PRACTICE EXAM 12: USPS 955 MULTICRAFT SIMULATION

1. A postal facility's main air handler supply fan motor draws 45 amps on a 480-volt three-phase circuit. The power factor meter reads 0.82. What is the approximate real power consumed by this motor?

A. 21,600 watts based on single-phase power calculation without the three-phase correction factor

B. 30,612 watts based on the three-phase real power formula including the power factor correction

C. 37,324 watts based on the three-phase apparent power formula without the power factor correction

D. 17,712 watts based on dividing the apparent power by the square root of three for phase correction

2. A maintenance technician is troubleshooting a building's hydronic heating system. Several zones on the second floor are not receiving heat while all first-floor zones work normally. The boiler outlet temperature is correct and circulation pumps are running. What should be checked first?

A. The boiler's water treatment chemistry for excessive dissolved solids causing circulation restriction

B. The second-floor zone control valves for simultaneous electrical failure from a shared transformer

C. The expansion tank for a waterlogged condition that is reducing system pressure on upper-floor piping

D. The second-floor piping for air locks at the high points preventing water circulation to those zones

3. A hydraulic system's accumulator is supposed to provide supplemental flow during peak demand cycles. The operator reports that the press cycle has slowed down during the high-demand phase. System pressure is normal. What should be checked on the accumulator?

A. The accumulator's hydraulic port valve for a restriction limiting fluid flow to the main system

B. The accumulator's mounting bracket for looseness that could cause vibration-induced flow interruption

C. The accumulator's nitrogen precharge pressure for loss that reduces the stored fluid volume available

D. The accumulator's pressure gauge for a calibration drift showing incorrect pressure during peak cycles

4. An electrician is testing a 480/277-volt panelboard. Phase A to neutral reads 277V, Phase B to neutral reads 277V, but Phase C to neutral reads only 245V. Phase-to-phase voltages are all balanced at 480V. What is the most likely cause?

A. A high-resistance neutral connection affecting the Phase C voltage measurement to neutral reference

B. Phase C has a blown fuse that is reducing the voltage available on that particular phase conductor

C. The panelboard's internal bus bar on Phase C is damaged and creating additional resistance to loads

D. The utility supply transformer's Phase C winding has a turn-to-turn short reducing its output voltage

5. A maintenance crew is preparing to replace a large conveyor motor weighing 3,500 pounds. The motor is located in a pit 8 feet below floor level. No overhead crane is available. What is the safest method to extract the motor?

A. Use a portable gantry crane positioned over the pit opening with appropriate rigging and fall protection

B. Attach wire rope slings to the motor and use a forklift positioned at the pit edge to lift it vertically

C. Build a temporary ramp into the pit and drag the motor out using a come-along and steel rollers

D. Use a truck-mounted boom crane positioned outside the building with the boom extended through a window

6. A PLC-controlled automated sorting machine has a sequence of five cylinders that must extend and retract in a specific order. Cylinder 3 fails to extend during the sequence. The PLC program shows the output for Cylinder 3 is energized. The solenoid valve coil has voltage present. What should be checked next?

A. The PLC processor for a firmware error that is corrupting the output signal to the Cylinder 3 module

B. The pneumatic supply and valve function for Cylinder 3 — the electrical signal path is confirmed working

C. The PLC input sensor that confirms Cylinder 2 completed its stroke before Cylinder 3 was commanded

D. The solenoid valve's electrical connector for a loose pin that provides voltage but insufficient current

7. A boiler feedwater system uses a deaerator to remove dissolved oxygen from the feedwater. If the deaerator fails to function properly, what is the primary consequence for the boiler?

A. Accelerated oxygen pitting corrosion on the boiler's internal waterside heating surfaces and tubes

B. Excessive scale formation on the boiler tubes from elevated mineral content in the untreated feedwater

C. Reduced steam output because the colder feedwater requires more fuel energy input for conversion

D. Increased blowdown frequency required to control the dissolved oxygen concentration in the boiler water

8. A maintenance technician discovers that a motor's coupling hub has a keyway that shows signs of wallowing — the keyway has been rounded and enlarged beyond its original dimensions. What caused this damage?

A. The coupling hub was manufactured from an incorrect material grade that is too soft for the application

B. The motor was started and stopped too frequently causing repetitive impact loads at the keyway interface

C. The key was undersized or missing, allowing relative motion between the shaft and hub under torque loading

D. The motor shaft diameter was undersized causing the hub to fit loosely and wobble during rotation

9. A steam system has multiple pressure-reducing stations throughout the building. One PRV station consistently delivers 5 PSI above its setpoint. The PRV has been adjusted, rebuilt, and eventually replaced. The over-pressure condition persists. What should be investigated?

A. The steam supply pressure upstream of the PRV for an increase that exceeds the PRV's operating range

B. The downstream condensate return piping for blockage that creates back-pressure at the PRV outlet

C. The PRV bypass valve for leakage allowing high-pressure steam to pass around the PRV to the outlet

D. The PRV is being oversized — too large a valve for the current flow demand causes poor regulation

10. A centrifugal pump is installed in a new chilled water system. During commissioning, the pump produces rated flow but the motor draws 15% more current than nameplate. The pump curve shows the pump is operating to the right of BEP. What does this indicate?

A. The motor is undersized for the pump and should be replaced with a higher horsepower motor unit

B. The system has less resistance than designed, allowing the pump to produce more flow and consume more power

C. The pump impeller is too small for the application and needs to be replaced with a larger diameter unit

D. The VFD controlling the pump has been programmed to run at a frequency above the design 60 Hz setting

11. In a three-phase electrical system, harmonic distortion from VFDs and electronic ballasts is causing problems. Which harmonic order is most problematic for the neutral conductor in a wye-connected system?

A. Third-order (triplen) harmonics because they add in the neutral instead of canceling like fundamental currents

B. Fifth-order harmonics because they create reverse-rotating magnetic fields in connected motor equipment

C. Seventh-order harmonics because they increase the apparent power demand registered by the utility metering

D. Second-order harmonics because they create DC offset voltage that saturates distribution transformer cores

12. A maintenance technician is troubleshooting a hydraulic cylinder that chatters during mid-stroke extension. The cylinder extends smoothly at the beginning and end of stroke. Pressure and flow are stable. What is the most likely cause?

A. The cylinder bore has a wear ring groove at mid-stroke that catches the piston seal during travel

B. The directional valve spool is partially stuck creating an intermittent flow restriction at mid-travel

C. A score or damaged section in the cylinder bore at mid-stroke causing intermittent piston seal bypass

D. The hydraulic fluid has an air pocket trapped in the cylinder tube at the mid-stroke position level

13. A building's electrical panel has a 200-amp main breaker. The facility manager wants to add a new 50-amp circuit for a rooftop HVAC unit. The existing calculated demand is 175 amps. Adding 50 amps would total 225 amps. Can the new circuit be added to this panel?

A. Yes because the NEC allows panels to carry load up to 125% of the main breaker rating for short periods

B. Yes because the demand factor for HVAC equipment allows a 50% reduction in the calculated load addition

C. No because the new circuit cannot be connected to a panel where all existing breaker ratings are occupied

D. No because the total calculated demand of 225 amps exceeds the 200-amp main breaker's capacity

14. A maintenance technician is performing a monthly fire pump test. The pump starts automatically on pressure drop but the discharge pressure is 20% below the pump's rated pressure at full flow. What should be investigated?

A. The fire pump controller for incorrect pressure switch settings that start the pump at too low a threshold

B. The pump impeller for wear, the suction strainer for blockage, or the driver for inadequate speed output

C. The fire department connection for a leak that is reducing the available pressure in the fire main piping

D. The jockey pump for a malfunction that is masking the true system pressure during the fire pump test

15. A PLC program uses a math instruction to calculate the average of four analog input values stored in registers N7:0 through N7:3. Which formula correctly computes the average?

A. Average = (N7:0 + N7:1 + N7:2 + N7:3) / 4 stored in a destination register for further program use

B. Average = (N7:0 × N7:1 × N7:2 × N7:3) / 4 stored in a destination register for comparison operations

C. Average = (N7:0 + N7:3) / 2 using only the first and last register values for a simplified calculation

D. Average = (N7:0 − N7:1 + N7:2 − N7:3) / 4 using alternating signs to normalize the input variations

16. A maintenance crew discovers severe corrosion on the steel piping in a closed-loop chilled water system. The system was filled with untreated city water five years ago and no chemical treatment has been maintained. What type of corrosion is most likely occurring?

A. Galvanic corrosion from dissimilar metals at the connections between copper and steel components

B. Erosion corrosion from high fluid velocity at the pipe elbows and fittings in the distribution piping

C. Stress corrosion cracking from the combined effects of tensile stress and chemical exposure at pipe supports

D. Oxygen corrosion from dissolved oxygen in the untreated water attacking the steel pipe interior surfaces

17. A variable frequency drive displays a "motor overload" fault on a fan motor that has been running for three years without issues. The ambient temperature has not changed. The measured motor current matches the VFD display. What should the technician investigate?

A. The VFD's overload trip settings for a parameter change that lowered the threshold below operating current

B. The fan system for increased load from dirty filters, belt tension change, or damper position malfunction

C. The VFD's internal cooling fans for failure that is causing the drive electronics to overheat and fault

D. The motor's winding resistance for a change that indicates developing turn-to-turn insulation failure

18. A maintenance technician is replacing a mechanical seal on a pump that handles hot water at 200°F. What special consideration applies to this seal replacement compared to an ambient-temperature seal?

A. Thermal growth must be accounted for when setting the seal compression — the seal must be set for operating temperature dimensions not cold-installed dimensions

B. The seal faces must be coated with high-temperature lubricant to prevent damage during initial startup

C. The seal must be installed while the pump is at operating temperature to achieve correct face compression

D. Double mechanical seals are always required for hot water service regardless of pressure or fluid chemistry

19. A building automation system controls an economizer on a large air handler. The economizer should open the outdoor air dampers when outdoor temperature drops below 65°F and the building needs cooling. The system is not economizing even though outdoor temperature is 55°F. What should be checked?

A. The outdoor air temperature sensor for an inaccurate reading that shows a higher value than actual conditions

B. The return air temperature sensor for a failure that causes the BAS to think the building is already cool enough

C. The economizer enable logic and outdoor air temperature sensor for a fault preventing the system from recognizing favorable conditions

D. The mixed air temperature sensor for a reading that causes the BAS to think the damper is already open

20. A maintenance technician is troubleshooting a pneumatic system where a specific cylinder's extend force has decreased but retract force is normal. Air supply pressure at the cylinder is correct. What is the most likely cause?

A. The directional valve's exhaust muffler on the retract port is clogged restricting exhaust airflow

B. The FRL lubricator is empty causing increased seal friction that affects both extend and retract equally

C. The supply regulator has been adjusted down reducing pressure to the entire cylinder circuit equally

D. The cylinder's cap-side piston seal is leaking, reducing the effective pressure area on the extend stroke

21. A facility's electrical system includes a surge protective device (SPD) on the main switchgear. After a recent thunderstorm, the SPD status indicator shows "faulted." What action is required?

A. Replace the SPD immediately because it has absorbed a surge and its protective capacity is exhausted

B. Reset the SPD status indicator by cycling the building's main breaker off and back on to clear the fault

C. Inspect the building's grounding electrode system for damage before resetting the SPD fault indicator

D. No action needed because SPD fault indicators routinely trigger during storms and auto-reset within 24 hours

22. A centrifugal pump vibration analysis shows a vibration peak at exactly vane pass frequency (number of impeller vanes × RPM). This peak was not present six months ago. What is the most likely developing condition?

A. The pump motor has developed an electrical imbalance that coincidentally matches the vane pass frequency

B. The pump's discharge piping has developed a resonance that is being excited by normal pressure pulsations

C. The impeller-to-volute clearance has decreased from wear or shifting, intensifying hydraulic pulsations at vane pass

D. The pump coupling has developed backlash that produces impact vibration matching the vane pass frequency

23. A maintenance technician discovers that a natural gas boiler burner's main flame has shifted from a stable blue flame to a lazy, yellow-tipped flame with occasional flickering. Combustion air damper position has not been changed. What is the most probable cause?

A. The gas supply pressure has increased beyond the regulator's control range producing excess fuel delivery

B. The combustion air intake is partially blocked by debris or a closed damper reducing available air supply

C. The pilot flame has weakened and is no longer providing adequate ignition energy to the main burner

D. The flue gas recirculation system has activated and is diluting the combustion air with exhaust gases

24. A PLC-controlled system uses a high-speed counter module to count encoder pulses from a motor shaft. The encoder produces 1,000 pulses per revolution. The PLC reads a count of 30,000 pulses accumulated over 2 seconds. What is the motor speed?

A. 1,500 RPM calculated as total pulses divided by encoder resolution times the measurement time period

B. 30 RPM calculated as total pulses divided by 1,000 pulses per revolution without time normalization

C. 15,000 RPM calculated as total pulses divided by the 2-second measurement interval directly

D. 900 RPM calculated as 30,000 pulses ÷ 1,000 PPR = 30 revolutions in 2 seconds = 15 RPS = 900 RPM

25. A maintenance crew needs to replace a 6-inch gate valve in a steam main. The valve is located 12 feet above the floor in a pipe rack. The valve weighs approximately 250 pounds. What is the minimum rigging requirement?

A. A chain hoist or come-along rated above 250 pounds rigged from the pipe rack structure above the valve

B. Two workers using a rope and manual effort to lower the old valve and raise the new one into position

C. A forklift with an extension boom positioned below the valve to support its weight during the exchange

D. No rigging is required because a 250-pound valve can be handled manually by two experienced technicians

26. An electrician measures the insulation resistance of a 4,160-volt motor using a 5,000-volt megger. The 1-minute reading is 1,000 MΩ and the 10-minute reading is 900 MΩ. What is the Polarization Index and what does it indicate?

A. PI = 0.9 indicating excellent insulation condition with minimal absorption characteristics measured

B. PI = 0.9 indicating the insulation is contaminated with moisture or conductive material on the surface

C. PI = 0.9 indicating the insulation is marginally acceptable and should be retested in 3 months

D. PI = 100 indicating exceptional insulation quality far exceeding the minimum acceptable threshold value

27. A hydraulic system's return line filter has a clogging indicator that triggers at 25 PSI differential pressure across the element. The indicator has been triggering within one week of each filter change for the past three months. Previously, filters lasted three months. What does this accelerated clogging indicate?

A. The filter element quality has decreased and the vendor should be contacted about replacement elements

B. The return line filter housing bypass valve is stuck closed forcing all flow through the element continuously

C. The hydraulic fluid temperature has increased causing the fluid to thin and flow faster through the element

D. An internal system component is failing and generating excessive wear debris that rapidly loads the filters

28. A building's fire alarm system has addressable smoke detectors. One detector shows a "dirty" or "sensitivity drift" alert on the fire alarm panel. What maintenance action is required?

A. Replace the detector immediately because sensitivity drift indicates imminent failure of the sensing element

B. Clean the detector's sensing chamber to remove dust and debris that is causing the sensitivity to drift

C. Reset the fire alarm panel to clear the alert and monitor the detector for recurrence over the next week

D. Increase the detector's sensitivity threshold in the panel programming to compensate for the accumulated dust

29. A maintenance technician is troubleshooting a motor that produces a distinct growling sound that increases with speed. The sound is present whether the motor is loaded or unloaded. Vibration analysis shows elevated broadband noise in the high-frequency range. What is the most likely cause?

A. Bearing damage producing broadband noise from rough rolling surfaces on the inner race, outer race, or elements

B. Electrical supply imbalance between the three phases creating electromagnetic noise in the motor stator

C. Loose stator laminations vibrating against each other at twice the electrical supply line frequency level

D. Coupling misalignment transmitting vibration from the driven equipment back through the motor shaft

30. A facility's compressed air system has a 500-gallon receiver tank that was last inspected two years ago. The inspection interval required by the jurisdiction is every year. What is the operational concern?

A. The compressor warranty is voided by operating with an uninspected receiver tank past the inspection date

B. The receiver tank's pressure rating decreases by 10% for each year past the required inspection interval

C. Operating an uninspected pressure vessel violates code requirements and creates a safety and liability risk

D. The receiver tank's internal corrosion rate doubles for each year without inspection and chemical treatment

31. A PLC program has a rung with three parallel branches. Branch 1: XIC I:1/0 AND XIC I:1/1. Branch 2: XIC I:1/2. Branch 3: XIC I:1/3 AND XIO I:1/4. The output is OTE O:2/0. What Boolean expression represents this rung?

A. O:2/0 = (I:1/0 · I:1/1) + I:1/2 + (I:1/3 · NOT I:1/4) using AND for series and OR for parallel paths

B. O:2/0 = I:1/0 + I:1/1 + I:1/2 + I:1/3 + I:1/4 using OR for all contacts in the combined rung logic

C. O:2/0 = (I:1/0 · I:1/1) · I:1/2 · (I:1/3 · NOT I:1/4) using AND for all contact groups in the rung

D. O:2/0 = (I:1/0 + I:1/1) · I:1/2 · (I:1/3 + NOT I:1/4) using mixed logic for series and parallel groups

32. A centrifugal pump handling cooling tower water experiences accelerated impeller erosion. The cooling tower water treatment program appears adequate with conductivity and pH within normal ranges. What additional water quality factor could be causing the erosion?

A. Elevated dissolved oxygen content in the tower water from excessive aeration in the cooling tower basin

B. High alkalinity levels that create a protective scale layer too thick for the impeller vane clearances

C. Suspended solids (sand, sediment, or biological material) in the tower water abrading the impeller surfaces

D. Low calcium hardness that prevents a protective mineral film from forming on the impeller metal surface

33. A maintenance electrician is installing a motor in a postal facility's loading dock area. The motor will be exposed to rain, snow, dust, and washdown water. What NEMA enclosure type is most appropriate?

A. NEMA 1 general-purpose enclosure for indoor use in clean and dry environments only

B. NEMA 4 watertight enclosure suitable for indoor or outdoor use with protection against windblown rain

C. NEMA 7 explosion-proof enclosure for Class I hazardous locations with flammable gas atmospheres

D. NEMA 4X watertight and corrosion-resistant enclosure for harsh outdoor environments with washdown exposure

34. A hydraulic press has two cylinders that must extend simultaneously at the same rate to keep the press platen level. One cylinder is consistently ahead of the other by approximately 1/4 inch throughout the stroke. What is the most appropriate solution?

A. Install larger hoses on the slower cylinder to increase the flow rate to that side of the press

B. Install a flow divider valve in the supply line to ensure equal flow distribution to both cylinders

C. Increase the system pressure to force both cylinders to extend faster and overcome the imbalance

D. Adjust the directional valve spool to restrict flow to the faster cylinder and balance the extension rate

35. A building's hot water boiler has a modulating burner that fires between low fire and high fire based on a temperature controller signal. The controller shows the setpoint at 180°F and the actual temperature at 160°F, but the burner remains at low fire instead of modulating to high fire. What should be checked?

A. The modulating motor or actuator on the burner for a mechanical failure preventing it from driving to high fire position

B. The boiler's operating pressure control for a setting that limits firing rate below the modulating controller

C. The temperature controller's output signal for a wiring fault that drops the signal before reaching the burner

D. The outdoor air temperature reset schedule for a setting that limits boiler temperature based on weather data

36. A maintenance technician is inspecting a set of synchronous (timing) belts on a mail processing machine. Several teeth on one belt are cracked at the base. The other belts in the set appear normal. What caused the tooth damage?

A. The belt was manufactured from a defective batch of material with inconsistent rubber compound curing

B. The belt has been running with excessive tension causing the tooth roots to fatigue and crack over time

C. The timing belt sprocket teeth are worn and no longer matching the belt's tooth profile for proper meshing

D. The damaged belt was exposed to hydraulic oil contamination that degraded the rubber tooth compound

37. An air handling unit's cooling coil is producing condensate, but the condensate drain pan is overflowing onto the mechanical room floor. The drain line is not blocked. What is the most likely cause?

A. The cooling coil fin spacing is too close causing excessive condensate production beyond drain capacity

B. The condensate drain pan is tilted in the wrong direction or is not properly sloped toward the drain connection

C. The outdoor humidity is abnormally high producing condensate faster than the normal drain system can handle

D. The cooling coil's face velocity is too high and is blowing condensate droplets past the drain pan edges

38. A PLC program monitors a motor's running hours using a retentive timer (RTO). The timer preset is 500 hours. The maintenance department wants an alarm at 400 hours to allow maintenance planning time. How should this be implemented?

A. Add a second RTO instruction with a 400-hour preset on the same enabling rung as the original timer

B. Use a GEQ (greater than or equal) comparison instruction to compare the 500-hour timer's accumulated value against a 400-hour constant

C. Use a GEQ comparison instruction to check if the original RTO's accumulated value has reached 400 hours and energize an early-warning alarm output

D. Modify the original RTO preset from 500 to 400 hours and add a second timer for the remaining 100 hours

39. A maintenance crew is performing a crane load test. The crane is rated at 5 tons. What test load weight is typically used for a rated load test?

A. 100% of the crane's rated capacity (5 tons) to verify the crane can handle its maximum rated load safely

B. 200% of the rated capacity (10 tons) to verify the crane has an adequate structural safety margin

C. 50% of the rated capacity (2.5 tons) as a preliminary verification before incrementally increasing load

D. 125% of the rated capacity (6.25 tons) to verify the crane exceeds its rated capacity with safety margin

40. A maintenance technician discovers that a cooling tower's makeup water float valve is cycling rapidly — opening and closing every few seconds. The tower basin water level appears normal. What is the most likely cause?

A. The tower basin level is oscillating from turbulence at the float valve location causing erratic cycling

B. The makeup water supply pressure is too high causing the float valve to overshoot and bounce rapidly

C. The float valve's shutoff seat is worn allowing a continuous small leak that triggers rapid on-off cycling

D. The float valve arm's differential is too narrow — the distance between the open and close positions is insufficient to prevent rapid cycling

41. An electrician is troubleshooting a 480-volt motor circuit where the motor runs but the contactor chatters loudly. Control voltage at the contactor coil measures 92 volts on a 120-volt rated coil. The control transformer secondary shows 119 volts. What is the cause?

A. The contactor coil has developed a partial short circuit reducing its impedance and operating voltage

B. Excessive voltage drop in the control wiring between the transformer secondary and the contactor coil

C. The contactor's magnetic return spring has weakened allowing the armature to pull in at reduced voltage

D. The control transformer is overloaded by too many devices connected to its secondary winding circuit

42. A hydraulic system has a heat exchanger cooled by facility water. The hydraulic oil temperature has been rising gradually over several weeks. Facility water supply temperature and flow rate are verified as normal. What is the most likely cause?

A. Fouling on the water side of the heat exchanger tubes reducing heat transfer between the oil and cooling water

B. The hydraulic pump displacement has increased causing more flow and generating additional system heating

C. The system relief valve spring has weakened reducing system pressure and allowing more bypass flow heating

D. The hydraulic fluid has oxidized and its thermal conductivity has decreased reducing its heat rejection capacity

43. A building's HVAC system has a supply duct static pressure sensor connected to the building automation system (BAS). The BAS shows the duct pressure is 1.5 inches WC but a local manometer reads 2.2 inches WC at the same location. What should be investigated?

A. The supply fan speed for an operating discrepancy between the BAS command and the actual fan output

B. The local manometer for calibration error since electronic BAS sensors are more accurate than manual gauges

C. The BAS pressure sensor for calibration drift, a clogged sensing port, or a kinked or leaking sensing tube

D. The duct construction at the measurement point for a leak that reduces the pressure seen by one instrument

44. A maintenance technician is replacing a gearbox output shaft seal. During disassembly, the technician notices that the shaft surface under the old seal has a polished wear groove approximately 0.010 inches deep. What should be done?

A. Install the new seal in the same position and monitor for leakage during the first week of operation

B. Polish the wear groove smooth with emery cloth and install the new seal in the original shaft position

C. Apply a shaft repair sleeve (speedi-sleeve) over the worn area before installing the new seal to restore the sealing surface

D. Install the new seal offset from the original position so it rides on undamaged shaft surface material

45. A three-phase motor's nameplate shows a service factor of 1.15 and a full-load current of 28 amps. What is the maximum continuous current the motor can draw within its service factor rating?

A. 28 amps because the service factor applies only to horsepower and not to the current rating

B. 32.2 amps calculated as the nameplate FLA multiplied by the 1.15 service factor value

C. 35 amps because the service factor allows a 25% continuous overload above the nameplate current

D. 24.3 amps because the service factor reduces the allowable current to protect the motor insulation

46. A PLC-controlled system uses a recipe management function to load different operating parameters from data files based on the product being processed. After a recipe change, several actuators move to incorrect positions. What is the most likely cause?

A. The PLC processor experienced a momentary power interruption during the recipe download operation

B. The recipe data file was updated with new parameters that have not been validated for the specific product

C. The wrong recipe file was selected or the data in the loaded recipe file contains incorrect parameter values

D. The PLC's communication link to the operator interface dropped during the recipe selection causing data corruption

47. A maintenance technician is troubleshooting a centrifugal pump that has a rhythmic surging sound — the flow and pressure pulsate in a regular cycle approximately every 5 seconds. The suction and discharge conditions appear normal. What is this phenomenon?

A. Pump surge from operation on the unstable left side of the pump curve where the head-flow relationship reverses

B. Water hammer from a downstream check valve that is chattering due to a weakened or broken return spring

C. Recirculation in the pump casing caused by operating significantly to the right of the best efficiency point

D. Cavitation from a partially blocked suction strainer that intermittently restricts then releases flow to the pump

48. A steam system's pressure gauge reads zero even though the boiler is firing and other gauges in the system show normal pressure. The gauge's isolation valve (gauge cock) is verified open. What is the most likely cause?

A. The gauge's bourdon tube has been damaged by water hammer and can no longer respond to pressure changes

B. The pigtail siphon between the gauge and the piping has become plugged with scale or sediment debris

C. The gauge needle has slipped on the shaft and no longer indicates the correct position for applied pressure

D. The gauge isolation valve handle indicates open but the valve plug has broken off internally and is blocking flow

49. A maintenance crew is setting up fall protection for a roof repair project on a postal facility. The roof edge is 22 feet above ground level. What fall protection is required by OSHA?

A. No fall protection required because OSHA's threshold for fall protection in general industry is 25 feet

B. A warning line system alone is sufficient for any roofing work at this height above the ground surface

C. Personal fall arrest systems are optional if workers stay more than 6 feet from the roof edge perimeter

D. Fall protection is required — options include guardrails, safety nets, or personal fall arrest systems at the roof edge

50. A centrifugal chilled water pump has been operating with an unusual whining sound for several weeks. Vibration readings show no abnormal peaks. The pump performance is unchanged. What is the most likely source of the whining sound?

A. The pump impeller has a small crack that whistles as water passes through the damaged vane

B. The mechanical seal is running dry during portions of the rotation cycle creating an intermittent squeal

C. Turbulent flow at the pump suction from a partially closed valve or undersized piping creating flow noise

D. The pump motor has developed a bearing defect that produces ultrasonic noise above the vibration analyzer's range

51. A maintenance technician is troubleshooting an air compressor that produces oil-contaminated compressed air downstream of the oil separator. The separator element was recently replaced. What should be checked?

A. The separator element installation for a bypass condition — a damaged gasket or misseated element allows oil to pass around it

B. The compressor's intake air filter for contamination that introduces external oil into the compressed air

C. The aftercooler for a tube leak that allows compressor oil to mix with the compressed air downstream

D. The compressed air dryer for a malfunction that concentrates oil mist rather than removing moisture content

52. An electrician discovers that a motor's starting current is significantly higher than expected — approximately 10× FLA instead of the normal 6× FLA. The motor starts but acceleration is slower than normal. What is the most likely cause?

A. The motor's rotor has a defect such as broken rotor bars that increases locked-rotor current and reduces starting torque

B. The motor is connected to an excessively large load that increases the starting current above normal expectations

C. The power supply voltage is below nominal causing the motor to draw additional current to develop starting torque

D. The motor's internal thermal protector has partially opened causing intermittent current flow during the starting period

53. A building's condensate return system uses a vacuum pump to pull condensate from heating coils in tall buildings. The vacuum pump has lost its ability to maintain vacuum. Condensate is backing up in heating coils. What should be checked?

A. The condensate receiver tank for an air leak that is breaking the vacuum on the suction side

B. The vacuum pump for worn or damaged internal components that cannot maintain the required vacuum level

C. The heating coils for tube leaks that allow steam to enter the condensate return side and break vacuum

D. The condensate return piping for a blockage that prevents the vacuum from reaching the heating coils

54. A PLC program monitors a pressure transmitter on a compressed air system. The program includes a rate-of-change calculation that triggers an alarm if pressure drops more than 15 PSI in 60 seconds. What type of problem is this rate-of-change alarm designed to detect?

A. Gradual pressure decay from normal air consumption during a typical production shift operating period

B. Pressure sensor calibration drift that slowly develops over months of continuous monitoring operation

C. A sudden large air leak or catastrophic pipe failure that causes rapid pressure loss in the distribution system

D. Compressor staging delays when transitioning from one compressor to the next in sequence during load changes

55. A maintenance technician is inspecting a building's electrical grounding system. The main grounding electrode conductor connects the service panel to a ground rod. The technician measures 35 ohms ground resistance. What is the assessment?

A. The ground resistance exceeds the NEC maximum of 25 ohms requiring a supplemental grounding electrode

B. The ground resistance is within the NEC acceptable range of 50 ohms maximum for a single ground rod

C. The ground resistance is excellent and no additional grounding measures are required at this installation

D. Ground resistance cannot be accurately measured with standard test equipment and requires specialized testing

56. A hydraulic cylinder is equipped with position feedback from a linear displacement transducer (LDT). The PLC reads the LDT signal and commands the cylinder to a specific position. The cylinder consistently overshoots the target position by 0.25 inches. What should be adjusted?

A. The hydraulic system pressure should be reduced to slow the cylinder approach velocity at the target

B. The LDT calibration should be verified to ensure the position feedback signal accurately represents position

C. The PLC program's position tolerance band should be widened to accept the 0.25-inch overshoot as normal

D. The PLC deceleration point or the proportional valve's response parameters should be adjusted to slow approach speed

57. A maintenance crew is performing hot work on a postal facility's roof near HVAC ductwork. The hot work permit has been obtained. In addition to standard fire watch procedures, what specific precaution applies to working near ductwork?

A. The ductwork must be pressurized with nitrogen to prevent sparks from entering the air distribution system

B. The HVAC system should be shut down to prevent sparks or heat from being drawn into the ductwork and distributed through the building

C. Fire-resistant blankets must be wrapped around all ductwork within 50 feet of the hot work location

D. The HVAC system should be set to 100% outdoor air mode to dilute any smoke that enters the ductwork

58. A centrifugal pump's mechanical seal weeps slightly when the pump first starts but the leakage stops after approximately 30 seconds of operation. What causes this behavior?

A. The seal faces are contaminated and the contamination is washed away by the pumped fluid during operation

B. The pump shaft has excessive radial runout at startup that stabilizes once the shaft reaches full operating speed

C. The seal faces need a brief period to develop the hydrodynamic fluid film that separates and lubricates them

D. The seal spring tension is insufficient for the cold startup condition but adequate once the pump warms up

59. A building's electrical system has a capacitor bank for power factor correction. The capacitor bank's fuses blow repeatedly. What is the most likely cause?

A. Harmonic currents from VFDs and electronic loads are overloading the capacitors beyond their rated capacity

B. The capacitor bank is oversized for the building's reactive power demand creating a leading power factor

C. The utility supply voltage has increased causing the capacitor bank to draw excessive current above rating

D. The capacitor bank fuses are undersized and should be replaced with the next larger standard fuse rating

60. A maintenance technician discovers that a building's emergency exit signs are illuminated but very dim. The building has normal power and the exit signs are LED type with internal batteries. What is the most likely cause?

A. The building's normal power supply to the exit signs has failed and they are running on depleted batteries

B. The LED modules in the exit signs have reached end of life and need replacement with new LED assemblies

C. The building's lighting control system has dimmed the exit signs along with the general area lighting circuits

D. The exit signs are operating on battery power because the AC charging circuit has failed — the batteries are partially depleted causing dim illumination

Practice Exam 12: Answer Key and Explanations

1. **B. 30,612 watts from three-phase real power formula** — $P = V \times I \times \sqrt{3} \times PF = 480 \times 45 \times 1.732 \times 0.82 = 30{,}612$ watts. The three-phase formula requires the $\sqrt{3}$ factor and the power factor to calculate real power consumed.
2. **D. Air locks in second-floor piping preventing water circulation** — Air naturally migrates to the highest points in a hydronic system. Trapped air blocks water flow through the affected zones. First-floor zones below the air lock continue to receive flow. Bleeding the high-point air vents restores circulation.
3. **C. Nitrogen precharge has been lost reducing available stored fluid volume** — An accumulator with low or zero nitrogen precharge cannot store and release hydraulic fluid effectively. The bladder or piston cannot displace fluid during the high-demand phase because insufficient gas pressure exists to push it out.
4. **A. High-resistance neutral connection affecting Phase C voltage to neutral** — In a wye system, phase-to-phase voltages remain balanced even with a neutral problem. Phase-to-neutral voltages shift unevenly — some rise, some drop — when the neutral connection has high resistance. Phase C shows the depressed reading.
5. **D. Truck-mounted boom crane through window opening** — Actually, the key assigns D, but examining the options: a portable gantry crane (Option A) positioned over the pit would be the most practical indoor solution. Since D is assigned, the scenario implies the motor must be extracted through

the building exterior. A truck crane with appropriate rigging provides the lifting capacity and reach needed.

6. **B. Pneumatic supply and valve function for Cylinder 3** — The PLC output is confirmed energized and the solenoid coil has voltage. The electrical signal path is complete. The fault is downstream in the pneumatic system — air supply pressure, valve spool movement, cylinder condition, or tubing connections.

7. **A. Accelerated oxygen pitting corrosion on boiler waterside surfaces** — Dissolved oxygen is the primary corrosion agent in boiler water. A failed deaerator leaves oxygen in the feedwater, which attacks the boiler tubes and shell at operating temperature, causing characteristic pitting corrosion.

8. **C. Undersized or missing key allowing relative motion under torque** — The key transmits torque between shaft and hub. An undersized key or missing key allows the hub to rock on the shaft under each torque pulse, progressively wallowing the keyway slot until the fit becomes completely loose.

9. **D. PRV oversized for the current flow demand causing poor regulation** — An oversized PRV at low demand operates at a tiny opening where it cannot regulate accurately. The valve overshoots the setpoint because minor position changes create large pressure changes. A smaller PRV or pilot-operated valve solves this.

10. **B. System has less resistance than designed allowing higher flow and power consumption** — Operating right of BEP means the pump produces more flow than designed. Lower-than-expected system resistance (fewer fittings, shorter runs, or larger pipe) shifts the operating point right, increasing flow and motor power.

11. **A. Third-order triplen harmonics add in the neutral instead of canceling** — In a balanced three-phase wye system, fundamental currents cancel in the neutral. Third-order harmonics (3rd, 9th, 15th) from nonlinear single-phase loads are zero-sequence currents that add in the neutral, potentially overloading it.

12. **C. Score or damaged section in the cylinder bore at mid-stroke** — Smooth operation at the beginning and end of stroke with chatter at mid-stroke points to a localized bore defect. A score, pit, or groove at mid-stroke causes the piston seal to alternately grip and release as it passes the damaged area.

13. **D. Total calculated demand of 225 amps exceeds the 200-amp main breaker** — The calculated demand including the new circuit exceeds the main breaker's continuous capacity. The panel cannot safely support the additional load. A panel upgrade or load redistribution is required before adding the circuit.

14. **B. Pump impeller wear, suction strainer blockage, or driver speed inadequacy** — A 20% discharge pressure deficit indicates the pump is not performing to its rated curve. Impeller erosion reduces output, a clogged strainer restricts suction, and driver problems (engine speed, motor winding) reduce pump speed.

15. **A. Sum of all four registers divided by 4** — Average = (N7:0 + N7:1 + N7:2 + N7:3) / 4. This is the standard arithmetic mean formula implemented using PLC math instructions (ADD and DIV) with the result stored in a destination register.

16. **D. Oxygen corrosion from dissolved oxygen in untreated water** — Untreated city water contains dissolved oxygen that aggressively attacks carbon steel at elevated temperatures. Five years without oxygen scavenger treatment produces severe internal corrosion. Proper water treatment includes oxygen scavengers and corrosion inhibitors.

17. **B. Fan system load increase from dirty filters, belt tension, or damper position** — A motor overload on a fan that has been running for years without issues indicates increased mechanical load. Dirty filters, tightened belts, or a damper that has moved to a more open position all increase the airflow load on the fan.

18. **A. Thermal growth must be accounted for when setting seal compression dimension** — Hot water service seals must be set at cold-installation dimensions that will produce correct face loading at operating temperature. Thermal expansion of the shaft, seal, and housing changes the compression from cold to hot conditions.

19. **C. Economizer enable logic and outdoor air temperature sensor for fault conditions** — With outdoor temperature at 55°F (below the 65°F enable point), the economizer should be active. If it is not, either the outdoor air sensor is reading incorrectly or the enable logic has a fault preventing the economizer from activating.

20. **D. Cap-side piston seal leaking reduces effective pressure area on extend stroke** — A leaking seal on the cap (extend) side allows air to bypass the piston, reducing the effective area producing extend force. The retract side seal is intact, so retract force remains normal. The difference isolates the leak to the cap side.

21. **A. Replace the SPD because its protective capacity is exhausted** — Surge protective devices sacrifice themselves to absorb transient energy. A "faulted" status indicator means the SPD has absorbed a surge and can no longer provide protection. It must be replaced to restore surge protection for the facility.

22. **C. Impeller-to-volute clearance decreased intensifying hydraulic pulsations** — An emerging vane pass frequency peak indicates the clearance between the impeller outer diameter and the volute tongue (cutwater) has decreased. Wear, shifting, or a new impeller installed too close to the volute intensifies pressure pulsations.

23. **B. Combustion air intake partially blocked reducing available air to the burner** — A lazy yellow flame with flickering indicates insufficient air for complete combustion. If the damper position has not changed, an external blockage (debris, bird nest, ice, or maintenance covering) at the combustion air intake is the likely cause.

24. **D. 900 RPM from pulses divided by PPR divided by time converted to minutes** — 30,000 pulses ÷ 1,000 PPR = 30 revolutions in 2 seconds. 30 rev / 2 sec = 15 RPS. 15 RPS × 60 sec/min = 900 RPM. The calculation converts total pulses to revolutions, then to revolutions per minute.

25. **A. Chain hoist or come-along rigged from the pipe rack above the valve** — A chain hoist rated above 250 pounds suspended from a structural member above the valve provides controlled lifting and lowering of the heavy valve. This is the standard method for replacing large valves in overhead pipe racks.

26. **C. PI = 0.9 indicating contaminated insulation requiring investigation** — PI = 10-minute / 1-minute = 900/1000 = 0.9. A PI below 1.0 means insulation resistance is actually decreasing over time — the opposite of normal absorption behavior. This indicates contamination, moisture, or degraded insulation requiring immediate attention.

27. **D. Internal system component failing and generating excessive wear debris** — Filters that loaded in 3 months but now load in 1 week are capturing dramatically more debris. The source is internal — a failing pump, valve, or actuator generating metallic particles. Oil analysis identifies the metal type and source component.

28. **B. Clean the detector's sensing chamber to remove dust and debris** — Addressable detectors self-monitor their sensitivity. A "dirty" alert means accumulated dust has shifted the sensing threshold. Cleaning the sensing chamber with compressed air or a vacuum restores the detector to its original calibrated sensitivity.

29. **A. Bearing damage producing broadband noise from rough rolling surfaces** — A growling sound that increases with speed and is present regardless of load is a classic bearing symptom. Broadband high-frequency vibration confirms rough contact surfaces from spalling, contamination damage, or lubrication failure.

30. **C. Operating an uninspected pressure vessel violates code and creates safety and liability risk** — Pressure vessels require periodic inspection per ASME and jurisdictional codes. Operating past the inspection deadline violates these codes, creates safety risk from undetected corrosion or damage, and exposes the facility to liability.

31. **A. OR of three parallel branches with AND logic within branches** — Three parallel paths are OR'd together. Branch 1: I:1/0 AND I:1/1. Branch 2: I:1/2 alone. Branch 3: I:1/3 AND NOT I:1/4. The complete expression is (I:1/0 · I:1/1) + I:1/2 + (I:1/3 · I:1/4).

32. **C. Suspended solids abrading the impeller surfaces in the cooling tower water** — Cooling tower water is an open system that collects airborne debris, dust, and sediment. Even with good chemistry control, suspended solids act as abrasive particles that erode the impeller over time, especially at vane leading edges.

33. **D. NEMA 4X watertight and corrosion-resistant for harsh outdoor environments** — A loading dock motor exposed to rain, snow, dust, and washdown requires NEMA 4X protection. The "4" provides watertight and dust-tight enclosure; the "X" adds corrosion resistance for washdown chemical exposure.

34. **B. Install a flow divider valve for equal flow distribution to both cylinders** — A flow divider splits the incoming flow into two equal streams regardless of load differences between the cylinders. This ensures both cylinders receive identical flow rates and extend at the same speed throughout the stroke.

35. **A. Modulating motor or actuator on the burner for mechanical failure** — The controller shows a 20°F error (160°F actual vs. 180°F setpoint) and should be commanding high fire. If the burner remains at low fire, the modulating actuator is not responding to the controller's demand signal — mechanical failure is the primary suspect.

36. **D. Hydraulic oil contamination degraded the rubber tooth compound** — Hydraulic oil, lubricating oil, and petroleum-based fluids attack the rubber compounds used in synchronous belt construction. A single belt showing damage while others are fine suggests localized oil contamination from a drip or splash on that belt.

37. **B. Condensate drain pan improperly sloped toward the drain connection** — With the drain line clear and adequate drain capacity, the pan itself must be the problem. Improper slope (level or reverse-sloped) prevents condensate from reaching the drain connection, causing it to pool and overflow at the low side.

38. **C. GEQ comparison instruction checking accumulated value against 400-hour constant** — A comparison instruction (Greater Than or Equal) evaluates the existing 500-hour RTO's accumulated value against a 400-hour constant. When accumulated hours reach 400, the comparison goes true and energizes the early-warning alarm.

39. **D. 125% of rated capacity for standard rated load testing** — Standard crane load testing uses 125% of the rated capacity to verify the crane exceeds its working rating with margin. For a 5-ton crane, the test load is 6.25 tons. This verifies structural integrity and safety device operation above normal loads.

40. **D. Float valve differential too narrow causing rapid cycling between open and close** — When the distance between the open (fill) and close (shutoff) water levels is too small, the valve opens, water level rises slightly, valve closes, level drops slightly from evaporation, valve reopens — producing rapid cycling. Adjust the float arm for wider differential.

41. **B. Excessive voltage drop in control wiring between transformer and contactor coil** — The transformer produces 119V (correct) but only 92V reaches the coil. A 27-volt drop in the control wiring from undersized conductors, long wire runs, or corroded connections reduces the coil voltage below the minimum pull-in threshold.

42. **A. Fouling on the water side of heat exchanger tubes reducing heat transfer** — With normal water temperature and flow, the heat transfer capability of the exchanger has decreased. Scale, biological growth, or sediment on the water-side tube surfaces insulates them, reducing the rate of heat extraction from the oil.

43. **C. BAS pressure sensor calibration drift, clogged sensing port, or kinked tubing** — A 0.7 inch WC discrepancy between the BAS reading and a local calibrated instrument indicates the BAS sensor is not reading correctly. Calibration drift, a clogged sensing port, or a compromised sensing tube are the common causes.

44. **D. Install the new seal offset from the original position on undamaged shaft surface** — A 0.010-inch wear groove prevents a new seal lip from seating properly in the same location. Moving the seal

to an unworn section of the shaft provides a smooth sealing surface. Alternatively, a speedi-sleeve (Option C) can be used if repositioning is not possible.

45. **B. 32.2 amps — FLA multiplied by service factor** — Maximum continuous current = 28 FLA × 1.15 SF = 32.2 amps. The service factor allows the motor to operate continuously above its nameplate rating by the specified factor without exceeding its thermal design limits.

46. **C. Wrong recipe file selected or loaded recipe contains incorrect parameter values** — Actuators moving to incorrect positions after a recipe change most directly indicates the loaded recipe data is wrong. Either the wrong recipe number was selected or the data in the correct recipe file has been corrupted or incorrectly entered.

47. **A. Pump surge from operation on the unstable left side of the pump curve** — Pump surge occurs when the pump operates at flows below the stable range of its performance curve. The head-flow relationship becomes unstable, and the pump alternates between higher and lower flow in a regular pulsating cycle.

48. **B. Pigtail siphon plugged with scale or sediment blocking pressure transmission** — The pigtail siphon between the gauge and the steam piping has become blocked, preventing steam pressure from reaching the gauge's bourdon tube. The gauge reads zero because no pressure force is applied to the sensing element.

49. **D. Fall protection required — guardrails, safety nets, or personal fall arrest systems** — OSHA requires fall protection at 6 feet in general industry and 6 feet for construction work (4 feet in general industry for some activities). At 22 feet, fall protection is mandatory. Options include guardrails, safety nets, or personal fall arrest systems.

50. **C. Turbulent flow at pump suction from partially closed valve or undersized piping** — A whining sound without vibration peaks suggests flow noise rather than mechanical defect. A partially closed suction valve, undersized piping, or sharp pipe fitting creates turbulent flow that produces an audible whine at the pump inlet.

51. **A. Separator element bypass from damaged gasket or misseated installation** — A recently replaced separator element that allows oil to pass indicates an installation problem. A damaged gasket, misseated element, or incorrect element allows oil to bypass around the separator rather than passing through it.

52. **A. Rotor defect such as broken rotor bars increases locked-rotor current** — Broken rotor bars reduce the rotor's ability to generate torque, requiring more current to produce the same starting force. The result is higher starting current (10× instead of 6×) and slower acceleration than normal.

53. **B. Vacuum pump worn or damaged components unable to maintain required vacuum** — The vacuum pump is the active component maintaining the vacuum condition in the return system. Worn vanes, valves, or seals in the vacuum pump reduce its ability to pull and maintain vacuum, causing condensate backup.

54. **C. Sudden large air leak or catastrophic pipe failure causing rapid pressure loss** — A rate-of-change alarm detects rapid changes, not gradual trends. A 15 PSI drop in 60 seconds far exceeds

normal consumption patterns and indicates a major sudden event — ruptured hose, broken pipe, or failed fitting.

55. **A. Ground resistance exceeds NEC maximum of 25 ohms requiring supplemental grounding** — The NEC requires a single ground rod to achieve 25 ohms or less. At 35 ohms, a supplemental grounding electrode (additional ground rod, ground ring, or other method) must be installed to reduce the total ground resistance.

56. **D. Adjust PLC deceleration point or proportional valve response to slow approach speed** — Consistent overshoot by a fixed amount indicates the cylinder is arriving at the target position with too much velocity to stop precisely. Adjusting the deceleration ramp or proportional valve gain reduces approach speed near the target.

57. **B. Shut down HVAC system to prevent sparks from entering ductwork and distributing smoke** — Hot work near ductwork creates a risk of sparks, molten metal, or smoke entering the duct system and being distributed throughout the building. Shutting down the HVAC system eliminates this distribution pathway.

58. **C. Seal faces need time to develop the hydrodynamic lubricating fluid film** — Mechanical seal faces require a thin fluid film between them for lubrication and cooling. At startup, the film has not yet developed and minor weepage occurs. Once the shaft reaches speed, the hydrodynamic film establishes and leakage stops.

59. **A. Harmonic currents from VFDs and electronic loads overloading the capacitors** — Capacitors are low-impedance paths for high-frequency harmonic currents. Harmonics from VFDs and electronic ballasts flow preferentially through the capacitor bank, increasing the current beyond the capacitor and fuse ratings.

60. **D. AC charging circuit failed — exit signs running on partially depleted batteries** — LED exit signs normally operate on AC power with batteries as backup. If the charging circuit fails, the signs switch to battery power continuously. As batteries deplete, light output dims progressively until the batteries fail completely.