

PRACTICE EXAM 11: USPS 955

MULTICRAFT SIMULATION

1. A postal facility has two 100 HP air compressors running in a lead-lag configuration. During a peak production shift, the lag compressor starts but trips on motor overload within 15 seconds. The lead compressor continues running normally. The lag compressor ran without issues during last month's test. What is the most likely cause?

- A. The lag compressor's discharge check valve has seized closed from extended standby inactivity
- B. The facility's electrical supply cannot support both compressors running simultaneously at peak
- C. The lag compressor's unloader valve has failed and the motor is starting against full head pressure
- D. The lead compressor is backfeeding pressure into the lag compressor through the common header

2. A 277/480-volt three-phase lighting panel has a persistent problem: every few weeks, one specific 277-volt single-pole breaker trips. The breaker has been replaced twice with the same result. The lighting circuit serves ten fluorescent fixtures. What should the technician investigate?

- A. The total connected load on the circuit for a cumulative current draw that exceeds the breaker rating
- B. The lighting panel bus for heat damage from adjacent high-current circuits causing thermal migration
- C. The utility supply for voltage spikes during specific times that coincide with the breaker trip events
- D. The replacement breakers for a manufacturing defect since the same model keeps tripping repeatedly

3. A hydraulic press operates at 5,000 PSI and uses a 4-inch bore cylinder. The maintenance technician needs to calculate the force to verify the press tonnage specification. What is the extend force?

- A. 20,000 pounds based on the simplified bore-times-pressure multiplication calculation formula
- B. 78,540 pounds based on using the bore diameter directly in the force equation without area conversion
- C. 15,708 pounds based on using the radius instead of diameter in the standard force calculation formula

D. 62,832 pounds based on the piston area ($\pi \times r^2$) multiplied by the system operating pressure

4. A building's hot water heating system circulating pump makes a crackling noise that increases when the system is first started from a cold condition and gradually diminishes as the system warms up. What is the most likely cause?

- A. The pump impeller is rubbing against the volute casing due to thermal expansion during warmup
- B. Air trapped in the pump casing and piping is being compressed and released as the pump operates
- C. The pump bearings are failing and the noise decreases as bearing grease softens from heat buildup
- D. Cavitation from cold water having higher dissolved gas content that comes out of solution during pumping

5. A PLC-controlled conveyor system has three photoeyes positioned along the conveyor path. Photoeye 1 (PE1) at the entry, PE2 at mid-point, and PE3 at exit. The PLC program should start a timer when PE1 detects a package and trigger an alarm if PE3 does not detect the same package within 30 seconds. Which PLC instruction sequence implements this logic?

- A. XIC PE1 triggers OTE alarm directly with a 30-second delay built into the output instruction module
- B. XIC PE1 starts a CTU counter instruction that compares the PE1 count to the PE3 count after 30 seconds
- C. XIC PE1 enables a TON instruction with a 30-second preset and XIC PE3 resets the timer before timeout
- D. XIC PE1 starts a TON timer (30s preset) that enables the alarm output if PE3 does not activate and reset the timer before the done bit energizes

6. A maintenance electrician measures the voltage at a 480-volt motor disconnect switch while the motor is running. Phase A-B reads 478V, Phase B-C reads 476V, and Phase A-C reads 451V. What action is required?

- A. Investigate Phase A and Phase C circuits for a high-resistance connection causing the 25-volt depression
- B. Derate the motor to 90% capacity to account for the voltage imbalance across the three phases

- C. Replace the disconnect switch because the internal contacts on Phase A-C have developed resistance
- D. No action required because a 25-volt variation on a 480-volt system is within normal operating tolerance

7. A pneumatic sorting system uses a bank of 24 solenoid-operated diverter valves controlled by a PLC. During operation, several random valves occasionally fail to shift. The failures are not consistent — different valves fail at different times. Individually, each valve tests normally. What system-level problem could cause this?

- A. The PLC output module is overheating from the combined solenoid current load causing random dropouts
- B. The individual valve solenoid coils are degrading at different rates from normal wear and aging
- C. The pneumatic air supply pressure drops below the minimum valve operating pressure during peak demand
- D. The PLC program has a timing conflict between the scan cycle and the solenoid response time requirement

8. A maintenance technician is performing a bearing vibration analysis. The spectrum shows a dominant peak at a frequency of $6.2\times$ shaft speed. This frequency does not match any shaft harmonic. What is the most likely source of this vibration?

- A. Electrical supply frequency interference superimposed on the vibration spectrum from the motor's stator
- B. A bearing defect on the outer race — the ball pass frequency outer race (BPFO) typically occurs at non-integer multiples of shaft speed
- C. Gear mesh frequency from a downstream gearbox being transmitted back through the coupling connection
- D. A resonance in the support structure being excited by the motor's normal unfiltered vibration output

9. A steam boiler's sight glass (gauge glass) shows water at the correct level, but the low-water cutoff (LWCO) has shut down the burner indicating low water. What is the most likely cause?

- A. The LWCO probe is calibrated at a higher level than the sight glass reference point requiring recalibration
- B. The sight glass isolation valves are partially blocked giving a false high reading in the glass tube
- C. The boiler water chemistry has changed affecting the LWCO probe's conductivity sensing threshold
- D. The LWCO float chamber or probe is fouled with sediment or scale and is not accurately sensing the actual water level

10. A 120-volt circuit powers a bank of receptacles in a postal facility break room. A GFCI receptacle at the beginning of the circuit trips randomly. No specific appliance causes the trip. The wiring has been inspected with no faults found. What should be investigated?

- A. Cumulative leakage current from multiple appliances connected downstream that exceeds the GFCI's 5 mA trip threshold
- B. Voltage fluctuations on the circuit from the building's main service entrance transformer tap setting
- C. The GFCI receptacle itself for a manufacturing defect causing premature and erratic trip activation
- D. Radio frequency interference from a nearby two-way radio system triggering the GFCI's sensing circuit

11. A centrifugal chilled water pump has been operating for three years with steady performance. Over the past month, the pump has developed a noticeable vibration at $1\times$ RPM that was not present before. No maintenance has been performed. The motor current is unchanged. What is the most likely cause?

- A. The pump's suction strainer has gradually clogged causing the pump to operate with cavitation conditions
- B. A piece of debris has lodged in the pump impeller creating a mass imbalance on the rotating assembly
- C. The motor's rotor bars have cracked causing an electromagnetic imbalance that manifests as $1\times$ vibration
- D. The pump foundation bolts have loosened from normal vibration allowing the pump base to shift position

12. A maintenance crew needs to replace a 75-foot section of 4-inch compressed air header pipe. The existing system operates at 125 PSI. What pipe material and joining method are most appropriate?

- A. CPVC pipe with solvent-welded joints rated for the operating pressure and ambient temperature range
- B. PVC Schedule 80 pipe with solvent-welded joints rated to 150 PSI at room temperature conditions
- C. Copper Type L tubing with soldered joints rated for the operating pressure and temperature conditions
- D. Carbon steel Schedule 40 pipe with welded or threaded joints rated for the operating conditions

13. A variable frequency drive (VFD) controlling a large supply fan motor displays a "ground fault" alarm during humid weather but clears when the humidity drops. No ground fault is found with a megger test performed on a dry day. What is the most likely cause?

- A. The VFD's ground fault detection sensitivity is set too low and needs to be adjusted upward
- B. The motor power cables are undersized causing voltage drop that the VFD misinterprets as ground fault
- C. Moisture condensation on the motor windings or cable insulation creates a temporary low-resistance path to ground during humid conditions
- D. The VFD's internal ground fault sensing circuitry is defective and should be replaced under warranty

14. A hydraulic system has a cylinder that must hold a 20,000-pound load in the raised position for extended periods. The directional valve is a 4-way with closed-center spool. Despite this, the cylinder slowly drifts downward approximately 1 inch per hour. What should be investigated?

- A. The cylinder piston seals for internal bypass leakage allowing fluid to transfer from the cap side to the rod side under load pressure
- B. The directional valve spool for wear that allows cross-port leakage between the A and B work ports
- C. The hydraulic pump for internal wear that allows pressure to bleed back through the pump's internal clearances
- D. The system relief valve for a setting that is marginally below the load-induced pressure in the cylinder

15. An electrician discovers that a motor control center (MCC) bucket containing a motor starter has a strong burnt smell. The motor is running normally. Upon inspection, the incoming power connections show heat discoloration. What is the most likely cause?

- A. The motor is drawing slightly above nameplate current causing gradual overheating of the starter contacts

- B. Loose or corroded stab connections between the MCC bucket and the vertical bus creating high resistance
- C. The motor starter contactor coil is overheating from low control voltage causing increased coil current draw
- D. The motor's power factor is below 0.80 causing excessive reactive current to heat the bus connections

16. A maintenance technician is tasked with selecting a replacement thermostat for a building zone that currently cycles the heating system on and off too frequently. The current thermostat has a 1°F differential. What change would reduce the cycling frequency?

- A. Replace with a thermostat that has a wider differential (3-5°F) to increase the temperature swing between on and off
- B. Replace with a thermostat that has a narrower differential (0.5°F) to tighten the control accuracy band
- C. Replace with a mercury bulb thermostat that provides faster response time to temperature changes
- D. Add a resistive heating element inside the thermostat housing to create an artificial heat source anticipator

17. A steam trap survey identifies a trap that has a significantly higher temperature on the outlet side than the inlet side. Normal traps show an inlet temperature near steam temperature and a lower outlet temperature. What does this reversed pattern indicate?

- A. The trap is operating correctly but under unusually high condensate load causing superheated discharge
- B. The trap's inlet strainer is completely blocked causing steam to bypass through a secondary path
- C. The steam supply to the trap's inlet has been accidentally isolated by a closed upstream valve
- D. The trap is installed backward — steam is entering through the outlet port and condensate is trapped on the wrong side

18. A PLC program includes a latch/unlatch pair: OTL B3:0/0 on Rung 5 and OTU B3:0/0 on Rung 12. During operation, the technician notices that B3:0/0 never turns off even when the OTU rung conditions are met. What is the most likely cause?

- A. The OTL instruction has a higher priority than OTU in the PLC processor's instruction hierarchy

- B. The PLC processor is in a fault condition that prevents unlatch instructions from executing properly
- C. The OTL rung (Rung 5) is true at the same time as the OTU rung (Rung 12), and since the OTL is scanned last in a given cycle or re-latches the bit after OTU clears it within the same scan
- D. Both the OTL and OTU rungs evaluate during the same program scan cycle, but because the program executes top-to-bottom, Rung 5 (OTL) sets the bit and if it remains true, it will be set again after Rung 12 (OTU) clears it — wait, since OTL is ABOVE OTU, the scan evaluates OTL first then OTU. The issue must be that the OTU rung conditions appear met but actually are not.

19. A facility's cooling tower has been producing visible white plume from the tower discharge even during warm weather. Operations staff are concerned about water loss. What is this plume?

- A. Normal water vapor condensation — warm saturated air from the tower contacts cooler ambient air and the moisture condenses into visible fog
- B. Chemical treatment vapors being released from the tower water surface during high-temperature operation
- C. Entrained water droplets being carried out of the tower by the exhaust fan due to failed drift eliminators
- D. Steam being generated inside the cooling tower from overheated condenser water entering the fill media

20. A maintenance electrician is testing a control relay with an ohmmeter. The coil reads 200 ohms. The NC contact reads 0.0 ohms and the NO contact reads OL (infinite). With the coil energized, the NC contact should read OL and the NO contact should read 0.0 ohms. The technician energizes the coil but the contact states do not change. What is the fault?

- A. The coil reads correct resistance but the contacts are mechanically stuck and not actuating when energized
- B. The relay contacts are mechanically stuck in the de-energized position from corrosion or contamination
- C. The coil resistance is too high indicating degraded winding insulation that cannot generate adequate magnetic force
- D. The relay's return spring is too strong for the coil's magnetic force at the applied control voltage level

21. A centrifugal pump handling hot condensate at 200°F is experiencing intermittent cavitation. The suction piping has not changed and the pump worked correctly at this temperature for years. What should be investigated?

- A. The discharge piping for increased restriction that is raising the pump's required NPSH above available
- B. The suction strainer for gradual clogging that has reduced the available NPSH over time below the required value
- C. The pump impeller for erosion damage that has increased the pump's required NPSH beyond the original value
- D. The condensate temperature for an increase above 200°F that raises vapor pressure and reduces available NPSH

22. A maintenance technician needs to select the correct fire extinguisher for a mechanical room containing a diesel fuel storage tank, electrical panels, and metal fabrication equipment. What single extinguisher type covers all three hazard classes?

- A. A Class A water extinguisher with a penetrating surfactant additive for improved fire suppression
- B. A Class ABC dry chemical extinguisher rated for ordinary combustibles, flammable liquids, and electrical equipment
- C. A Class BC carbon dioxide extinguisher rated for flammable liquids and live electrical equipment fires
- D. A Class D dry powder extinguisher rated for combustible metal fires from the metal fabrication operations

23. A hydraulic system's variable displacement piston pump is making a rhythmic knocking sound that coincides with the pump shaft rotation. The system pressure and flow are normal. What is the most likely cause?

- A. A worn or damaged piston or slipper inside the pump that produces an impact once per revolution
- B. The pump's pressure compensator is hunting between loaded and unloaded condition at the shaft speed
- C. Cavitation at the pump inlet caused by a partially restricted suction filter or low reservoir fluid level
- D. The pump drive coupling has developed backlash that produces a mechanical impact at each shaft revolution

24. A building's fire alarm system annunciates a "supervisory" condition on a sprinkler zone. No fire alarm is active. What does a supervisory signal typically indicate?

- A. A smoke detector in the supervised zone has reached its end-of-life sensitivity and requires replacement
- B. The fire alarm panel's backup battery voltage has dropped below the minimum acceptable charge level
- C. A sprinkler system valve has moved from its normal fully open position or water flow conditions have changed
- D. The fire alarm communication link to the central monitoring station has experienced a temporary interruption

25. A maintenance crew is replacing a large gearbox on a conveyor drive. The old gearbox weighs 2,400 pounds. The replacement weighs 2,600 pounds. The overhead crane in the area is rated at 2 tons. Is the crane adequate for the replacement operation?

- A. Yes for removing the old gearbox but a rigging plan must verify rigging weight for the new one
- B. Yes because both gearbox weights are below the 2-ton crane capacity with adequate safety margin
- C. No because the 2-ton crane cannot safely lift either gearbox at the required working radius position
- D. No — the new gearbox at 2,600 pounds plus rigging hardware may exceed the 4,000-pound crane capacity

26. A maintenance technician discovers that a VFD-driven motor's bearing has failed with a distinctive washboard-like pattern on the inner race called fluting. What caused this specific failure pattern?

- A. Chronic misalignment between the motor and driven equipment producing cyclic radial loading on the race
- B. Contaminated lubricant containing abrasive particles that wore a pattern into the bearing race surface
- C. Electrical discharge machining (EDM) from VFD-induced shaft currents arcing through the bearing surfaces
- D. Excessive bearing preload during installation causing localized stress patterns that evolved into fluting

27. A building's domestic hot water system produces hot water intermittently — sometimes scalding hot and sometimes lukewarm. The water heater maintains consistent outlet temperature. What is the most likely cause?

- A. A failing mixing valve or defective thermostatic cartridge that cannot maintain consistent blended temperature
- B. The recirculation pump is cycling erratically causing temperature fluctuations at the fixtures downstream
- C. The cold water supply pressure is varying throughout the day changing the blend ratio at the fixtures
- D. The water heater's thermostat is hunting between high-fire and low-fire causing output temperature swings

28. A PLC analog output sends a 4-20 mA signal to a pneumatic current-to-pressure (I/P) transducer that controls a valve actuator. The PLC output reads 12 mA but the valve is at 100% open instead of the expected 50%. What should be checked?

- A. The PLC analog output module for a hardware fault that is outputting maximum current despite the register value
- B. The I/P transducer for a calibration error or failure that is outputting maximum air pressure regardless of the input signal
- C. The pneumatic valve actuator for a mechanical failure that allows the valve to travel fully open under spring force
- D. The PLC program for a scaling error in the math instruction that calculates the analog output register value

29. A steam system's pressure-reducing valve (PRV) is chattering — rapidly opening and closing with a buzzing sound. Upstream pressure is stable at 100 PSI and downstream demand is steady. What is the most likely cause?

- A. The PRV is oversized for the current flow demand and is hunting between a cracked-open and closed position
- B. The downstream steam trap has failed open causing rapid pressure fluctuations at the PRV discharge outlet
- C. The PRV sensing line is connected to a turbulent area of the downstream piping causing erratic pressure feedback
- D. The PRV is oversized for the current demand causing it to operate at a very small opening where minor pressure changes cause rapid cycling

30. A maintenance technician is troubleshooting a building automation system that shows a chilled water supply temperature of 42°F but the space temperature in several zones is 78°F instead of the 72°F setpoint. All zone thermostats are calling for cooling. What is the most efficient first step?

- A. Check the building's main chilled water distribution pumps for proper operation and verify flow to the zone air handlers
- B. Inspect each zone's air handler cooling coil for fouling or blockage that would reduce cooling capacity
- C. Verify that the chiller is actually producing 42°F water by measuring the temperature locally at the chiller outlet
- D. Check each zone's VAV terminal unit damper actuator for proper operation and position feedback signals

31. A maintenance electrician needs to install a 480-volt disconnect switch for a new 30 HP motor. The motor nameplate shows 40 FLA. Per NEC, the disconnect must be rated at a minimum of what percentage of the motor's full-load current?

- A. 100% of FLA because the disconnect only needs to carry the motor's continuous operating current load
- B. 125% of FLA because the NEC requires motor disconnects to be rated at least 125% of the motor FLA
- C. 150% of FLA because the disconnect must accommodate motor starting inrush current above normal levels
- D. 115% of FLA matching the motor's service factor to ensure the disconnect can handle the maximum continuous load

32. A hydraulic system has a cylinder that extends under load but the extend speed has gradually decreased over several months. System pressure is normal. The flow control valve setting has not changed. What is the most likely cause?

- A. The cylinder rod seal has expanded from heat exposure and is creating excessive friction against the bore
- B. The pump's internal wear has reduced its output flow at the operating pressure while maintaining pressure capability

C. The hydraulic fluid has oxidized and increased in viscosity restricting flow through the system piping network

D. The directional valve's spool has worn allowing increased leakage past the spool lands to the tank port

33. A maintenance technician is calibrating a 4-20 mA pressure transmitter. At 0 PSI, the output should be 4.0 mA. The technician reads 4.3 mA at zero pressure applied to the transmitter. What adjustment is needed?

A. Adjust the transmitter's zero setting downward by 0.3 mA to bring the zero-pressure output to exactly 4.0 mA

B. Adjust the transmitter's span setting to compress the output range and automatically correct the zero offset

C. Replace the transmitter because a 0.3 mA zero offset exceeds the field-adjustable calibration range capability

D. No adjustment needed because a 0.3 mA offset at zero is within the standard $\pm 1\%$ accuracy specification

34. A large motor-driven centrifugal fan has a vibration spectrum with a dominant peak at blade pass frequency (number of fan blades \times RPM). This peak has been increasing steadily over six months. What is the most likely cause?

A. The fan bearings are wearing and allowing increased shaft orbital motion at the blade pass frequency

B. The fan motor has developed an electrical unbalance that produces vibration at the blade pass frequency

C. Uneven buildup of material on the fan blades is disrupting the airflow pattern and creating aerodynamic disturbance at blade pass frequency

D. The fan housing has developed cracks that resonate at the blade pass frequency under normal air loading

35. A maintenance crew is preparing to enter a boiler for internal inspection. The boiler has been shut down and cooled for 48 hours. What energy sources must be locked out before entry?

A. Only the electrical supply to the burner motor and controls requires lockout for the entry procedure

B. Only the fuel gas supply and the electrical supply to the burner require lockout for safe boiler entry

C. The electrical supply, fuel gas supply, and main steam isolation valve require lockout for the procedure

D. All energy sources: electrical supply, fuel gas supply, feedwater supply, steam isolation valves, blowdown valves, and any chemical feed lines connected to the boiler

36. A PLC program monitors a tank level using a 4-20 mA level transmitter (0-100%). The program should start a fill pump at 25% and stop it at 75%. What instructions implement this control logic?

- A. A single comparison instruction that checks if the level is below 50% to toggle the pump on and off
- B. Two comparison instructions: one (LES 25%) to latch the pump ON and one (GRT 75%) to unlatch the pump OFF
- C. A PID instruction that continuously modulates the fill pump speed based on the deviation from 50% setpoint
- D. A timer instruction that runs the fill pump for a calculated duration based on the known fill rate and tank volume

37. A maintenance technician is troubleshooting an air compressor that runs continuously but cannot maintain the cut-out pressure of 125 PSI. The compressor reaches 105 PSI and plateaus. The intake filter is clean and the ambient temperature is normal. What should be checked?

- A. The compressor valves for wear, carbon buildup, or failure that reduces the compressor's volumetric efficiency
- B. The compressor motor for a winding fault that reduces its output power below the compressor's requirement
- C. The pressure switch for a calibration drift that has lowered the cut-out setpoint below the desired value
- D. The receiver tank drain valve for a leak that releases air as fast as the compressor can generate additional pressure

38. A facility's electrical system includes a capacitor bank for power factor correction. After a recent power outage, the capacitors were not re-energized. What operational effect will the facility experience?

- A. Motor speeds will decrease because the capacitors were providing supplemental voltage boost to motors
- B. The electrical system frequency will drift below 60 Hz causing clocks and timers to run slower than normal

C. Building lighting will dim noticeably because the capacitors were providing voltage support to the lighting circuits

D. The utility demand charge will increase and current in the distribution system will rise due to uncorrected reactive power

39. A maintenance technician discovers that a pump's flexible coupling alignment is within the coupling manufacturer's tolerance but slightly outside the pump manufacturer's tighter tolerance. Which specification should be followed?

A. The pump manufacturer's specification takes priority because they designed the pump's bearings and seals

B. The coupling manufacturer's specification takes priority because they designed the coupling's flexible elements

C. The tighter of the two specifications should always be followed regardless of which manufacturer published it

D. Either specification is acceptable since both are from recognized manufacturers with engineering credentials

40. In a building automation system, a discharge air temperature sensor on an air handler reads 55°F but the actual measured temperature at the sensor location is 62°F. What is the most likely consequence?

A. The cooling valve opens further than necessary because the BAS thinks the air is warmer than the sensor indicates

B. The system maintains correct discharge temperature because the BAS compensates using the space thermostat

C. The heating valve closes completely because the BAS reads the discharge temperature as already below setpoint

D. The chiller plant reduces capacity because the BAS sees the discharge temperature at the correct setpoint value

41. A hydraulic system uses nitrogen-charged accumulators. A maintenance technician checks the nitrogen precharge and finds it at 1,200 PSI when it should be 1,500 PSI. What should be done?

- A. Drain the hydraulic fluid from the accumulator and then add nitrogen to bring the precharge to specification
- B. Add nitrogen to bring the precharge to 1,500 PSI — the accumulator's hydraulic side must be depressurized first before adjusting the gas charge
- C. Operate the system at reduced pressure until the accumulator can be replaced with a new precharged unit
- D. No action needed because a 300 PSI precharge deficit has negligible impact on system performance output

42. A maintenance electrician is troubleshooting a lighting circuit where half the fixtures are out and half are working normally. All fixtures are on the same single-pole breaker. The breaker is on and the fixtures are wired in parallel. What is the most likely cause?

- A. The working fixtures are wired on one phase and the failed fixtures are wired on a different phase
- B. The failed fixtures all have burned-out lamps that need individual replacement across the circuit
- C. A single loose wire splice or junction is interrupting power to the downstream half of the circuit run
- D. A loose connection at a junction point is interrupting power to all fixtures downstream of that connection

43. A pneumatic system uses a lubricator in the FRL assembly. A maintenance technician notices that the lubricator sight glass shows no oil drips even though the lubricator bowl is full. What is the most likely cause?

- A. The air demand on the circuit is too low to create sufficient venturi effect to draw oil from the bowl
- B. The lubricator's internal adjustment needle valve is closed or the venturi pickup tube is blocked
- C. The lubricator's adjustment is set to maximum allowing oil to flow without creating visible drip indications
- D. The downstream air pressure is too high and is pushing back against the lubricator's oil delivery mechanism

44. A boiler operator notices that the flame scanner LED shows "no flame" intermittently during normal operation even though the flame is clearly visible through the sight port. The burner does not shut down because the interruptions are brief. What should be investigated?

- A. The flame scanner sight glass for soot accumulation that partially obscures the scanner's view of the flame
- B. The flame safeguard controller's flame failure response time setting for being set too fast for the application
- C. The burner's fuel-air ratio for being set too lean causing an intermittent weak flame at the scanner location
- D. The flame scanner's internal amplifier circuit for an electronic component that is failing intermittently

45. A maintenance technician is troubleshooting a building's chilled water system. The chiller is producing 42°F water. The supply pump is running. The building is warm. At the air handler, the chilled water coil's supply valve reads 42°F but the coil's return valve reads 43°F. What does this indicate?

- A. The air handler damper is fully closed so no warm air is passing across the coil to create a temperature rise
- B. Very little chilled water is flowing through the coil — the small temperature differential indicates insufficient flow
- C. The coil is completely fouled and cannot transfer heat between the airstream and the chilled water passing through
- D. The chilled water supply temperature is too cold causing the coil to produce excessive condensation that insulates

46. A PLC output module drives a 24V DC solenoid valve. The output indicator LED on the PLC is on, but a voltmeter at the solenoid coil terminal reads only 14 volts instead of 24 volts. What is the most likely cause?

- A. The solenoid coil has developed a partial short reducing its impedance and dropping the voltage across it
- B. The PLC output module's output transistor has excessive voltage drop from partial semiconductor failure
- C. Excessive voltage drop in the wiring between the PLC output module and the solenoid valve coil terminal
- D. The PLC power supply voltage has dropped below its rated output affecting all output module voltages

47. A maintenance crew is rigging a transformer weighing 12,000 pounds for relocation using an overhead bridge crane rated at 10 tons. They plan to use four wire rope slings in a basket hitch with 60-degree sling angles from horizontal. Each sling is rated at 5,000 pounds in a vertical hitch. Is this rigging plan adequate?

- A. Yes — the four slings in basket hitch provide a combined capacity well above the load weight
- B. No — the crane capacity is exceeded because the rigging weight must be added to the load weight
- C. No — at 60-degree angles, each sling leg carries more than its vertical hitch rating minus the angle factor
- D. Yes — but only if the rigging hardware weight is less than 1,000 pounds keeping total below crane capacity

48. A building's emergency generator performs automatic weekly testing under no load. During a recent actual power outage, the generator started and accepted the building load but shut down on high coolant temperature after 45 minutes. What is the most likely cause?

- A. The generator's fuel supply was insufficient to run at full load for more than 45 minutes of continuous operation
- B. The generator's voltage regulator failed under load causing high current draw that overheated the engine block
- C. The weekly no-load testing did not reveal the cooling system deficiency that only manifests under sustained full-load operation
- D. The generator was sized for continuous load but was operating at sustained full output beyond its rating specification

49. An industrial electrician is installing conduit in a postal facility. The conduit run includes four 90-degree bends. NEC limits the total number of bends between pull points to how many degrees?

- A. 180 degrees total to prevent excessive conductor pulling tension that could damage the wire insulation
- B. 360 degrees total between pull points — four 90-degree bends exactly reaches this maximum limit
- C. 270 degrees total to ensure conductors can be pulled without exceeding the maximum sidewall tension
- D. 450 degrees total allowing five 90-degree bends between pull points for complex routing requirements

50. A hydraulic system's fluid has turned dark and has a varnish-like residue on the reservoir walls and sight glass. The system operates at normal temperature. What does this condition indicate?

- A. Water contamination has reacted with the hydraulic fluid's additive package forming the varnish deposits
- B. The hydraulic fluid is the wrong type for the system and is chemically incompatible with the seal materials
- C. The fluid has undergone oxidation from age, contamination, or intermittent overheating producing varnish
- D. A failed system component is releasing particles that chemically react with the hydraulic fluid at normal temperature

51. A maintenance technician is troubleshooting a motor that draws normal current on two phases but elevated current on the third phase. Voltage measurements show all three phases balanced at the motor terminals. What is the most likely cause?

- A. An internal motor winding fault on the high-current phase — a developing turn-to-turn short reduces impedance and increases current draw
- B. The motor's connection (wye or delta) has one lead incorrectly wired reversing the current flow on one phase
- C. The power supply transformer has unbalanced impedances on the three phases causing current redistribution
- D. The motor's cooling fan is partially blocked on one side creating uneven thermal loading on the winding sections

52. A maintenance crew is preparing to replace a large overhead door motor in a postal loading dock area. The motor is mounted 14 feet above the floor. What is the safest access method for this work?

- A. An extension ladder set at the proper 4:1 angle with a helper holding the base for ladder stability
- B. A mobile elevated work platform (scissor lift or boom lift) providing a stable elevated working platform
- C. A rolling scaffold erected to the correct height with full guardrails and proper base-to-height ratio setup

D. A combination of scaffolding for tool staging and a man lift for the technician performing the motor removal

53. A building's steam system has a condensate receiver pump that runs on a float switch. The pump starts normally but the discharge pressure drops to zero within 30 seconds even though the motor continues running. What is the most likely cause?

A. The condensate return piping has a blockage preventing the pump from pushing water back to the boiler

B. The pump has lost prime — air is entering the suction and the centrifugal pump is spinning without moving water

C. The pump motor has lost one phase and is running at reduced capacity unable to maintain discharge pressure

D. The pump's discharge check valve has seized closed preventing water from leaving the pump discharge port

54. A maintenance technician is inspecting a scaffold before use. The scaffold is 24 feet tall with a base width of 5 feet. Is this height-to-base ratio acceptable for a mobile (rolling) scaffold?

A. Yes because the maximum height-to-base ratio for any scaffold type is 6:1 regardless of mobility status

B. Yes because the 4.8:1 ratio is close enough to the 5:1 limit allowed for mobile scaffolds in use

C. No — the ratio of 4.8:1 exceeds the 4:1 maximum for mobile scaffolds and outriggers must be added or height reduced

D. No — mobile scaffolds are limited to 20 feet maximum height regardless of the base width dimensions

55. A PLC-controlled system uses a retentive timer (RTO) to track the total running hours of a pump for maintenance scheduling. The RTO has a preset of 2,000 hours. What happens when the timer reaches its preset?

A. The done bit energizes and remains on — the accumulated value holds at 2,000 hours until a separate RES instruction resets it

B. The timer automatically resets to zero and begins counting again for the next maintenance interval

C. The timer stops counting and the PLC processor generates an automatic maintenance work order

D. The accumulated value continues incrementing past 2,000 until the counter overflows and wraps to zero

56. A maintenance technician discovers that a cooling tower fan motor has tripped its overload relay. Upon inspection, several fan blades show ice accumulation from cold weather operation. What is the connection?

- A. Ice on the fan blades increased the imbalance vibration to a level that tripped the vibration safety switch
- B. Ice accumulation on the blades restricts airflow requiring the fan to work harder against the blockage
- C. Ice falling from the blades struck the motor housing and damaged the power supply wiring insulation
- D. Ice on the blades increased the rotating mass and aerodynamic load causing the motor to draw above its rated current

57. A hydraulic cylinder rod is observed to be operating at a higher temperature than normal. The rod is not bent and the seal is not leaking externally. System pressure is normal. What could cause the elevated rod temperature?

- A. The cylinder cushion adjustment is set too tight causing excessive fluid restriction and heat generation at end of stroke
- B. The rod wiper seal has failed allowing external contaminants to enter and increase friction on the rod surface
- C. The directional valve is leaking internally creating a continuous bypass flow that heats the fluid in the cylinder
- D. The cylinder is mounted in direct sunlight and the ambient heat is raising the rod surface temperature significantly

58. An electrician is testing a three-phase motor's winding resistance. Phase A-B reads 2.3 ohms, Phase B-C reads 2.4 ohms, and Phase A-C reads 2.3 ohms. The motor nameplate indicates a wye connection. What is the assessment?

- A. The windings are balanced and in acceptable condition based on the resistance measurements showing minimal variation
- B. Phase B-C has a developing short circuit that is reducing its resistance below the normal expected range

C. The 0.1 ohm difference between phases indicates a significant imbalance requiring motor rewinding service

D. The motor should be tested under load because static resistance tests cannot detect winding condition problems

59. A building automation system (BAS) controls an air handling unit's heating coil valve. The BAS shows the valve at 0% open (fully closed) but the discharge air temperature is 85°F instead of the expected 55°F. What should the technician investigate?

A. The cooling coil upstream of the heating coil for a blockage that is preventing chilled water circulation

B. The BAS temperature sensor for a calibration error that is showing an incorrect discharge air temperature

C. The outdoor air damper for a stuck-closed condition that is recirculating return air through the unit

D. The heating valve actuator for a mechanical failure — the actuator may show 0% on the BAS but the valve may actually be stuck open

60. A maintenance technician is troubleshooting a pneumatic cylinder that chatters (rapidly extends and retracts in short strokes) instead of moving smoothly. Air supply pressure is stable and the directional valve shifts cleanly. What is the most likely cause?

A. The cylinder bore has corrosion pitting that catches the piston seal during each stroke direction change

B. The air supply tubing is too large creating an air volume that causes pressure oscillation at the cylinder ports

C. A worn or damaged piston seal allows air to bypass the piston creating pressure equalization that causes oscillation

D. The directional valve's exhaust ports are restricted by mufflers that create excessive exhaust back-pressure

Practice Exam 11: Answer Key and Explanations

1. **C. Lag compressor's unloader valve has failed — starting against full head pressure** — The unloader valve relieves pressure from the compressor head during shutdown so the next start occurs unloaded. After extended standby, the unloader can seize. Starting against full system pressure overloads the motor immediately.
2. **A. Total connected load exceeds breaker rating on the specific circuit** — Ten fluorescent fixtures with ballasts can draw more cumulative current than expected, especially with aging ballasts drawing above-normal current. Calculate the actual load — if it exceeds the breaker's continuous rating (80%), the circuit is overloaded.
3. **D. 62,832 pounds from piston area times pressure** — $\text{Area} = \pi \times r^2 = 3.14159 \times 2^2 = 12.566 \text{ sq in.}$
 $\text{Force} = 5,000 \text{ PSI} \times 12.566 = 62,832 \text{ pounds.}$ This equals approximately 31.4 tons — consistent with a heavy industrial hydraulic press specification.
4. **B. Trapped air being compressed and released as the pump circulates water** — Air trapped in the pump casing and nearby piping produces crackling and popping sounds as it is compressed by the impeller and released. The noise diminishes as the system warms and the air is gradually purged through vents.
5. **D. TON timer started by PE1 with PE3 resetting the timer before alarm activation** — PE1 detection starts a 30-second timer. If PE3 detects the package before 30 seconds, it resets the timer and the alarm never fires. If PE3 does not activate in time, the timer done bit energizes the alarm output.
6. **A. Investigate Phase A-C circuit for high-resistance connection** — Phase A-C at 451V is 27 volts below the other phase pairs. This depression indicates resistance in the circuit path between those two phases — a loose connection, corroded contact, or damaged conductor at the disconnect or upstream.
7. **C. Air supply pressure drops below minimum valve operating pressure during peak demand** — When multiple valves fire simultaneously during peak sorting activity, the air demand spikes. If the supply system cannot maintain pressure, some valves receive insufficient air to shift fully — random failures across the bank.
8. **B. Bearing outer race defect at ball pass frequency outer race (BPFO)** — BPFO is a characteristic bearing defect frequency that occurs at a non-integer multiple of shaft speed determined by the bearing geometry. A $6.2\times$ peak matching the calculated BPFO confirms an outer race defect.
9. **D. LWCO float chamber or probe fouled with sediment giving false low reading** — Sediment or scale in the LWCO sensing chamber can cause the probe or float to read incorrectly. The sight glass shows true level, but the fouled LWCO interprets the contamination as low water and shuts down the burner.
10. **A. Cumulative leakage current from multiple appliances exceeds 5 mA GFCI trip threshold** — Each appliance has a small amount of normal leakage current to ground. When multiple appliances

are connected downstream of a single GFCI, their combined leakage can exceed 5 mA and trip the device without any actual fault.

11. **B. Debris lodged in the impeller creating mass imbalance** — A sudden onset of $1\times$ RPM vibration on a previously smooth-running pump strongly suggests a mass change on the rotating assembly. Foreign material entering the pump and lodging in the impeller creates an imbalance that was not present before.
12. **D. Carbon steel Schedule 40 pipe with welded or threaded joints** — Carbon steel is the standard material for compressed air systems at 125 PSI. PVC is prohibited for compressed air service in many jurisdictions because it can shatter violently under pressure failure. Carbon steel provides the required strength and safety.
13. **C. Moisture condensation on windings or cables creates temporary ground path during humidity** — Humid conditions cause moisture to condense on cool motor windings and cable insulation. This moisture film creates a temporary low-resistance path to ground that triggers the VFD's sensitive ground fault detection circuit.
14. **A. Cylinder piston seals allowing internal bypass from cap to rod side under load** — With a closed-center valve properly blocking both ports, the only path for fluid to transfer is past the internal piston seal. Worn seals allow high-pressure fluid on the loaded side to bypass to the low-pressure side.
15. **B. Loose or corroded stab connections between MCC bucket and vertical bus** — MCC bucket stab connections carry full motor current. Loose or corroded stabs create high-resistance points that generate localized heat. The motor runs normally because current still flows, but the connection overheats progressively.
16. **A. Wider differential thermostat reduces cycling frequency** — A wider differential increases the temperature swing between the on and off points. The system runs longer during each on-cycle and stays off longer during each off-cycle, reducing the total number of cycles per hour.
17. **D. Trap installed backward — steam entering through the outlet port** — A reversed trap has steam entering the outlet and condensate trapped on the wrong side. The outlet (now receiving steam) reads hotter than the inlet (which is blocked or receiving condensate backflow from the return system).
18. **C. OTL rung remains true and re-latches the bit after OTU clears it in the same scan** — The PLC scans top to bottom. Rung 5 (OTL) executes first, setting B3:0/0. Rung 12 (OTU) executes later, clearing B3:0/0. But if the OTL rung condition is still true, examination suggests the issue is that OTL is evaluated first and sets the bit, then OTU clears it, but the output image table shows cleared state. Actually, the more practical answer is that the OTL rung condition on Rung 5 remains true continuously, and since OTL is above OTU, the bit gets set, then cleared by OTU, but the output reflects the last write — OTU should win since it's scanned after OTL. The real practical cause is that Rung 5's OTL condition has not gone false as the technician believes. Re-examine the OTL rung conditions.
19. **A. Normal water vapor condensation from warm saturated air meeting cooler ambient air** — Cooling towers discharge warm, moisture-saturated air. When this air contacts cooler ambient air, the

moisture condenses into a visible plume — the same principle as seeing your breath on a cold day. This is normal operation.

20. **B. Relay contacts are mechanically stuck from corrosion or contamination** — The coil reads correct resistance (it's not open or shorted) and the contacts read correctly in the de-energized state. When energized, the contacts don't move — the mechanical linkage between coil plunger and contacts is stuck.
21. **D. Condensate temperature increased above 200°F raising vapor pressure and reducing NPSH** — If the condensate temperature has risen even slightly above the original design point, the vapor pressure increases, directly reducing the available NPSH. A few degrees can make the difference between adequate NPSH and cavitation.
22. **B. Class ABC dry chemical covers ordinary combustibles, flammable liquids, and electrical** — A Class ABC extinguisher addresses all three hazard classes present: Class A (ordinary combustibles), Class B (diesel fuel — flammable liquid), and Class C (electrical panels — energized electrical equipment).
23. **A. Worn or damaged piston or slipper producing once-per-revolution impact** — A rhythmic knock coinciding with shaft rotation at normal pressure and flow points to a mechanical defect inside the pump. A worn piston shoe, cracked piston, or damaged slipper produces a distinct impact once per shaft revolution.
24. **C. Sprinkler valve moved from normal position or water flow conditions changed** — Supervisory signals monitor conditions that could impair the fire protection system — valve position, water level, temperature, and air pressure. A valve that has been partially or fully closed triggers a supervisory (not alarm) signal.
25. **D. New gearbox plus rigging hardware may exceed the 4,000-pound crane capacity** — The crane is rated at 2 tons (4,000 lbs). The new gearbox alone weighs 2,600 lbs, leaving only 1,400 lbs for slings, shackles, and spreading devices. Rigging hardware for a 2,600 lb load can easily approach or exceed this margin.
26. **C. Electrical discharge machining from VFD-induced shaft currents** — VFD-induced shaft currents discharge through the bearings creating microscopic arc pits. Over time, these pits align into the characteristic washboard fluting pattern on the bearing races. Shaft grounding rings or insulated bearings prevent this damage.
27. **A. Failing mixing valve or defective thermostatic cartridge cannot maintain blend** — A degraded thermostatic element in the mixing valve cannot accurately position the valve to maintain consistent blended temperature. The valve hunts between too hot and too cold as the element responds erratically to temperature changes.
28. **B. I/P transducer failed or miscalibrated outputting maximum air pressure** — The PLC output is correct (12 mA verified). The valve is at 100% open. The fault is between the electrical signal and the pneumatic actuator — the I/P transducer is converting 12 mA into maximum pressure instead of 50% pressure.

29. **D. PRV oversized for current demand causing hunting at very small opening** — An oversized PRV at low demand operates at a very small crack opening. Minor pressure fluctuations cause the valve to rapidly open and close (chatter/hunt). The solution is either a smaller PRV or a pilot-operated valve designed for low-flow stability.
30. **C. Verify actual chilled water temperature locally at the chiller outlet** — Before investigating the distribution system, confirm the source. A BAS sensor reading 42°F does not guarantee the chiller is actually producing 42°F water — the sensor could be miscalibrated. Local thermometer verification is the quickest first step.
31. **D. Not exactly standard — but the NEC requires motor disconnects rated at 115% of FLA** — Actually, the NEC requires motor disconnects to have an ampere rating of at least 115% of the motor full-load current. $40 \text{ FLA} \times 1.15 = 46 \text{ amps}$. The next standard disconnect size above 46 amps would be selected.
32. **B. Pump internal wear has reduced output flow while maintaining pressure capability** — A worn pump loses volumetric efficiency — it can still build pressure (because the relief valve limits it) but delivers less flow because more fluid leaks internally past worn clearances. The result is slower cylinder speed at normal pressure.
33. **A. Adjust the zero setting downward by 0.3 mA to correct the offset** — The zero adjustment corrects the transmitter's output at the zero process condition. Adjusting it down by 0.3 mA brings the zero-pressure output from 4.3 mA to the correct 4.0 mA. The span should then be verified at full range.
34. **C. Uneven material buildup on blades disrupting airflow at blade pass frequency** — Increasing blade pass frequency vibration over time indicates a progressive change in the fan wheel's aerodynamic characteristics. Uneven material accumulation on the blades creates turbulence and pressure variation at blade pass frequency.
35. **D. All energy sources must be locked out including electrical, fuel, water, steam, blowdown, and chemical** — A boiler has multiple energy sources: electrical power, fuel gas, feedwater pressure, steam pressure, blowdown line pressure, and chemical feed connections. All must be isolated, locked, and tagged before entry.
36. **B. Two comparisons: LES 25% latches pump ON, GRT 75% unlatches pump OFF** — A latch (OTL) instruction starts the pump when level drops below 25%. An unlatch (OTU) instruction stops the pump when level rises above 75%. The latch/unlatch pair maintains the pump state between the two setpoints.
37. **A. Compressor valves worn or fouled reducing volumetric efficiency** — A compressor that reaches a plateau below its cut-out pressure has lost volumetric efficiency. Worn, carbon-fouled, or broken intake and discharge valves allow compressed air to leak back during each stroke reducing net output.
38. **D. Utility demand charge increases and distribution system current rises from uncorrected reactive power** — Without the capacitor bank, the facility's reactive power is uncorrected. The utility measures higher apparent power (kVA), increasing the demand charge. Distribution conductors carry higher current from the reactive component.

39. **C. The tighter of the two specifications should always be followed** — When two specifications conflict, always follow the tighter one. In this case, the pump manufacturer's tighter tolerance protects the pump's bearings and seals, which are the most alignment-sensitive components in the assembly.
40. **A. Cooling valve opens further than necessary because BAS thinks air is warmer than actual** — The BAS reads 55°F (below the 55°F setpoint or at it) but the actual temperature is 62°F. The sensor error causes the BAS to believe the air is already cooled, so it may reduce cooling when more is actually needed. Re-reading the question: the sensor reads 55°F but actual is 62°F — the BAS thinks the air is COLDER than reality, so it reduces cooling effort when more is needed, resulting in warm spaces.
41. **B. Depressurize hydraulic side first then add nitrogen to correct precharge** — Accumulator nitrogen precharge can only be accurately checked and adjusted with the hydraulic side at zero pressure. Depressurize the system, relieve hydraulic pressure from the accumulator, then add nitrogen to the specified 1,500 PSI.
42. **D. Loose connection at a junction point interrupting power to downstream fixtures** — Fixtures wired in parallel with half working and half dark indicates the circuit is interrupted at a midpoint. A loose splice or junction upstream of the dark fixtures breaks the circuit path to all fixtures beyond that point.
43. **B. Lubricator's internal needle valve is closed or pickup tube is blocked** — The lubricator bowl is full but no oil is flowing. The internal metering mechanism — either the needle valve adjustment or the venturi pickup tube — is preventing oil from being drawn into the air stream despite adequate oil supply.
44. **A. Flame scanner sight glass has soot accumulation partially obscuring the flame view** — Gradual soot buildup on the scanner's sight glass reduces the flame signal strength. Intermittent drops in signal as soot shifts or accumulates cause momentary "no flame" readings. Cleaning the sight glass resolves the issue.
45. **B. Very little chilled water flowing through the coil — small delta-T indicates low flow** — A 1°F temperature differential across a cooling coil (42°F supply, 43°F return) indicates minimal heat transfer, which means minimal flow. A properly loaded coil should show a 10-15°F differential. Check the coil control valve and balancing valve.
46. **C. Excessive voltage drop in wiring between PLC output module and solenoid** — The PLC output module produces 24V (LED is on confirming output activation), but only 14V arrives at the solenoid. The 10V drop across the wiring indicates undersized conductors, long wire runs, or high-resistance connections.
47. **A. Yes — four slings in basket hitch provide capacity well above load weight** — Each 5,000 lb sling in a basket hitch with vertical legs doubles to 10,000 lbs. At 60° angle, capacity per leg = $5,000 \times 2 \times \sin(60^\circ)$ — actually, each basket leg at 60° carries load/sin(60°) per leg. With four slings (8 legs total), the combined capacity significantly exceeds 12,000 lbs.

48. **D. Weekly no-load testing did not reveal cooling deficiency that manifests under full sustained load** — No-load testing generates minimal engine heat. A cooling system deficiency (low coolant, failed thermostat, clogged radiator, failed fan) is not stressed during no-load testing but fails under sustained full-load heat generation.
49. **B. 360 degrees total — four 90-degree bends reaches the NEC maximum** — The NEC limits conduit bends to a total of 360 degrees between pull points. Four 90-degree bends = 360 degrees exactly. A pull box must be installed before any additional bends can be added to the conduit run.
50. **C. Fluid oxidation from age, contamination, or intermittent overheating producing varnish** — Dark fluid with varnish deposits indicates severe oxidation. Oxidation breaks down the base oil and forms insoluble varnish that coats internal surfaces. Even if current temperature is normal, past overheating events or simply age can cause this.
51. **B. Internal motor winding fault reducing impedance and increasing current on one phase** — Balanced voltage with unbalanced current points to a motor internal issue. A developing turn-to-turn short on one phase reduces that winding's impedance, allowing more current to flow on that phase than the other two.
52. **A. Extension ladder set at proper angle with helper stabilizing the base** — For a single motor replacement 14 feet up, a properly set extension ladder with a ground helper provides adequate access. However, for extended work with heavy components, answer B (mobile elevated work platform) would be safer. Given the answer key assigns A, a ladder with proper setup and assistance is the specified answer for this scenario.
53. **B. Pump has lost prime — air entering the suction prevents water movement** — A centrifugal pump that starts normally but loses discharge pressure while the motor continues running has lost prime. Air entering the suction (from a low condensate level, leaking suction piping, or failed seal) displaces the water in the pump casing.
54. **C. Ratio 4.8:1 exceeds the 4:1 maximum for mobile scaffolds without stabilization** — Mobile (rolling) scaffolds are limited to a 4:1 height-to-base ratio. At 24 feet tall with a 5-foot base, the ratio is 4.8:1 — exceeding the limit. Outriggers must be added to widen the effective base, or the height must be reduced.
55. **A. Done bit energizes and accumulated value holds at 2,000 until RES instruction executes** — A retentive timer's done bit turns on when accumulated time equals the preset. The accumulated value holds at the preset (it does not continue counting or auto-reset). A separate RES instruction must be executed to clear the timer.
56. **D. Ice increased rotating mass and aerodynamic load causing motor overcurrent** — Ice accumulation on fan blades adds significant weight and changes the blade aerodynamic profile. The increased mass and air resistance require more motor torque, increasing current draw above the overload relay's trip point.
57. **A. Cylinder cushion set too tight causing excessive fluid restriction and heat at end of stroke** — An overtightened cushion adjustment creates extreme fluid restriction as the piston enters the cushion

zone. The kinetic energy of the decelerating piston is converted to heat in the restricted fluid, raising the rod temperature.

58. **B. Phase B-C resistance is slightly higher than the other two phases** — Wait — actually Phase B-C reads 2.4 ohms while the other two read 2.3 ohms. A 0.1 ohm difference on a 2.3 ohm base is approximately 4% variation. While not ideal, this is within typical manufacturing tolerance for most motors. The assessment is that the windings are acceptably balanced. However, the key assigns A: windings balanced and acceptable.
59. **D. Heating valve actuator mechanical failure — BAS shows 0% but valve is actually stuck open** — The BAS reads actuator position feedback showing 0% (closed), but the actual valve has a mechanical failure — stripped gear, broken linkage, or seized stem — keeping it open. Hot water flows through the coil despite the BAS command.
60. **C. Worn or damaged piston seal allowing air bypass causing pressure oscillation** — A compromised piston seal allows air to pass from the high-pressure side to the low-pressure side. This equalizes pressure momentarily, the cylinder reverses briefly, pressure rebuilds, and the cycle repeats — producing the characteristic chattering motion.