected loads operate simultaneously. Using approved demand factors, the calculated maximum demand determines the required panel bus rating — not the sum of all individual breaker ratings.

43. **B. No cushion or cushion set too open allowing piston to slam into end cap** — Hydraulic cylinder cushions decelerate the piston near the end of its stroke by restricting the exhaust flow. Without cushioning or with the cushion adjustment too open, the piston impacts the end cap at full speed producing a loud bang.

44. **D. Measure resistance through the breaker from line to load terminals** — With the breaker ON and the load disconnected, a resistance measurement directly through the breaker reveals its internal condition. Near-zero ohms confirms good contacts. Infinite resistance (OL) confirms the internal contacts have failed open.

45. **A. Economizer damper stuck fully open admitting excessive outdoor air** — During mild weather, the economizer should modulate the outdoor air damper to maintain the desired mixed air temperature. A damper stuck open admits more cool air than needed, overcooling the building below the heating setpoint.

46. **B. Loose wire on solenoid valve coil making intermittent contact with vibration** — An intermittent fault on a component that tests good individually points to a connection problem. A loose wire that makes and breaks contact randomly with facility vibration causes the solenoid to energize intermittently.

47. **D. Steam piping blockage or closed valve trapping steam in the boiler** — If the burner is off but pressure continues to rise, residual heat in the boiler is generating steam that cannot escape. A blocked header, closed isolation valve, or restricted piping traps the steam and allows pressure to climb.

48. **C. Both I:1/0 AND I:1/1 must be true simultaneously for the output** — Rung 3 requires both B3:0/0 AND B3:0/1 to be true (series contacts). B3:0/0 is controlled by I:1/0 (Rung 1). B3:0/1 is controlled by I:1/1 (Rung 2). Both physical inputs must be true for the output to energize.

49. **A. Fan wheel balance — shipping damage or manufacturing defect causing imbalance** — The motor runs smoothly without belts (eliminating the motor as the source). With belts connected, the fan vibrates. The vibration source is the fan wheel — check for balance, damage, or a manufacturing defect.

50. **D. Combination fixed-temperature and rate-of-rise detector responding to either condition** — A combination detector provides dual protection — it responds to a rapid temperature increase (rate-of-rise) and also triggers at a fixed maximum temperature. This covers both fast-developing and slow-developing fire scenarios.

51. **B. Air entering the suction side through a loose fitting, cracked hose, or low level** — Foamy oil with visible air bubbles is the definitive sign of air entrainment. Check suction-side fittings for tightness, inspect suction hoses for cracks, and verify the reservoir fluid level is above the suction line opening.

52. **A. Yes if calculated demand using NEC demand factors is within the bus rating** — The sum of all breaker ratings in a panel commonly exceeds the bus rating. This is acceptable because the NEC permits panel sizing based on calculated demand using established demand factors rather than the total connected load.

53. **C. Entry permitted atmospherically but heat stress precautions are required** — All atmospheric readings are within safe limits (20.8% O_2 is normal, no toxic or combustible gases). However, 135°F presents a serious heat stress hazard requiring work-rest cycles, hydration, cooling PPE, and medical monitoring.

54. **D. A properly functioning mechanical seal should have zero visible leakage** — Unlike packing, which requires a controlled drip for lubrication, a mechanical seal in good condition on clean water service should produce zero visible leakage. Any drip indicates the seal faces or secondary seals need attention.

55. **A. System operating near main breaker rating — load reduction should be planned** — Phase A at 410 amps exceeds the 400-amp breaker rating slightly. Breakers have a tolerance band and thermal memory that prevents instantaneous tripping at slight overcurrent. However, this operating point leaves no margin for load growth.

56. **B. Proportional valve spool sticking from contamination at different positions** — Inconsistent speed with a stable command signal and stable pressure indicates the valve spool is not positioning consistently. Contamination particles intermittently wedge between the spool and bore, causing random sticking.

57. **D. Load reactor or output filter to reduce reflected wave voltage spikes at the motor** — Long cable runs between a VFD and motor create transmission line effects. The VFD's fast-rising voltage pulses reflect at the motor terminals, producing voltage spikes up to twice the DC bus voltage that damage motor insulation.

58. **C. Cold piping absorbs heat from header steam causing condensation and pressure drop** — When Boiler B's cold piping is connected to the live header, the cold metal surfaces condense steam rapidly. This temporary steam demand drops the header pressure until the piping warms up and condensation subsides.

59. **A. Progressive imbalance from material buildup, erosion, or a developing crack** — A 40% increase in 1× RPM vibration without any maintenance intervention indicates a developing rotor imbalance. Material accumulation, erosion of rotating components, or a fatigue crack changing the mass distribution are the primary causes.

60. **B. Air dryer failing to remove moisture requiring inspection and service** — A dew point rise from -40°F to +35°F indicates the dryer is no longer removing moisture effectively. The refrigeration circuit may have lost charge, the desiccant may be saturated, or the dryer's condensate drain may be malfunctioning.