Please note that some references to protocol, publications, performance data etc. are fictitious in this EXAMPLE. Please use your own DATA for your IQCP.

The following represents one example of how you might organize your IQCP for QC of a commercial cartridge-based molecular test system for detection of a single or multiple targets. This is based in part on information included in CLSI EP23-A "Laboratory Quality Control Based on Risk Management" and CDC/CMS "Developing an IQCP, A Step-by-Step Guide". Laboratories should modify this template and examples to support their practice. A unique IQCP should be implemented for each separate method or system.

A practical strategy would be to review this example together with materials provided by your manufacturer, your accreditation organization, and CMS when developing an IQCP for QC for a commercial cartridge-based molecular test system.

IQCP for QC of *molecular test system* XYZ

Facility: ABC Hospital
Test System: *Cartridge-based molecular test system* XYZ (targets and specimen types)
Test System Primary SOPs include: #2.1.1 "Processing Microbiological Specimens" #5.1.7 "XYZ System for Molecular Detection of Microbe Q"
Historical Quality Review: CLIA '88 regulations require performing at least positive and negative QC for each test on each day of use. If an internal quality control process (e.g., electronic/procedural/built-in) is used instead of external control material to meet daily quality control requirements, the laboratory must have an individualized quality control plan (IQCP) approved by the laboratory director. This laboratory has been using the XYZ molecular test to detect Pathogen Q from XX to XX dates (this time period recommended to be greater than 30 d) without any significant QC problems. Issues related to QC performance have included XX (e.g., list examples such as contamination or deterioration of QC materials). Processes to mitigate patient reporting errors based on use of unacceptable specimens or suboptimal test reagents or conditions are addressed in this IQCP.

Information Used to Conduct Risk Assessment
[Below are example metrics a lab may consider when performing risk assessment. Labs should determine which metrics are appropriate for individualized risk assessment.]

Regulatory and Accreditation Requirements:
Checklist from Accreditation Agency: Checklist items _____
Method Verification: Instrument received and test system verification completed in year _____. Decreased QC frequency consistent with manufacturer's recommendations was verified in year _____ Documented QC performance for 30 successive days filed in _____.

Testing personnel:
Training of Personnel: Completion of training documented in_____. XX new technologists were trained during the assessment period [XX-XX].
Competency Assessment: New employees 6 months and 12 months after initial training and annually thereafter. Documentation filed in_____. Competency from XX new personnel occurred after 6 months, during the assessment period [XX-XX]. Annual competency from XX personnel occurred during the assessment period [XX-XX]. All trained technologists passed competency during the assessment period [XX-XX].
Proficiency Testing: Rotate personnel; all personnel review results. Proficiency testing records filed in_____. No inaccurate results were obtained during proficiency testing, during the assessment period [XX-XX]. [Describe inaccurate results and follow-up if relevant or refer to documentation.] Name of survey listed
Specimen:
Summary of Testing: During the assessment period (XX to XX dates), testing was performed on # positive and # negative specimens
Number of repeat tests required for initially indeterminate or invalid results
Indeterminate results after repeats occurred in __%__of tests.
Number of reports corrected due to errors was #
Environment:
Rooms: • Humidity, electric, temperature and ventilation requirements according to the instrument manual have been reviewed.
Test System and Reagents Information:
Manufacturer: • Package insert contains system performance data and describes testing principle and procedure, QC recommendations, and limitations. Package insert (PI) is located _____. • Manufacturer's alerts and bulletins are located_____. Detail testing affected by manufacturer's alert and bulletins. • Operator's manual including troubleshooting guide is located_____.
Scientific Publications Used During Collection of Information for Risk Assessment: 1. CAP Microbiology Checklist 2020 Edition, MIC.65200 2. CLSI. *Establishing Molecular Testing in Clinical Laboratories*. CLSI Document MM19-A. Wayne, PA: Clinical and Laboratory Standards Institute: 2015. 3. CLSI. *Laboratory Quality Control Based on Risk Management*. 1st ed. CLSI Document EP23. Wayne, PA: Clinical and Laboratory Standards Institute: 2011. 4. CDC: Individualized Quality Control Plan (IQCP), https://www.cdc.gov/labquality/iqcp.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fclia%2Fiqcp.html

5. CMS: Individualized Quality Control Plan (IQCP),https://www.cms.gov/Regulations-and-Guidance/Legislation/CLIA/Individualized_Quality_Control_Plan_IQCP

6. Burd EM. Validation of laboratory-developed molecular assays for infectious diseases. Clin Microbiol Rev. 2010 Jul;23(3):550-76. doi: 10.1128/CMR.00074-09. PMID: 20610823; PMCID: PMC2901657.

Summary of in-house data from QC testing:

QC testing was performed according to SOP _____.

Review of QC records for the past 12 months (XX to XX dates) that contained approximately XX results demonstrated:

- % occurrence of random QC errors that corrected upon repeat testing.

Summary of in-house data from routine instrument performance checks:

Instrument checks were performed according to SOP _____.

Review of instrument QC records for the past 12 months (XX to XX dates) that contained approximately XX routine checks of instrument XYZ and 1 report following scheduled maintenance performed by the company's service engineer revealed no instrument performance problems that would impact patient results.

Summary of corrected reports and physician complaints:

Documentation located _____.

Review of corrected reports for the last 12 months (XX to XX dates) indicated:

No corrected reports from instrument or assay malfunction. No delays in test turn-around-time (TAT) due to QC issues. No episodes of instrument or reagent/cartridge contamination. There were no physician complaints as a result of unsatisfactory test performance.

Risk Assessment and Determination of Risk Level

Frequency of error occurrence:	**Severity of harm to patient:**
Unlikely (once every 2-3 years)	Negligible (temporary discomfort)
Occasional (once per year)	Minor (temporary injury; not requiring medical intervention)
Probable (once per month)	Serious (impairment requiring medical intervention)
Frequent (once a week)	Critical (life threatening consequences)

Risk Level:

Risk level for any Risk Factor that is "Not Acceptable" must be addressed in the IQCP.

Risk level for any Risk Factor that is "Acceptable" may be included in the IQCP at the discretion of the Laboratory Director.

Risk Acceptability Matrix

Freq./Severity of Harm	Negligible	Minor	Serious	Critical
Frequent	Not Acceptable	Not Acceptable	Not Acceptable	Not Acceptable
Probable	Acceptable	Not Acceptable	Not Acceptable	Not Acceptable
Occasional	Acceptable	Acceptable	Acceptable	Not Acceptable
Unlikely	Acceptable	Acceptable	Acceptable	Acceptable

Risk Acceptability Assignment - Below is one example of a risk assessment determination. Laboratories should review their own data and subsequently determine the risk levels for their particular laboratories.

Risk Factor (Possible Sources of Error)	Frequency of error occurrence	Severity of harm to patient	Risk Level
Preanalytical			
Specimen (Primary):			
Patient identification	Probable	Serious	Not Acceptable
Collection/container/volume	Frequent	Negligible	Not Acceptable
Integrity	Frequent	Negligible	Not Acceptable
Transport	Frequent	Negligible	Not Acceptable
Storage	Probable	Negligible	Acceptable
Specimen (Organism, if testing is performed from culture):			
Sample Stability	Frequent	Minor	Acceptable
Inappropriate Transport Conditions/Media	Unlikely	Minor	Acceptable
Improper or insufficient sample collection.	Frequent	Minor	Not Acceptable
Sample Stability	Frequent	Minor	Not Acceptable
Analytical			
Testing Personnel:			
Training	Unlikely	Serious	Acceptable
Competency	Unlikely	Serious	Acceptable
Experience	Occasional	Serious	Acceptable
Proficiency Testing	Unlikely	Negligible	Acceptable
Staffing	Occasional	Minor	Acceptable
Reagents:			
Shipping/receiving	Occasional	Minor	Acceptable
Storage	Unlikely	Serious	Acceptable
Expiration dates	Unlikely	Minor	Acceptable
Preparation/use	Occasional	Minor	Acceptable
QC material storage/prep	Occasional	Negligible	Acceptable
PCR Template/Amplicon Contamination	Unlikely	Serious	Acceptable
Environment:			
Temperature/airflow/humidity/ ventilation	Occasional	Negligible	Acceptable
Utilities	Occasional	Minor	Acceptable
Space	Unlikely	Negligible	Acceptable
Noise/vibration	Unlikely	Negligible	Acceptable
Environmental Contamination (Quality Failure)	Occasional	Serious	Acceptable
Test System:			
Extraction or other failures (e.g., early termination of run, failed electronic controls, other system type errors)	Occasional	Minor	Acceptable
Cross contamination during sample prep	Probable	Minor	Unacceptable

Change in pathogen target sequences	Unlikely	Serious	Acceptable
Transmission of results to LIS	Unlikely	Serious	Acceptable
No results (Due to amplification/method failure)	Probable	Serious	Unacceptable
Postanalytical			
Test Results:			
Test reporting delays	Occasional	Minor	Acceptable
Transmission of results to Electronic Health Record	Occasional	Serious	Acceptable
Reported results errors (e.g., erroneous results reported or lack of review of indeterminate results before releasing results)	Frequent	Serious	Not Acceptable
Negative clinician feedback (e.g. complaints/suggestions regarding delayed results and potential erroneous results)	Unlikely	Serious	Acceptable

Risk Assessment

Possible Sources of Error		How can identified sources of error be reduced?
Risk Factor	**Possible Error**	
Preanalytical		

1A: Specimen - Biological	• Improper specimen procurement/ handling/processing	• Adhere to procedures in SOP #XX that addresses patient identification and specimen collection, labeling, transport, storage and remedial actions to control improperly handled specimens or delayed specimens.
		• Annually review representative specimen processing errors (N=10 to 15) with all staff involved with patient specimens.
		• During initial training and competency assessment, emphasize:
		  • Proper specimen handling/processing is the most critical part of any test
		  • Failure to set up test properly may result in delayed or inaccurate results

Patient/specimen identification		See above (Specimen)
Collection/container/ volume		See above (Specimen)
Integrity		See above (Specimen)
Transport		See above (Specimen)
Storage		See above (Specimen)
Clinical relevancy	• Clinically irrelevant testing of specimen source • Physicians may request testing of specimen sources that are not clinically relevant; requests may be inappropriate and results misleading	• SOP xxx describes routinely acceptable specimen types for the molecular assay. • Physicians can request esoteric testing in select patients; comment added to final report indicating name of physician initiating special request. Supervisor/director discusses with requesting physician those requests that may be inappropriate.
Sample Stability or Storage Conditions	• Specimens that are not transported in the appropriate transport media or transported to the laboratory	During initial training and competency assessment, emphasize:

	promptly can lead to false negative results. • Nucleic acids can degrade rapidly if storage conditions are not appropriate.	• Check for use of approved transport media and collection times of raw or preserved specimens
Improper or insufficient sample collection	• Insufficient sample volumes or an improperly collected specimen can increase the risk of a false negative result.	• Minimum specimen volume requirements are defined in SOP XX. Recollection is recommended and test orders are canceled if sufficient volume is not obtained.
Analytical		
2: Testing Personnel	• Incompletely trained • Unaware of updated protocols	During initial training and competency assessment, emphasize: • Key aspects of the test procedure and reporting • Emphasize sterile technique and proper handling of specimens and reagents for molecular testing. • Supervisor annual review of any changes in microbial identification recommendations by accrediting agencies or manufacturer
Training		See above (Testing Personnel)
Competency		See above (Testing Personnel)
Experience		See above (Testing Personnel)
Proficiency Testing		• All staff read (and sign off) on proficiency testing (PT) sample critiques
Staffing	Inadequate to perform testing without errors	• Supervisor to annually review appropriate staffing needs for identification testing and schedule staff accordingly
3: Reagents		During initial training and competency assessment, emphasize standard rules to always: • Take responsibility for reagents/supplies (all staff) • Maintain reagents at proper storage conditions • Check expiration dates • Perform required QC

Receiving/storage	• Incorrect ordering • Depleted reagent supply • Reagent integrity compromised	• Designated staff member(s) assigned to inventory (order/receipt) materials to ensure supply is properly maintained and testing materials are handled appropriately on receipt
Expiration dates		• See above (Reagents)
Preparation/use	• Use of incorrect cartridge for analyte	• Use color codes / labels on boxes of cartridges
QC storage/prep	• QC out of control	During initial training and competency assessment, emphasize: • Proper storage of QC materials • Potential sources of QC failures • QC troubleshooting • QC frequency • QA measures to ensure reliable reporting of patient results
PCR Template/Amplicon Contamination	• Amplicon contamination of environment through damaged kit or cartridge	• Inspection of kit or testing cartridge before and after use to examine visually for tears or loss of integrity
4: Environment	• Erroneous results obtained and reported (ancillary equipment failure leading to erroneous results; pipettors, etc.) • Indicators of clean environment failed (e.g., positive environmental control test through monthly swipe testing)	During initial training and competency assessment, emphasize standard rules for: • Take responsibility for any possible instrument/ environmental problem (out of the ordinary observation) (all staff) • Equipment maintenance • Temperature recording (done automatically with continuous monitoring device) • Electrical supply • Best practices for maintaining clean environment to emphasize change of gloves before set-up, dedicated set-up area for molecular testing, regular intervals of cleaning for decontamination, etc.
Temperature/airflow/humidity /ventilation		See above (Environment)

Utilities		See above (Environment)
Space		N/A (sufficient space available)
Noise/vibration		See above (Environment)
5: Test System		During initial training and competency assessment, emphasize standard rules for: • Take responsibility for any possible instrument/test system problem (out of the ordinary observation) (staff trained on test system)
Mechanical/electronic/malfunction	• Results not reported (e.g., instrument malfunction and/or aborted test)	• Perform preventive maintenance according to recommended schedule • During initial training and competency assessment, emphasize: • How to avoid jams • Process for repeat testing if an instrument error occurs to avoid significant result delay • Troubleshooting and communication with manufacturer technical services
Software	• Erroneous results reported	• Daily supervisor (or supervisor designee) review of reported results • Software flags unusual results requiring supervisor review • During initial training and competency assessment, emphasize: • Results requiring follow up action (e.g., confirmation by repeat testing) • Atypical results requiring consultation with supervisor
Pathogen target sequence mutated	• Failure to detect target organism if present	• Maintain awareness of literature on pathogen. • Stay informed of manufacturer updates and bulletins regarding assay post-market performance
Transmission of results to LIS	• Incorrect transmission of results • Delay in transmission of results	• Daily supervisor (or supervisor designee) review of reported results • Annual check of test system- LIS computer interface

Postanalytical		
6: Test Results		• Supervisor maintains summary of incorrect results released and meets with laboratory director monthly to review this summary • During initial training and competency assessment, emphasize timely reporting of both preliminary results and final reports
Test reporting delays	• Results delayed beyond that expected for organism type	See above (Test Results)
Transmission of results to Electronic Health Record	• Incorrect transmission of results • Delay in transmission of results	See above (Test Results)
Review reported results	• Erroneous results reported	See above (Test Results)
Clinician feedback	• Complaints/suggestions regarding delayed or potential erroneous results	See above (Test Results) • Incorporate suggestions into QA plan, as appropriate.

Final QCP for *Cartridge based molecular test system* XYZ
Based on our risk assessment and Quality Assessment, the QCP consists of following the instructions that are provided in explicit detail in SOP #XX "XYZ System for Molecular Detection of Microbe Q". Positive and negative QC testing will be performed at least monthly on each instrument.
Testing of appropriate QC materials on each new lot/shipment of cartridges before or concurrently with placing these materials into use for testing patient specimens.
Testing of appropriate QC materials on each cartridge type after major system maintenance or software upgrade before or concurrently with placing the equipment back into service.
Recording and evaluating QC results according to QC acceptability criteria as defined in #XX "XYZ System for Molecular Detection of Microbe Q". Any abnormal result is immediately investigated.

Quality Assessment: Ongoing Monitoring for QCP Effectiveness (Performed by supervisor and/or section head)

Reasons for QC failures, PT failures, and patient result reporting errors will be examined and addressed as needed in a new/updated risk assessment: 1) Has a new risk factor been identified? 2) Does this change the frequency of risk? 3) Does the risk factor change the potential severity of harm to patient?		
Daily review of patient results for reporting errors and clinician complaints. Take corrective action and revise QCP as needed.		
Monthly review of QC results by supervisor or section head. Take corrective action and revise QCP when unexpected QC failures indicate adjustment to the QC plan defined herein is needed.		
Regular review of Proficiency Testing results. Take corrective action and revise QCP if necessary when PT results are not acceptable.		
Monthly review of all equipment maintenance/monitoring logs according to standard laboratory protocols. Take corrective action and revise QCP as needed.		
Daily monitoring and recording of instrument (room) and cartridge storage temperatures. Any out of range result is investigated and reported to the supervisor.		
Regular training and competency assessment according to standard laboratory protocols. Modify training and revise QCP as needed.		
Continual participation in this institution's quality program that addresses specimen handling and erroneous specimen labeling. Take corrective action and revise QCP as needed.		
This QCP has been reviewed and is approved by the laboratory director (as named on the CLIA license).	**Signature**	**Date**