PRACTICE EXAM 6: USPS 955 MULTICRAFT SIMULATION

1. A 480-volt motor is running at full load. The measured line current is 52 amps and the power factor is 0.87. What is the approximate real power consumed by this three-phase motor?

A. 24,960 watts based on voltage times current alone

B. 43,238 watts based on three-phase apparent power formula

C. 18,720 watts based on single-phase power calculation

D. 37,583 watts based on the three-phase real power formula

2. A postal facility's chilled water system has three identical pumps piped in parallel. Under normal conditions, two pumps run and one is a standby spare. What is the primary purpose of the standby pump?

A. To increase the system flow rate during peak cooling demand

B. To provide immediate backup if an operating pump fails, maintaining system capacity

C. To circulate water through the idle piping sections for freeze protection

D. To maintain system pressure during low-demand overnight operating periods

3. An electrician finds a 240-volt circuit with a measured current of zero amps, yet the voltmeter shows 240 volts at the panel and 240 volts at the receptacle. What is the circuit condition?

A. Normal — the circuit is energized but no load is connected or operating

B. The neutral conductor is open between the panel and the receptacle

C. The circuit has a hidden short circuit that is not drawing measurable current

D. The voltmeter is malfunctioning and displaying incorrect voltage readings

4. A reciprocating positive displacement pump is being used to inject chemical into a water treatment system. The pump must deliver exactly 2.5 gallons per hour. What pump characteristic makes this precise delivery possible?

A. The pump's variable impeller speed adjusts automatically to maintain flow

B. The pump's internal bypass valve regulates discharge pressure to control flow

C. The pump delivers a fixed volume per stroke regardless of discharge pressure

D. The pump's centrifugal force maintains constant velocity through the discharge nozzle

5. A maintenance technician is troubleshooting a PLC-controlled packaging machine. Output O:3/0 controls a solenoid valve but the valve does not actuate. The PLC program shows O:3/0 is energized (bit = 1). What should be checked next?

A. The PLC input module for the sensor that triggers the output

B. The output module, output wiring, and solenoid valve coil for a fault

C. The PLC program for a logic error preventing the output from energizing

D. The PLC processor battery for a low-charge condition causing data loss

6. A building's steam heating system operates at 15 PSI. At what approximate temperature does water boil at 15 PSI gauge pressure?

A. 212°F — the boiling point is independent of pressure changes

B. 180°F — increased pressure lowers the boiling point of water

C. 195°F — the boiling point increases by 1°F for each PSI above atmospheric

D. 250°F — increased pressure raises the boiling point above the atmospheric 212°F

7. A technician performing a vibration survey discovers that a motor-pump assembly shows dominant vibration at 2× line frequency (120 Hz on a 60 Hz system). What is the most likely cause?

A. Electrical problems in the motor — stator eccentricity, broken rotor bars, or unequal air gap

B. Mechanical imbalance of the pump impeller at its rotating frequency

C. Cavitation in the pump suction caused by insufficient NPSH available

D. Loose pump mounting bolts creating structural resonance at random frequencies

8. Which type of fire extinguisher is specifically designed for use on fires involving combustible metals such as magnesium or titanium?

A. Class A water-based extinguisher with an extended discharge nozzle

B. Class B carbon dioxide extinguisher with a diffusing horn attachment

C. Class D dry powder extinguisher with a specialized application nozzle

D. Class K wet chemical extinguisher designed for cooking oil and grease

9. A hydraulic system has a variable displacement axial piston pump. The operator reports that the system responds sluggishly and cylinder movement is slower than normal. System pressure reads correctly at the relief valve setting. What should be checked?

A. The relief valve spring for fatigue or incorrect adjustment

B. The pump's swashplate mechanism and compensator for proper displacement control

C. The directional valve solenoids for correct electrical supply voltage

D. The actuator cylinder bore for corrosion or scoring causing friction

10. In a series RLC circuit operating at resonance, what is the relationship between inductive reactance and capacitive reactance?

A. Inductive reactance is twice the value of capacitive reactance

B. Capacitive reactance is twice the value of inductive reactance

C. Both reactances are zero because they cancel each other completely

D. Inductive reactance equals capacitive reactance — they cancel, leaving only resistance

11. A maintenance technician discovers oil pooling beneath a hydraulic cylinder rod gland. There is no visible damage to the rod surface. What is the most likely cause?

A. The rod seal (wiper or U-cup) has worn or degraded and needs replacement

B. The cylinder piston seal has failed allowing internal bypass leakage

C. The hydraulic fluid viscosity is too low for the operating temperature range

D. The cylinder relief valve is set too high causing excessive internal pressure

12. What is the standard method for testing a safety valve on a low-pressure steam boiler?

A. Increase the boiler pressure until the safety valve lifts on its own

B. Close the main steam valve and monitor pressure rise on the gauge

C. Manually lift the test lever on the safety valve to verify it opens freely and reseats

D. Remove the safety valve and bench-test it on a hydraulic test stand

13. A PLC timer instruction TOF (Off-Delay Timer) has a preset of 30 seconds. When does the timer begin timing?

A. When the timer rung input transitions from true to false

B. When the timer rung input transitions from false to true

C. Immediately upon PLC power-up regardless of input state

D. When the PLC processor enters the run mode from program mode

14. A maintenance technician is selecting a replacement bearing for a gearbox output shaft that carries both heavy radial loads and significant thrust loads simultaneously. Which bearing type is most appropriate?

A. Deep groove ball bearing with a snap ring for axial retention

B. Cylindrical roller bearing with a loose inner ring for thermal expansion

C. Needle roller bearing with a drawn cup outer race for space savings

D. Tapered roller bearing installed in a matched pair for combined loading

15. An AC induction motor's nameplate shows a power factor of 0.82 at full load. What does this mean for the facility's electrical system?

A. The motor draws more current from the supply than would be needed if all power were real power — the excess is reactive current

B. The motor operates at 82% mechanical efficiency converting electrical input to shaft output

C. The motor's insulation system is rated for 82% of the maximum thermal capacity

D. The motor's starting torque equals 82% of its full-load running torque capacity

16. A newly installed pneumatic control valve is stroking to its full open position but fails to modulate at intermediate positions. The 4-20 mA control signal from the PLC is verified as correct and stable. What is the most likely cause?

A. The valve positioner is not calibrated — the positioner must be set to match the valve's stroke range to the 4-20 mA input signal

B. The air supply pressure to the valve actuator exceeds the positioner's rated input

C. The PLC analog output module is producing a stepped rather than linear signal

D. The valve body packing is too tight and creating excessive stem friction

17. What is the primary advantage of using a plate heat exchanger instead of a shell-and-tube heat exchanger in a building HVAC application?

A. Plate exchangers can operate at much higher pressures than shell-and-tube types

B. Plate exchangers require no gaskets and are completely maintenance-free

C. Plate exchangers provide significantly more heat transfer area in a smaller physical size

D. Plate exchangers can handle steam directly without a pressure reduction station

18. A technician measures the voltage at each terminal of a three-phase disconnect switch while the motor is running. Phase A reads 479V, Phase B reads 481V, and Phase C reads 0V. What does the Phase C reading indicate?

A. Normal operation — one phase always reads lower than the others under load

B. The Phase C fuse is blown or the Phase C switch contact is open

C. The motor has an internal winding fault grounding Phase C to the frame

D. The voltmeter probe is not making proper contact on the Phase C terminal

19. A chain hoist rated at 2 tons is being used to lift a motor weighing 3,200 pounds. The rigging hardware (sling, shackle, hook) weighs approximately 75 pounds. Is this lift within the hoist's capacity?

A. Yes — the total load is well within the 2-ton hoist capacity with margin

B. Yes — rigging hardware weight does not count toward the hoist's rated capacity

C. No — the total load must be recalculated in kilograms to verify compliance

D. No — the total load of 3,275 pounds is below 4,000 pounds (2 tons) but the 82% utilization leaves insufficient safety margin

20. In a DC shunt motor, what happens to the motor speed when field resistance is increased?

A. Speed increases because weakening the field reduces back-EMF, allowing more armature current and faster rotation

B. Speed decreases because the armature voltage drops proportionally with field current

C. Speed remains constant because shunt motors are inherently speed-regulated regardless of field changes

D. The motor stalls because reducing field current eliminates the torque-producing magnetic field

21. A building automation system controls an air handling unit's outdoor air damper. During winter operation, the damper should be at minimum position to reduce heating load. The damper is stuck at 100% open. What is the immediate operational impact?

A. The heating system operates normally but with slightly higher energy consumption

B. The building overheats because excessive outdoor air increases solar heat gain

C. The heating coil may not be able to maintain space temperature with full outdoor air intake, and freeze protection becomes a critical concern

D. The chilled water system activates to compensate for the excess outdoor air

22. A maintenance technician discovers that a centrifugal pump's discharge pressure pulsates rhythmically during operation. The suction pressure is stable. What is the most likely cause?

A. A partially clogged suction strainer restricting flow intermittently to the pump inlet

B. A damaged or worn impeller with missing or eroded vanes creating uneven pressure distribution

C. An air pocket trapped in the discharge piping causing pressure fluctuation

D. The motor is experiencing electrical supply voltage fluctuations under varying load

23. During oxy-acetylene cutting of a 1-inch steel plate, the cut starts cleanly but the kerf gradually widens and the cut edges become rough with excessive slag. What adjustment is needed?

A. Increase the acetylene pressure to provide more preheating fuel to the cut

B. Slow down the cutting speed to allow the preheat flames more dwell time

C. Reduce the cutting oxygen pressure that has been set too high for the material

D. Increase the cutting speed — the torch is moving too slowly, allowing the kerf to widen from excessive heat input

24. What does the abbreviation NPSH stand for in pump system design?

A. Net Positive Suction Head — the pressure available at the pump suction above the fluid's vapor pressure

B. Nominal Pump Suction Height — the maximum elevation a pump can be installed above the fluid source

C. Negative Pressure Suction Hazard — the condition that causes pump seal failure from vacuum exposure

D. Non-Pressurized Suction Housing — the pump casing design for atmospheric inlet operation

25. A maintenance technician is troubleshooting an intermittent fault on a 120-volt control circuit. The circuit works correctly most of the time but occasionally drops out for a few seconds. Standard voltage and resistance tests show no faults. Which diagnostic approach is most appropriate?

A. Replace all components in the circuit as a precautionary measure

B. Install a data logger on the supply voltage to monitor for utility sags

C. Use a strip chart recorder or data logger to monitor the control circuit voltage continuously and capture the intermittent voltage drop when it occurs

D. Increase the wire size in the control circuit to reduce impedance

26. A facility's power monitoring system shows that peak electrical demand occurs during a 15-minute window each morning when the mail processing equipment starts up. Why is this peak demand a concern?

A. Peak demand determines the utility's demand charge for the entire billing period

B. Morning startups always cause voltage sags that damage electronic equipment

C. The utility imposes a time-of-use surcharge on power consumed before noon

D. Peak demand causes the building's main transformer to exceed its thermal rating

27. Which lubrication method delivers the most precise quantity of grease to multiple lubrication points on a scheduled automatic basis?

A. Manual grease gun application by a technician on a weekly PM route

B. Centralized automatic grease distribution system with progressive divider blocks

C. Oil mist lubrication system with adjustable metering nozzles at each point

D. Single-point automatic grease cup dispensers installed on each bearing housing

28. A three-wire start/stop circuit has a start button, stop button, seal-in contact, and two safety interlocks in series with the motor starter coil. The motor starts when the start button is pressed but stops immediately when the start button is released. All safety interlocks are verified closed. What is the fault?

A. The seal-in (holding) contact is not closing when the starter coil energizes

B. The stop button is wired normally open instead of normally closed

C. One of the safety interlocks has excessive resistance causing voltage drop

D. The motor starter coil has a partial short reducing its holding force

29. A boiler water treatment program shows a steady increase in dissolved solids concentration over three months despite regular blowdown. What should be investigated?

A. The chemical feed pump for overdosing of treatment chemicals into the boiler

B. The steam safety valve for internal leakage allowing steam loss and concentration

C. The blowdown valve for insufficient opening duration or frequency — not enough water is being drained to control solids concentration

D. The condensate return system for excessive condensate temperature above design limits

30. A hydraulic press uses a 6-inch bore cylinder operating at 2,500 PSI. The press must hold a workpiece clamped for 60 seconds during each cycle with no cylinder movement. Which directional valve center condition is most appropriate?

A. Open center — all ports connected to allow free flow circulation

B. Float center — both actuator ports connected to tank for free cylinder movement

C. Tandem center — pump flow to tank with actuator ports connected for recirculation

D. Closed center — all ports blocked to trap fluid and hold the cylinder in position

31. A maintenance technician is testing a dual-element time-delay fuse with an ohmmeter. The fuse reads 0.0 ohms. What does this indicate?

A. The fuse is defective and has an internal short circuit that must be corrected

B. The fuse is intact — a good fuse has near-zero resistance, providing a continuous path for current

C. The fuse has been previously overloaded and its time-delay element has welded shut

D. The ohmmeter is not sensitive enough to measure the fuse element's resistance

32. An air compressor's unloader valve fails to open when the compressor reaches cut-out pressure. What is the immediate consequence?

A. The compressor runs more efficiently because no air is wasted through the unloader

B. The receiver tank pressure drops rapidly below the normal operating range

C. The compressor motor overheats from running at reduced load for extended periods

D. The compressor starts against full head pressure on the next cycle, overloading the motor and potentially stalling it or tripping the overload

33. What is the correct procedure for filling a grease gun from a bulk grease container?

A. Fill the gun by pulling the plunger back and pressing the barrel opening directly into the bulk grease, minimizing air introduction and contamination exposure

B. Scoop grease from the container with a clean spatula and pack it into the gun barrel

C. Heat the grease to 150°F to liquefy it and pour it through the gun's fill port

D. Remove the gun's spring and plunger assembly and pack grease in from the rear

34. A PLC analog output module sends a 4-20 mA signal to a variable frequency drive (VFD) to control motor speed. The PLC output reads 12 mA but the VFD display shows the motor running at 15 Hz instead of the expected 30 Hz. What is the most likely cause?

A. The PLC program has a scaling error in the math instruction that generates the output

B. The VFD's analog input is configured for a 0-10V signal instead of 4-20 mA

C. The VFD's analog input scaling is misconfigured — the input range does not match the PLC's output range

D. The 4-20 mA signal wire has excessive resistance causing signal attenuation

35. What is the primary purpose of a sight glass on a hydraulic reservoir?

A. To allow visual inspection of the fluid color for contamination assessment

B. To indicate the fluid level in the reservoir during operation and maintenance

C. To observe fluid turbulence patterns for air entrainment detection

D. To verify that the return filter is functioning by watching for particle discharge

36. A technician is welding a repair on a cast iron component using an oxy-acetylene torch. Why is a slow, even preheating of the entire part recommended before welding?

A. Preheating softens the cast iron surface for better weld penetration

B. Preheating burns off surface contaminants and oil from the casting pores

C. Preheating is only necessary for cast iron parts thicker than 2 inches

D. Preheating reduces the temperature differential that causes cracking in the brittle cast iron material during and after welding

37. A motor nameplate indicates the following: 10 HP, 460V, 3PH, 60 HZ, 14.0 FLA, 1755 RPM, SF 1.15. What does the service factor (SF) of 1.15 indicate?

A. The motor can operate continuously at 115% of its rated 10 HP (up to 11.5 HP) without exceeding its thermal design limits

B. The motor's starting torque is 115% of its full-load running torque

C. The motor is 15% more efficient than a standard-efficiency motor of the same rating

D. The motor requires 15% additional ventilation beyond standard cooling provisions

38. A building's domestic hot water recirculation pump runs 24 hours per day to maintain hot water temperature at distant fixtures. What is the most energy-efficient improvement to this system?

A. Replace the recirculation pump with a larger model for faster water heating

B. Install a timer or aquastat to cycle the pump based on schedule or temperature

C. Reduce the hot water heater setpoint temperature by 20°F to decrease standby losses

D. Install larger diameter recirculation piping to reduce pump energy consumption

39. In Boolean algebra, what is the simplified result of the expression $A \cdot (A + B)$?

A. The expression simplifies to A + B based on the distributive property

B. The expression simplifies to A based on the absorption property

C. The expression simplifies to $A \cdot B$ because the duplicate A term cancels

D. The expression cannot be simplified further and remains as written

40. A maintenance crew is preparing to replace a large motor in a mechanical room. The motor weighs 2,800 pounds and is located directly beneath an overhead bridge crane rated at 5 tons. The motor mounting bolts have been removed. What must be confirmed before attaching the crane sling?

A. The motor's center of gravity location for proper sling placement

B. Only the crane capacity needs verification — it far exceeds the motor weight

C. The motor should be jacked up first before the crane hook is positioned

D. The weight of the motor, the weight of all rigging hardware, and proper sling selection and attachment points

41. A maintenance technician observes that a natural gas boiler's flame scanner LED indicator shows "flame detected" even though the burner is off and no flame is present. What does this indicate?

A. The flame scanner is detecting a false flame signal — possible causes include a hot refractory glowing in the scanner's field of view or a defective scanner

B. Normal standby indication showing the scanner is powered and ready for operation

C. The pilot gas valve is leaking and maintaining a small undetected pilot flame

D. The flame safeguard controller is in test mode and overriding the scanner input

42. What is the maximum recommended percentage of voltage drop for a combined feeder and branch circuit from the service entrance to the farthest outlet?

A. 2% for the feeder and 2% for the branch circuit — 4% total combined

B. 10% total combined as measured at the point of utilization equipment

C. 3% for the feeder and 2% for the branch circuit — 5% total combined maximum

D. There is no recommended maximum — equipment operates at any available voltage

43. A pneumatic system has a pressure regulator set at 80 PSI. Downstream of the regulator, the pressure gauge reads only 55 PSI when a cylinder actuates. What is the most likely cause?

A. The cylinder seals have failed causing internal bypass leakage during actuation

B. The regulator spring has weakened and can no longer maintain the setpoint under load

C. The air supply piping between the regulator and the cylinder is too long or too small

D. The supply piping or regulator is undersized for the flow demand — pressure drops when the cylinder draws air faster than the regulator or piping can deliver

44. A centrifugal pump operates on the following conditions: 500 GPM flow at 120 feet of head. The system requires only 350 GPM. What is the most energy-efficient method to reduce the pump output?

A. Close the discharge valve partially to increase system resistance and reduce flow

B. Trim (reduce the diameter of) the pump impeller to match the pump's output to the required flow and head

C. Install a bypass line from the discharge back to the suction to recirculate excess flow

D. Run the pump in intermittent on-off cycles to achieve the average required flow rate

45. A maintenance technician is inspecting scaffolding before a crew begins work. Which finding requires correction before anyone is permitted on the scaffold?

A. The planking does not extend at least 6 inches past the support frame on one end — incomplete platform support creates a tipping hazard

B. The scaffold has three cross braces instead of the recommended four for the height

C. The scaffold base plates are resting on concrete rather than on wooden mudsills

D. The scaffold access ladder is mounted on the narrow end instead of the wide end

46. A facility's electrical distribution system includes a 500 kVA transformer. The building load averages 400 kW at a power factor of 0.85. Is the transformer adequately sized?

A. Yes — the transformer has 100 kVA of spare capacity above the building load

B. Yes — the 400 kW load is less than the 500 kVA transformer rating with margin

C. No — the apparent power demand is approximately 471 kVA, leaving only 29 kVA of margin and operating the transformer near its maximum rating

D. No — the transformer must be rated at twice the load for adequate safety margin

47. A hydraulic system's oil cooler is bypassed during winter operation to help the system warm up faster. The maintenance team forgets to re-enable the cooler in spring. What consequence will this cause during summer operation?

A. Elevated fluid temperature causing accelerated seal degradation, reduced oil viscosity, shortened oil life, and potential component damage

B. Increased system pressure above the relief valve setting due to thermal expansion

C. Reduced actuator speed because hot oil has higher viscosity and flows more slowly

D. No significant impact — the reservoir provides adequate heat dissipation without the cooler

48. What characteristic distinguishes a Class I, Division 1 hazardous location from a Class I, Division 2 location?

A. Division 1 involves combustible dust while Division 2 involves flammable gases

B. Division 1 has a higher ambient temperature than Division 2 locations

C. Division 1 allows standard electrical equipment while Division 2 requires explosion-proof

D. Division 1 has ignitable concentrations of flammable gas present during normal operations while Division 2 has them only during abnormal conditions

49. A maintenance technician is replacing a motor contactor. The new contactor is the correct NEMA size and voltage rating but has AC-rated coil while the original had a DC-rated coil. Can the AC coil contactor be used?

A. Yes — AC and DC coils are interchangeable if the voltage ratings match

B. No — the coil must match the control circuit type; an AC coil on a DC circuit can overheat and fail, and a DC coil on AC will chatter and not seal properly

C. Yes — but only if an external rectifier is added to the control circuit

D. No — contactors with different coil types have incompatible contact configurations

50. A compressed air system energy audit reveals that the facility is running three 100 HP compressors continuously even though the average air demand requires only the output of 1.5 compressors. What is the recommended corrective action?

A. Install a sequencing controller to stage compressors on and off based on system demand, running only the capacity needed at any given time

B. Replace all three compressors with a single 300 HP unit for better efficiency

C. Reduce the system pressure setpoint by 20 PSI to lower the compressor output

D. Install additional receiver tank storage to reduce compressor cycling frequency

51. A maintenance technician is troubleshooting a conveyor belt tracking problem. The belt consistently drifts to the right side of the conveyor. What is the most likely mechanical cause?

A. The belt is loaded unevenly with more weight on the left side of the conveyor

B. The drive motor is running backward causing asymmetric belt tension distribution

C. The conveyor idlers or head/tail pulleys are misaligned — the right side is running ahead of the left, steering the belt in that direction

D. The belt material has stretched more on the right side due to uneven vulcanization

52. An industrial electrical panel has a ground fault protection (GFP) system on the main breaker. During a heavy rainstorm, the GFP trips even though no equipment has faulted. What is the most likely cause?

A. Lightning induced a voltage transient that the GFP interpreted as a fault

B. The GFP sensitivity setting is too low for the building's normal ground leakage

C. The main breaker thermal element tripped from ambient temperature rise

D. Rainwater intrusion into outdoor junction boxes or conduit runs is creating ground leakage current that exceeds the GFP threshold

53. A maintenance technician is adjusting the belt tension on a V-belt drive. What is the generally accepted method for checking correct tension?

A. Tighten the belts until they cannot be twisted more than 90 degrees by hand

B. Deflect the belt at the midpoint of the span with a known force and measure the deflection against the manufacturer's specification

C. Pluck the belt like a guitar string and listen for the correct pitch frequency

D. Measure the distance between sheave centers and compare to the belt catalog length

54. A building has two identical boilers piped in parallel. During cold weather, both boilers operate. Boiler A maintains 12 PSI steam pressure while Boiler B maintains only 8 PSI. Both boilers are set for the same pressure. What should be investigated on Boiler B?

A. The combustion system — dirty burner, incorrect fuel-air ratio, fouled heat transfer surfaces, or a control issue preventing Boiler B from firing at full capacity

B. The steam header piping for a restriction between Boiler B and the distribution system

C. The feedwater pump for Boiler B for cavitation reducing water supply to the boiler

D. The boiler room ventilation for inadequate combustion air supply to both boilers

55. In a control circuit, a normally open pressure switch is set to close at 50 PSI and open at 45 PSI. What is the switch's differential?

A. 50 PSI — the maximum operating pressure of the switch in the system

B. 45 PSI — the minimum operating pressure before the switch reactivates

C. 5 PSI — the difference between the closing (cut-in) and opening (cut-out) pressures

D. 95 PSI — the sum of the closing and opening pressure setpoints combined

56. A maintenance technician is performing predictive maintenance on a group of electric motors using infrared thermography. What specific anomaly would indicate a developing motor problem?

A. Uniform temperature distribution across the motor frame during full-load operation

B. One section of the motor frame significantly hotter than the rest, indicating a localized winding hot spot or blocked ventilation passage

C. The motor frame temperature matching the ambient room temperature exactly

D. The coupling guard showing the same temperature as the motor frame surface

57. A hydraulic cylinder must hold a heavy load in a fixed position for extended periods during each machine cycle. Which type of hydraulic circuit element best prevents cylinder drift under load?

A. A pressure-compensated flow control valve in the cylinder supply line

B. A check valve in the tank return line to prevent backflow from the reservoir

C. A counterbalance valve or pilot-operated check valve in the cylinder work port line

D. A pilot-operated check valve or counterbalance valve installed in the cylinder port lines to lock fluid and prevent drift

58. What distinguishes a wiring diagram from a schematic (elementary) diagram?

A. A wiring diagram shows physical locations and actual wire routing while a schematic shows logical circuit connections arranged for troubleshooting clarity

B. A wiring diagram is used only for three-phase power circuits while schematics cover only control circuits

C. A wiring diagram uses standard electrical symbols while a schematic uses proprietary manufacturer-specific symbols

D. A wiring diagram shows only the main power conductors while a schematic includes all control and power connections

59. A postal facility has a 1,000 kW emergency diesel generator. During monthly testing, the generator starts and runs at rated voltage and frequency under no load. However, during an actual power outage, the

generator starts but voltage drops severely when the transfer switch connects the building load. What is the most likely cause?

A. The transfer switch contacts have excessive resistance causing voltage drop

B. The fuel supply is adequate for no-load testing but insufficient for loaded operation

C. The generator's voltage regulator or excitation system cannot maintain output under load

D. The building load exceeds the generator's nameplate capacity rating of 1,000 kW

60. A maintenance technician needs to determine the direction of fluid flow through an unmarked check valve installed in a piping system. How can the flow direction be identified without removing the valve?

A. Check valves have identical appearance from both ends and cannot be identified

B. The valve body has a cast or stamped arrow indicating the direction of permitted flow

C. The larger end of the valve body always points in the flow direction by convention

D. Flow direction must be determined by pressurizing each end with a test pump

Practice Exam 6: Answer Key and Explanations

1. **D. Three-phase real power formula** — $P = V \times I \times \sqrt{3} \times PF = 480 \times 52 \times 1.732 \times 0.87 = 37{,}583$ watts. The three-phase formula includes the $\sqrt{3}$ factor and the power factor to calculate real (useful) power consumed.
2. **B. Standby pump provides immediate backup on failure** — Redundant pump configurations ensure that if an operating pump fails, the standby pump starts automatically to maintain system capacity. This prevents service interruption to cooling-dependent mail processing operations.
3. **A. Normal energized circuit with no load connected** — Voltage present at both ends with zero current simply means the circuit is energized but nothing is plugged in or turned on. No current flows because there is no load to draw current. This is a normal open-circuit condition.
4. **C. Fixed volume per stroke regardless of discharge pressure** — Positive displacement pumps deliver a precise volume with each stroke. Changing the stroke rate changes the delivery rate proportionally. This characteristic makes PD pumps ideal for chemical metering applications.

5. **B. Check output module, wiring, and solenoid valve** — The PLC program shows the output bit is ON, confirming the logic is satisfied. The fault is downstream of the processor — either the output module is not switching, the wiring is broken, or the solenoid coil has failed.

6. **D. 250°F boiling point at 15 PSI gauge** — Increased pressure raises the boiling point of water above the atmospheric 212°F. At 15 PSI gauge (approximately 30 PSIA), water boils at approximately 250°F. This higher temperature makes steam an effective heating medium.

7. **A. Electrical motor problems cause 2× line frequency vibration** — Vibration at exactly 120 Hz (2× the 60 Hz supply frequency) is the signature of electromagnetic problems — stator eccentricity, broken rotor bars, or unequal air gap. Mechanical problems produce vibration at multiples of shaft speed, not line frequency.

8. **C. Class D extinguisher for combustible metal fires** — Class D extinguishers use specialized dry powder agents designed for burning metals. Water, CO_2, and standard dry chemical extinguishers can cause violent reactions with burning metals and must never be used.

9. **B. Check swashplate mechanism and compensator** — Correct pressure with slow actuator speed indicates the pump is producing pressure but not enough flow. A stuck or malfunctioning swashplate or compensator prevents the pump from reaching full displacement, reducing flow output.

10. **D. At resonance, XL equals XC and they cancel** — At the resonant frequency, inductive reactance exactly equals capacitive reactance. They oppose each other and cancel, leaving only the circuit's resistance to limit current. Impedance is minimum and current is maximum at resonance.

11. **A. Rod seal has worn and needs replacement** — External oil leakage at the rod gland with no rod surface damage indicates the dynamic seal (wiper or U-cup) has worn beyond its sealing capability. The rod is not causing the wear — the seal material has reached end of life.

12. **C. Manually lift the test lever on the safety valve** — The standard field test for safety valves on low-pressure boilers is lifting the test lever to verify the valve opens freely and reseats without leaking. This confirms the valve is not stuck and will function during an overpressure event.

13. **B. TOF begins timing when input goes from true to false** — An off-delay timer starts its timing cycle when the enabling input drops from true to false. The output contacts remain in their energized state during the timing period and return to normal when the preset time elapses.

14. **D. Tapered roller bearings in matched pairs for combined loads** — Tapered roller bearings handle simultaneous heavy radial and axial loads. Installed in opposing pairs (face-to-face or back-to-back), they carry combined loads in both directions and are the standard for gearbox output shafts.

15. **A. Motor draws more current than real power alone requires** — A power factor of 0.82 means only 82% of the apparent power performs useful work. The remaining 18% is reactive current that flows through the supply conductors without contributing to motor output.

16. **A. Valve positioner needs calibration** — A positioner translates the 4-20 mA signal into valve stem position. An uncalibrated positioner does not correctly map the signal range to the valve stroke range, causing the valve to go full open instead of modulating proportionally.

17. **C. Plate exchangers provide more surface area in smaller size** — Corrugated plate stacks create turbulent flow and provide extremely high heat transfer area per unit volume. Plate exchangers are dramatically more compact than shell-and-tube designs of equivalent capacity.

18. **B. Phase C fuse is blown or switch contact is open** — Zero voltage on one phase while the other two read normal indicates the Phase C supply conductor is interrupted — either a blown fuse in the disconnect or a failed switch contact on that phase.

19. **D. Lift is within capacity but margin is minimal** — Total load = 3,200 + 75 = 3,275 lbs. The 2-ton (4,000 lb) hoist has a capacity margin of 725 pounds (18%). While technically within rating, best practice recommends more margin. The lift is permissible but requires careful execution.

20. **A. Speed increases when shunt field resistance increases** — Increasing field resistance reduces field current, weakening the magnetic field. Reduced field means less back-EMF, allowing more armature current and higher speed. This is the standard speed control method for shunt DC motors.

21. **C. Heating capacity may be insufficient and freeze risk increases** — Full outdoor air intake during winter dramatically increases the heating load. The heating coil may not have enough capacity to warm the cold outdoor air. More critically, cold air can freeze the heating coil if it overwhelms the hot water supply.

22. **B. Damaged impeller with eroded vanes** — An impeller with missing or severely eroded vanes creates uneven pressure distribution during rotation. Each passage of a damaged vane section produces a pressure dip, resulting in rhythmic discharge pressure pulsation at the impeller rotation frequency.

23. **D. Torch moving too slowly — increase cutting speed** — Excessive heat input from slow travel widens the kerf, roughens the cut edges, and produces heavy slag. Increasing travel speed reduces heat input per unit length, producing a narrower, cleaner cut with less slag.

24. **A. Net Positive Suction Head** — NPSH is the absolute pressure available at the pump suction above the vapor pressure of the fluid. Adequate NPSH prevents cavitation. NPSHa (available) must exceed NPSHr (required by the pump) for safe operation.

25. **C. Continuous monitoring captures intermittent events** — Intermittent faults cannot be found with spot measurements because the fault may not be present when the technician is testing. A data logger or strip chart recorder monitors continuously and captures the event whenever it occurs.

26. **D. Peak demand sets the utility demand charge** — Most commercial utility rates include a demand charge based on the highest 15 or 30-minute average power consumption during the billing period. One high peak sets the demand charge for the entire month regardless of average consumption.

27. **B. Centralized automatic system with progressive divider blocks** — Progressive divider blocks meter precise grease quantities to each lubrication point on a timed schedule. The system eliminates missed points, ensures consistent delivery, and operates automatically without technician intervention.

28. **A. Seal-in contact not closing when starter energizes** — The motor starts when the start button provides a temporary path to the coil. When the button is released, the seal-in contact should maintain the circuit. If it fails to close, the coil de-energizes and the motor stops immediately.

29. **C. Blowdown insufficient to control dissolved solids** — If dissolved solids concentration increases despite regular blowdown, the blowdown duration or frequency is not adequate to remove solids as fast as they accumulate from makeup water and evaporation.

30. **D. Closed center traps fluid and holds cylinder position** — A closed-center spool blocks all ports when centered, trapping hydraulic fluid on both sides of the cylinder piston. This locks the cylinder in position, holding the clamping force during the 60-second press cycle.

31. **B. Good fuse reads near-zero resistance** — A fuse is a continuous conductor when intact. Near-zero resistance confirms the fusible element is complete and can carry current. A blown fuse reads OL (infinite resistance) indicating the element has melted open.

32. **D. Compressor starts against full head pressure** — The unloader valve relieves pressure from the compressor head during shutdown so the next start occurs with no load. A failed unloader leaves full system pressure on the compressor head, requiring the motor to start against this load.

33. **A. Pull plunger back and press barrel into bulk grease** — This method minimizes air introduction and contamination. Pulling the plunger creates suction that draws grease into the barrel as the opening is pressed into the container. Clean technique prevents contaminating the grease supply.

34. **C. VFD analog input scaling is misconfigured** — The PLC sends the correct 12 mA signal, but the VFD interprets it incorrectly due to a mismatch between the VFD's configured input range and the actual 4-20 mA signal. Recalibrating the VFD's analog input scaling corrects the speed error.

35. **B. Sight glass indicates reservoir fluid level** — The sight glass provides a visual indication of hydraulic fluid level in the reservoir. Maintaining correct level ensures adequate fluid volume for system operation, heat dissipation, and air separation. Low level indicates leaks or insufficient fill.

36. **D. Preheating reduces temperature differential and prevents cracking** — Cast iron is brittle and cracks easily from thermal stress. Preheating the entire part reduces the temperature difference between the weld zone and the surrounding material, minimizing thermal stress that causes cracking during welding and cooling.

37. **A. Motor can operate continuously at 115% of rated HP** — A service factor of 1.15 means the motor can carry 11.5 HP (115% of 10 HP) continuously without exceeding its thermal design limits. This provides margin for occasional overload or adverse operating conditions.

38. **B. Install timer or aquastat to cycle the pump** — Running the recirculation pump 24/7 wastes energy during periods of low or no hot water demand. A timer limits pump operation to occupied hours, and an aquastat cycles the pump based on return water temperature.

39. **B. Simplifies to A by absorption property** — The Boolean absorption law states $A \cdot (A + B) = A$. The A term absorbs the (A + B) term because whenever A is true, the entire expression is true regardless of B. When A is false, the entire expression is false regardless of B.

40. **D. Confirm motor weight, rigging weight, and proper sling selection** — Before any lift, the total load (motor plus all rigging hardware) must be confirmed within the crane's capacity. Proper sling selection and attachment points ensure balanced, secure lifting. All three elements must be verified.

41. **A. False flame signal from hot refractory or defective scanner** — A flame scanner indicating "flame detected" with no burner operation is a serious safety concern. Hot refractory surfaces can emit enough radiation to fool the scanner, or the scanner itself may be defective. Either condition must be corrected immediately.

42. **C. 5% total — 3% feeder plus 2% branch circuit** — The NEC recommends limiting total voltage drop to 5% from service entrance to the farthest outlet. This is typically allocated as 3% for the feeder and 2% for the branch circuit, though any combination totaling 5% is acceptable.

43. **D. Piping or regulator undersized for flow demand** — Pressure that holds at the setpoint statically but drops during actuator operation indicates the supply path cannot deliver air fast enough. The regulator's flow capacity or the piping diameter is insufficient for the cylinder's air consumption rate.

44. **B. Trim the impeller to match required flow and head** — Impeller trimming permanently reduces the pump's output to match the system requirement. It is the most energy-efficient solution because the pump draws only the power needed for the reduced output, unlike throttling which wastes energy as heat.

45. **A. Planking not extending past support frame requires correction** — Scaffold planks must extend at least 6 inches beyond the support frame on each end to prevent tipping when a worker steps near the edge. Incomplete platform support is a fall hazard that must be corrected before use.

46. **C. Apparent power is 471 kVA leaving minimal margin** — Apparent power = kW / PF = 400 / 0.85 = 471 kVA. The 500 kVA transformer is 94% loaded. While technically adequate, this leaves minimal margin for load growth, inrush currents, or harmonic loading.

47. **A. Elevated temperature causes seal degradation and reduced oil life** — Without the cooler, the system cannot reject heat during warm weather operation. Elevated fluid temperature degrades seals, reduces viscosity below the safe operating range, accelerates oil oxidation, and shortens component life.

48. **D. Division 1 has ignitable gases during normal operations** — Class I, Division 1 locations have flammable gas or vapor concentrations present continuously or frequently during normal operations. Division 2 locations have such concentrations only during abnormal conditions such as equipment failure.

49. **B. Coil type must match the control circuit power type** — An AC coil on a DC control circuit lacks the impedance that limits AC current, causing overheating. A DC coil on an AC circuit cannot develop sufficient holding force because it requires steady-state DC to maintain the magnetic field.

50. **A. Install sequencing controller to stage compressors on demand** — A compressor sequencing controller starts and stops compressors based on actual system pressure demand, running only the capacity needed at any time. This eliminates the waste of running three compressors when 1.5 would suffice.

51. **C. Misaligned idlers or pulleys steering the belt** — Belt tracking is controlled by the alignment of idlers, head pulley, and tail pulley. If one side of a pulley or idler is ahead of the other, the belt is steered toward the advanced side. Realigning the pulleys corrects the tracking.

52. **D. Rainwater intrusion creating ground leakage current** — Water entering outdoor electrical enclosures, junction boxes, or conduit provides a path for current leakage to ground. When the total leakage exceeds the GFP threshold, the main breaker trips even without an equipment fault.

53. **B. Deflect belt at midpoint with known force and measure** — The standard method applies a specific perpendicular force at the belt span midpoint and measures the resulting deflection. Correct tension produces deflection matching the manufacturer's specification for that belt and span length.

54. **A. Investigate Boiler B combustion system** — With identical pressure settings but different outputs, Boiler B is not producing as much steam. Dirty burner components, incorrect fuel-air ratio, fouled heating surfaces, or a control issue limiting firing rate are the most common causes.

55. **C. 5 PSI differential between close and open pressures** — Differential = close pressure − open pressure = 50 − 45 = 5 PSI. The differential prevents rapid cycling by requiring a meaningful pressure change before the switch changes state again.

56. **B. Localized hot spot indicates winding fault or blocked ventilation** — Uniform temperature is normal. A significantly hotter section indicates either a winding turn-to-turn short generating excess heat in that area or blocked ventilation preventing cooling of that motor section.

57. **D. Pilot-operated check valve or counterbalance valve locks fluid** — These valves block fluid flow from the cylinder ports until intentionally opened by a pilot signal from the directional valve. They prevent load-induced pressure from pushing fluid out of the cylinder and causing drift.

58. **A. Wiring diagram shows physical layout; schematic shows logical connections** — Wiring diagrams represent actual physical locations and wire routing for installation and wire tracing. Schematics arrange the same components for logical clarity and troubleshooting, regardless of physical location.

59. **C. Voltage regulator or excitation system failing under load** — A generator that maintains voltage at no load but drops under load has an excitation problem. The automatic voltage regulator (AVR) or exciter cannot increase field current fast enough to compensate for the voltage drop caused by load current.

60. **B. Cast or stamped arrow on the valve body indicates flow direction** — Check valve manufacturers cast or stamp a directional arrow on the valve body showing the permitted flow direction. This arrow is the standard identification method and is visible without removing or disassembling the valve.