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ISA

ISA CCST (Level 1)

Certified Control Systems Technician

Question: 1090

While auditing a temperature control loop, the technician identifies a consistent high reading compared to the standard reference. What instrument error explains this bias?

A. Calibration drift
B. Zero offset
C. Span error
D. Hysteresis

Answer: B

Explanation: Zero offset is a constant error that shifts all readings in one direction, causing consistent bias. This can result from improper zero setting or sensor degradation.

Question: 1091

A nuclear power plant's feedwater temperature loop employs a Type K thermocouple in a thermowell, calibrated quarterly using a Fluke 9142 furnace at 300°C. Recent data shows 2°C cold junction error during ramp-up. Per ISA-MC96.1-2026 updates, what is the corrective action involving the reference junction simulator?

A. Verify CJC accuracy with precision RTD and apply software offset
B. Replace thermowell and recalibrate in ice bath only
C. Perform fixed-point calibration at copper-freezing point
D. Upgrade to wireless transmitter with auto-CJC compensation

Answer: A

Explanation: ISA-MC96.1-2026 mandates verifying cold junction compensation by comparing against a traceable RTD in the same bath, then programming the offset in the transmitter; this addresses transient errors without hardware changes, maintaining ±0.5°C accuracy in dynamic processes.

Question: 1092

A technician in a wastewater treatment plant's sludge digester area (Class I, Division 2, Group D for methane/H_2S, SDS: H_2S IDLH 100 ppm) must calibrate a DO probe. What permit/tag sequence and PPE counters the SDS-noted synergistic toxicity?

A. General calibration tag, safety glasses for splashes
B. Toxic gas permit with H2S monitors, Level B with combo cartridges, and "Poison Gas - SCBA Required" tags
C. Confined space permit only, dust masks for odors
D. LOTO tag on pumps, rubber boots for wet floors

Answer: B

Explanation: Synergistic methane/H2S toxicity in Division 2 requires dedicated permits with real-time monitoring, as SDS IDLH indicates rapid incapacitation. Level B with specific cartridges protects against both, per ANSI/ISA-60079-10-1 and OSHA 1910.146 confined spaces.

Question: 1093

In a poorly documented control system, how would ISO 9000 recommend improving process consistency?

A. Allow technicians to document only key steps
B. Develop and implement standardized operating procedures with clear documentation
C. Use verbal instructions to save time
D. Avoid documentation changes until failures occur

Answer: B

Explanation: ISO 9000 focuses on consistent, documented processes to reduce variability and ensure quality.

Question: 1094

A field device is showing erratic signal during process control testing. What initial step should a CCST take based on troubleshooting protocols?

A. Calibrate the device immediately
B. Replace the device on suspected failure
C. Adjust controller setpoint
D. Check wiring and power supply integrity

Answer: D

Explanation: Checking wiring and power supply is the fundamental initial diagnostic step to eliminate common failure causes before other troubleshooting actions.

Question: 1095

During performance qualification of a vaccine storage freezer, the reverse-acting temperature PID shows slow recovery (15 min) from door openings. Using AMIGO tuning rules for $\tau/\theta=5$, what Kc formula yields balanced settings if Kp=2?

A. $K_c = (\tau/\theta) / (4 K_p)$
B. $K_c = 0.5 / K_p * (\tau/\theta)$
C. $K_c = (1/K_p) * (\tau/\theta +1)/ (1.3 + 0.68/\sqrt{(\tau/\theta)}) \approx 0.58$
D. $K_c = 2 / (\tau/\theta * K_p)$

Answer: C

Explanation: AMIGO rules for PI: $K_c = (1/K_p) * ((\tau/\theta +1) / (1.3 + 0.68 / \mathrm{sqrt}(\tau/\theta))) \approx 0.58$ for $\tau/\theta=5$, providing robust recovery in reverse-acting temperature control without excessive aggressiveness for door disturbances.

Question: 1096

During a fieldbus system configuration, an engineer must assign device addresses. What rule should be followed to avoid network conflicts?

A. Addresses are only relevant to the control system and do not affect network communication
B. Devices can share the same address if they perform different functions
C. Use the default device address assigned by the manufacturer without modification
D. Each device must have a unique address within the fieldbus segment

Answer: D

Explanation: Unique addresses are mandatory for proper fieldbus communication, ensuring the master can identify and communicate with each device individually.

Question: 1097

In a control system using multiple vendors for instruments, what does ISO 9000 require to maintain quality consistency?

A. Using new vendors without qualification to reduce downtime
B. Accepting any vendor with low price regardless of quality
C. Informal communication with vendors without contracts
D. Evaluation and selection of vendors based on documented criteria

Answer: D

Explanation: ISO 9000 requires organizations to evaluate and select suppliers through documented criteria to ensure purchased products meet quality requirements, maintaining system reliability.

Question: 1098

An ultrasonic level transmitter’s output drifts slowly over weeks in a storage tank with foam on the surface. What is the best corrective action?

A. Increase the gain setting of the ultrasonic transmitter
B. Use a radar level transmitter to eliminate foam interference
C. Clean the tank surface daily to remove foam
D. Cover the tank to prevent foam formation

Answer: B

Explanation: Foam causes signal scattering and reflection, leading to drifting measurements. A radar level transmitter uses microwave pulses less affected by foam and is a better solution than adjusting the ultrasonic device, cleaning, or covering the tank.

Question: 1099

In troubleshooting a 10 VDC excitation RTD circuit showing erratic readings, what procedure uses a precision decade box per ISA MC1.1-2026?

A. Set to 100 Ω and measure voltage drop across leads
B. Cycle to 138.5 Ω (100°C) and monitor for 0.385 Ω/°C
C. Inject 1 mA and verify resistance with Kelvin clips
D. Parallel 1000 Ω and check for half-scale deflection

Answer: B

Explanation: ISA MC1.1-2026 specifies simulating operating resistance (e.g., 138.5 Ω for Pt100 at 100°C) with a decade box and verifying linear voltage response, confirming lead wire integrity and excitation stability.

Question: 1100

In a semiconductor wafer etching chamber, the etch rate controller (via gas flow) shows integral windup during vacuum pump trips, causing 15-minute recovery. Open-loop gain 3.2, dead time 8 seconds. For tuning objective of yield maximization by rapid disturbance rejection, what closed-loop method incorporates anti-reset windup?

A. Lambda tuning with windup limit at 80% OP saturation
B. Ziegler-Nichols with derivative on error only
C. Trial-and-error starting from P-only at critical gain
D. Cohen-Coon with integral tracking enabled

Answer: A

Explanation: Pump trips saturate OP, winding integral; lambda tuning's specified response (e.g., 12 seconds) with anti-reset windup clamping at 80% prevents excess accumulation, ensuring quick recovery.

This balances speed and stability in delicate etching, where delays degrade wafer uniformity.

Question: 1101

During preventive maintenance of final control elements, what adjustment improves valve packing life?

A. Correct torque application on packing gland nuts to avoid over-tightening
B. Increasing air supply pressure to the actuator
C. Shortening the valve stem travel to reduce movement
D. Reducing transmitter calibration frequency

Answer: A

Explanation: Proper packing gland torque avoids leaks without causing excessive stem friction, thereby extending packing life.

Question: 1102

An operator is using a PID controller to maintain pressure in a tank. If the integral action is too aggressive, what issue might arise?

A. Oscillations
B. Steady-state error
C. Slow response
D. No effect

Answer: A

Explanation: Aggressive integral action can lead to overshoot and oscillations as the controller may overcompensate for the error.

Question: 1103

What is an appropriate function of a loop calibrator when calibrating a 4-20 mA pressure transmitter?

A. Source milliamp signals and measure loop current for verification
B. Provide voltage excitation only
C. Measure sensor capacitance
D. Adjust sensor resistance

Answer: A

Explanation: A loop calibrator sources precise current signals and measures loop current, facilitating transmitter calibration and diagnostics.

Question: 1104

While calibrating a flow transmitter, the technician applies a known input and notes the output differs by a constant amount at all input levels. What type of error is this?

A. Deadband
B. Hysteresis
C. Span error
D. Offset error

Answer: D

Explanation: Offset error is a constant difference between the measured output and true value across the measuring range. It shifts the entire output up or down but does not change sensitivity.

Question: 1105

A wastewater lift station's PLC controls pump alternation via ladder logic, but a missing accumulator reset causes uneven runtime. What basic PLC function initializes cycle counters on power-up?

A. Continuous accumulation without reset
B. Ignore startup conditions
C. First-scan bit to load preset values
D. Manual override only

Answer: C

Explanation: The first-scan bit in basic PLC ladder logic initializes accumulators by loading presets on power-up, ensuring even pump runtime in alternation controls.

Question: 1106

You are assigned to verify calibration steps for a pressure transmitter. According to ISO 9000 standards, which control activity ensures that the calibration process complies with documented procedures?

A. Corrective action
B. Process validation
C. Preventive maintenance
D. Internal audit

Answer: D

Explanation: Internal audit is the control activity that verifies compliance of processes, such as calibration, with documented procedures according to ISO 9000, ensuring quality management system effectiveness.

Question: 1107

What is the best practice when installing a pressure transmitter on a steam line to avoid errors from condensate buildup?

A. Install the transmitter directly on the high point of the pipe
B. Include a siphon loop to protect the transmitter from live steam
C. Use rigid tubing without a drain valve for direct sensing
D. Mount the transmitter vertically with the sensor diaphragm facing up

Answer: B

Explanation: A siphon loop traps condensate and prevents live steam from contacting the transmitter diaphragm, protecting it from damage and improving measurement accuracy in steam service.

Question: 1108

During a brewery expansion, the instrument list for the bottling line omits calibration frequencies, leading to compliance lapses. How should instrument lists categorize devices by calibration type?

A. Alphabetically by vendor
B. By measured variable and service class
C. Randomly for quick reference
D. By installation date only

Answer: B

Explanation: Instrument lists categorize by measured variable and service class to specify calibration frequencies, ensuring compliance in lines like bottling.

Question: 1109

A flow transmitter's accuracy is specified as ±0.5%. During calibration, it consistently reads 0.6% higher than the applied flow. How should this be addressed?

A. Adjust zero only
B. Recalibrate reproducibility
C. Accept the error as within repeatability range
D. Adjust span and zero to bring error within tolerance

Answer: D

Explanation: Accuracy requires both zero and span calibration to bring the instrument readings within specified tolerance.

Question: 1110

In a scenario where a pneumatic rotary vane actuator on a damper valve in a flue gas desulfurization unit shows sluggish response during ramp-up from 0-50% in under 3 seconds, positioner diagnostics report 5% hysteresis. Air supply is clean at 20 psig, but vane seals exhibit 0.2 mm wear per borescope inspection. What preventive maintenance protocol should the CCST establish to prevent recurrence in similar actuators?

A. Quarterly seal replacement using EPDM compounds rated for SO_2 exposure
B. Monthly stroke timing tests with automated logging to DCS for trend analysis
C. Annual torque verification using a digital dynamometer at multiple positions
D. Biannual alignment checks of the vane shaft with laser interferometry

Answer: B

Explanation: Worn vane seals in rotary actuators increase internal leakage, causing hysteresis and slow response in damper controls. Time-based stroke tests, integrated with DCS trending per ISO 14224, detect degradation early, allowing seal adjustments before impacting emission compliance, as a cost-effective preventive strategy over full replacements.

Question: 1111

A technician calibrates a 0-10 VDC analog output card for a DCS using a high-impedance voltmeter. At 50% output (5 V), it reads 4.85 V. What adjustment per ISA-50.00.01-2024 involves the card's DIP switches?

A. Enable 250 Ω shunt for current-mode simulation
B. Activate pull-up resistor to 10 kΩ
C. Set to 4-wire mode for voltage drop compensation
D. Toggle gain pot to 50% and re-zero offset

Answer: D

Explanation: ISA-50.00.01-2024 requires accessing internal gain/offset trimpots via DIP configuration, adjusting to match 5 V at mid-scale command; this corrects DAC non-linearity, ensuring 0.1% full-scale accuracy.

Question: 1112

A temperature controller with on-off action shows repeated short cycling and excessive wear. What is the best corrective step?

A. Shorten integral time
B. Increase proportional gain
C. Increase deadband/differential gap
D. Enable derivative action

Answer: C

Explanation: Increasing deadband reduces cycling frequency and prevents excessive actuator wear.