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HOW AGILENT CROSSLAB COMPLIANCE SERVICES INTEGRATE WITH QUALITY SYSTEMS AND REGULATIONS

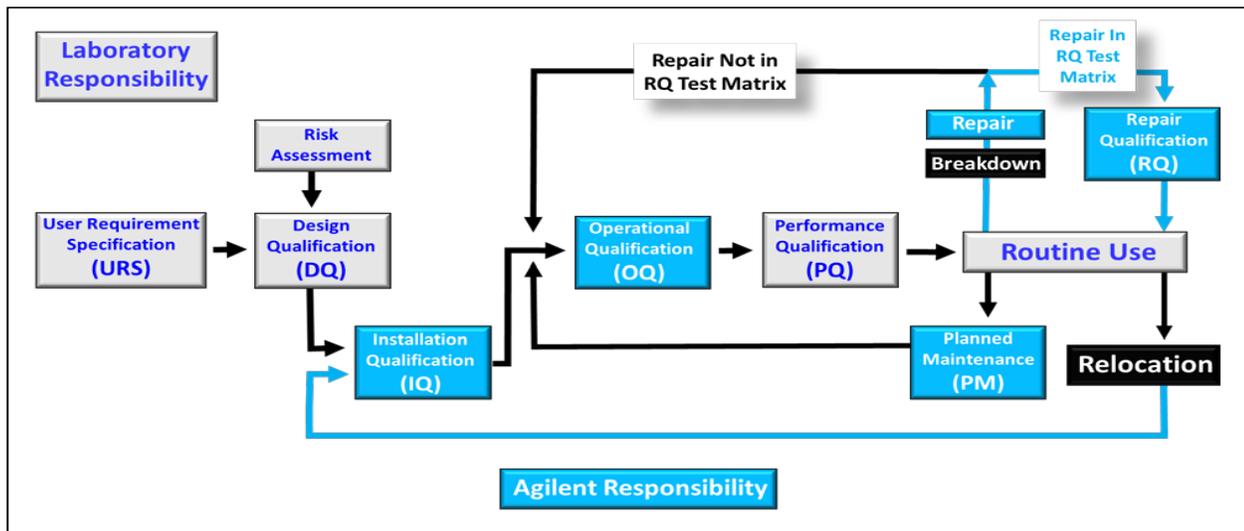
Agilent CrossLab Compliance Services



Agilent CrossLab Compliance Services

Agilent CrossLab Compliance Services are designed to seamlessly integrate with traditional quality systems used by firms and recognized by regulatory agencies worldwide. Analytical instruments must be suitable for their intended use. This requirement is good science in all laboratories and a regulatory requirement in pharma and biopharma laboratories. A life-cycle process for documenting and testing the suitability of laboratory instruments should be followed and Agilent recommends the life cycle framework defined in USP General Chapter <1058> on Analytical Instrument Qualification (AIQ). USP <1058> defines the governing framework and requirements that need to be satisfied, but the laboratory is responsible for how they satisfy these requirements.

- The United States Pharmacopoeia (USP) is the only major pharmacopoeia with a general chapter dedicated to analytical instrument qualification, making <1058> an important global regulatory reference. The information is provided in a scientific, risk-based approach to analytical instrument qualification (AIQ). However, the life-cycle framework contained within USP <1058> is not prescriptive in its implementation, making the embedded scientific and risk-based principles flexible and universally applicable.
- The scientific process followed by CrossLab uses the Agilent's Automated Compliance Engine (ACE) to deliver paperless electronic qualification. The life-cycle stages Agilent perform are highlighted in the life-cycle diagram below. As part of this life-cycle, Agilent can configure the qualification tests performed to align with user requirements.



USP <1058> AIQ Framework

NOTE: RQ services, described later in this document, can be added to standard qualification services.

ACE Workflow and Equipment Qualification Plans (EQPs)

Overview

Within the ACE workflow, the qualification tests, setpoints, and limits are defined in an EQP that can be configured to ensure that testing satisfies user requirements. When the qualification work is complete, an Equipment Qualification Report (EQR) is issued. The electronic workflow used within ACE has significant data integrity advantages over traditional paper or Excel-based qualification protocols, as validated calculations can be performed directly using electronic data such as chromatograms and metrology test values. Several of the instrument life-cycle stages are the responsibility of the laboratory, Agilent can provide compliance consultancy services and documentation which can help customers satisfy these requirements. These additional services are not included in our typical qualification offering.



High-level ACE Qualification Workflow

Standard and User-defined Limits

(Hardware qualifications only)

EQPs are available for download and approval as standard documents with Agilent recommended tests, setpoints, and limits, or they can be electronically configured by approved personnel to align with user requirements and intended range of use requirements. The degree of configuration depends on the analytical technology, but most EQPs can be configured to some degree, and one feature that can typically be changed is test limits.

EQPs are designed to be configurable (dependent on the analytical technology and standard requirements), but including additional tests or setpoints can impact the qualification time and associated cost. If a test limit is changed, ACE includes the capability to report results against the Agilent approved limit and any customer required limits (that is, both can be reported simultaneously).

If a user-defined test limit is more stringent than an Agilent recommended limit, Agilent makes no guarantee or obligation regarding the instrument passing the tighter test specification requirements. It is important to appreciate that tests performed under conditions of use (that is, to satisfy pharmaceutical monograph and application requirements) can have different limits than those defined in the OQ. It is the continuum of the combined OQ, PQ, and any point of use testing performed each time the instrument is used that together satisfy regulatory requirements.

User Requirements Specification (URS)

The purpose of user requirements is to document the intended use of the instrument within the life-cycle process and quality management system (QMS) being followed. Therefore, the URS is a customer / laboratory responsibility. Defining user requirements is often used to guide the customer in instrument selection and is stated as the first activity that should be followed in <1058>. The URS is important for two main reasons.

- It is a regulatory requirement for FDA and EU GMP that the intended use of the instrument and any software must be specified.
- Investment protection perspective means getting the right instrument for the right job.

Qualification protocols should test the instrument against any limits or specifications listed in the URS, which should document the intended range of use. Depending on the instrument complexity and how it is classified, a separate URS document may not be needed, but the URS requirements of the <1058> framework must be satisfied. A separate URS is almost always recommended for computerized systems.

An instrument performance specification is a product of the instrument development process by the supplier. It typically documents the performance the instrument can achieve. The URS should be based on intended use of the instrument and not the instrument specification. Additionally, if the intended use of a system changes, this may trigger a need to review the URS and associated qualification testing (for example, to ensure range of use is tested if used with a new analytical procedure).

Agilent offers compliance consultation services and documentation that can help customers address URS requirements.

Design Qualification (DQ)

The main function of the DQ stage of the laboratory instrument life-cycle process is to document why the selected instrument is suitable. Typically, this includes consideration of the instrument specification, how the instrument will be qualified, and the QMS followed by the instrument manufacturer. All together, these confirm that instrument performance is capable of satisfying user requirements. Depending on laboratory instrument life-cycle policy or SOPs being followed, instrument requirements and the relationship between the URS and DQ stages may vary – but as long as the <1058> framework principles are satisfied, this is not a problem, as it is left to each laboratory to justify and document its specific approaches.

The responsibility for satisfying DQ requirements primarily lies with the laboratory, with support from the supplier.

Agilent’s approach to satisfying DQ requirements of USP <1058> includes the following.

- All Agilent hardware and software laboratory products, including the ACE software used to deliver qualification services, are designed, manufactured, and tested according to Agilent internal quality life-cycle development procedures.
- Certificates of Agilent testing, validation, and conformance to standards are provided with new Agilent instruments and similar certification can be provided for ACE software.
- Agilent is capable of installation, support, preventive maintenance, on-going qualification, and re-qualification after repair and user training worldwide.

Agilent offers a compliance consultation service that can help customers with DQ documentation.

Installation Qualification (IQ)

The main functions of the IQ stage are to document that laboratory is suitable (for example, critical systems typically include a site inspection / checklist), that the instrument is installed correctly in the environment, and IQ checks such as module start up are completed. IQ is provided and automated by ACE, which collects, checks, and tests Agilent hardware and software products for the following.

1. Purchase Order Details: Allows the customer to verify that the instrument being qualified matches their design requirements (if available) and purchase order.
2. Preparation and Installation Details: Gathers and records information about preparation and installation documents.
3. Documentation: Gathers and records information about reference and user manuals for initial installations.
4. Product Quality Assurance Details: Collects and records certificates and other forms that verify that the vendor has developed and built the product according to internal standards.
5. Startup: Verifies that all modules/components start up properly.
6. Installation Verification (software only): Verifies the correctness of all installation-related files.

Operational Qualification (OQ)

The main function of the OQ stage is to evaluate and document instrument performance at the intended operational range of use. OQ protocols should include a mix of metrology, functional, and operational tests. ACE qualification protocols include information about the test description and rational, setpoints, and the limits (acceptance criteria) for each technique, category, and instrument configuration.

OQ is provided and automated by ACE. ACE checks and tests for Agilent hardware and software products include the following.

- Metrological tests such as flow, temperature, pressure, and so on that ensure that the system is performing within Agilent (or user) specifications.
- Qualification results are reported in the EQR, which can include details of all test certificates, standards, and training information for the engineer performing the work. (Note that the EQR can be configured to customer requirements.)
- System or "holistic" tests verify the combined functions of the various system components
- The qualification testing can be configured to ensure URS requirements, such as range of use are tested.

For software qualification, the OQ consists of automated diagnostics regression testing and verification of the software installation. This supports continued use of the software in regulated environments (at install and as part of supporting periodic review).

In line with regulatory requirements, the EQPs should be approved before work is performed and the EQR should be reviewed and approved when the work is complete (as illustrated in Figure 2). The EQR contains all the raw data, results, and relevant information and attachments for complete compliance and traceability.

Mechanical Qualification (MQ)

(Dissolution systems only)

The main function of the MQ stage is to document that the mechanical performance of the instrument meets specifications and is functioning properly.

Performance Qualification (PQ)

The main function of the PQ stage is to document that the instrument is fit for purpose under conditions of intended use and to create an approved framework that ensures the instrument continues to perform as required. Because instrument range of use is tested within the OQ stage, it is usually not necessary to test this during PQ. It should be noted that requirements for instrument maintenance and repair fall within the PQ life cycle stage within the USP <1058> framework, as they are components of ensuring the continued performance of the instrument.

The customer is responsible for satisfying PQ requirements. (NOTE: Agilent can provide a PQ for Dissolution systems only.)

It is important to note that PQ is a lifecycle activity and not a one-time event. PQ tests may include activities such as method validation or system suitability tests (SST), but in Agilent's opinion, SSTs contribute towards ensuring continued performance of the instrument (that is, PQ testing), but do may not fully satisfy <1058> PQ requirements.

Repair Qualification (RQ)

After an instrument is repaired, tests should be performed to evaluate the effectiveness of the repair and document that repaired instrument satisfies performance requirements. Agilent offers a service called Repair Qualification (RQ), which refers to the requalification of laboratory instrument hardware after a repair. For some laboratory systems, to document the performance after repair may require a full OQ. However, for some modular or component-based systems, such as HPLC and GC for example, partial qualification testing can be justified. This is accomplished by performing the qualification tests that are applicable to only the module or system component related to the repair, reducing the time the instrument is out of service. Re-qualifying the instrument after repair is a regulatory requirement defined in USP <1058>.

Agilent offers service contracts to repair and requalify an instrument during the period between scheduled annual OQs.

The level of retesting is prescribed in the RQ section of ACE: a form is displayed for the operator showing all types of repairs possible and the retesting required. Part of an example form for an LC system is shown below.

Re-Qualification After Repair		
Pump Strategies		
Repair/Replace Strategy	Modules	OO Testing
Internal pump head parts, active inlet valve (or AIV cartridge), (parts of) check valves, reference valves, inlet manifold or pump drive, or taking pump head apart to clean (versus repair)	Any pump	Flow Accuracy & Precision
Pulse damper, pressure transducer	Any pump	Flow Accuracy & Precision
Multi-channel gradient valve	Quaternary	Flow Accuracy & Precision Gradient Composition

The full list of RQ repair and retest guidance is available for customer review.

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SERVICE DELIVERY METHODS

CUSTOMER APPROVAL OF ALTERNATIVE METHOD AND EQR STORAGE

Agilent CrossLab Compliance Services



Overview

Agilent recommends use of **Network ACE** for CrossLab qualification services that are enabled using the Agilent Automated Compliance Engine (ACE) software. Network ACE and Local ACE both access data directly (default methods) and are considered equivalent from a data integrity and data traceability perspective (see below). To provide additional flexibility in qualification service delivery, an alternative method is also available that accesses data indirectly. Use of the alternative method requires customer pre-approval using this form.

Available Methods

Method	Definition
Network ACE (Agilent recommended)	ACE software is installed on a network node within the laboratory LAN infrastructure. Raw data locations are always captured in the equipment qualification report (EQR), which provides end to end traceability and a fully characterized data workflow in the delivery. This method requires collaboration with the customer to load ACE behind the customer firewall.
Local ACE	ACE software resides on an independent external drive that can be driven from the system controller, where the customer data system (CDS) resides. Because the external drive is connected to the CDS, the data integrity of this method is equivalent to that of the Network ACE delivery method. Raw data is imported directly into ACE by the Data Manager tool, with the data paths always captured in the report, which provides data traceability assurance.
Alternative (Requires pre-approval)	This method requires customer pre-approval due to data integrity implications. <u>Only choose this option in scenarios like the following:</u> <ul style="list-style-type: none"> ACE software is not run from a PC directly connected to the customer CDS, such as the FSE's laptop. System data files are transferred indirectly from the CDS to the FSE laptop instead of directly as done with Network and Local ACE methods. Data is acquired using a CDS on the FSE's laptop and transferred directly to ACE. The CDS used in this method is qualified for data collection purposes.

EQR Storage

Select the checkbox below to authorize Agilent to store copies of the EQRs generated by ACE for Agilent internal assessments. The intention of the assessment is to evaluate the delivery of the qualification service, with a focus to improve delivery and assess the appropriateness of data integrity measures. The storage is exclusively for the internal assessment by Agilent and is not shared with other organizations. It is not to be considered a backup for the EQR provided at qualification delivery.

Customer Approval of Alternative Method and EQR Storage

Authorize Agilent to use the alternative method (check for approval):

Authorize Agilent to store EQRs for their internal assessment (check for approval):

Approved By/Title:	
Date Approved:	
Comments:	

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Introduction

With heightened scrutiny of data integrity, the Agilent Automated Compliance Engine (ACE) software must be able to access instrument-generated raw data files one of two ways: directly, using the connection between network nodes or with the server; and indirectly, through storage in a secure transfer location. (In this document, data integrity refers to the who, what, and where of data used in generating an ACE equipment qualification report, or EQR.)

ACE includes three main service delivery methods that address data integrity requirements; the rest of this document provides details to determine which one best fits a customer's needs.

Regardless of the delivery method, ACE features and delivery procedures are compatible.

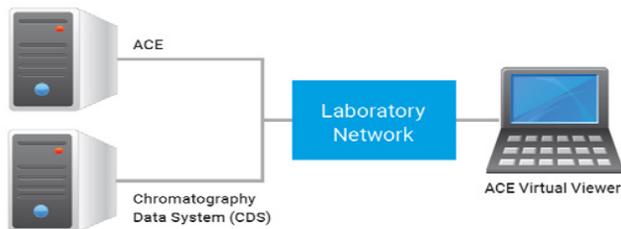
Network ACE (Agilent Recommended)

Overview



ACE software is installed on a network node within the laboratory LAN infrastructure, which requires collaboration with the customer to load ACE behind their firewall. Raw data locations are always captured in the EQR, which provides end-to-end traceability and a fully characterized data workflow in the delivery.

Details



Typical Network ACE installation diagram

Installing ACE in a separate node (a.k.a. the host PC) on the same network as the system controller offers data traceability that is equivalent to an installation on the system controller itself. The system controller (where the CDS resides) and the ACE host PC are identified and seen by the server and subject to the customer's data access controls and general IT policies. The CDS's audit trail records data movements between nodes or between the client and server, and ACE's data traceability features identify the original data directory and therefore ensures end-to-end data traceability

The ACE host PC has a separate/partitioned drive for ACE software. During ACE's installation, two services are setup on the operating system (OS): one for security and the other as a watchdog. Because the ACE host PC sits on the network as a shared drive, engineers access ACE through the networked drive: ACE is not installed on ACE Virtual Viewer PCs.

Requirements

Installation

- Install on a host PC with a separate drive (different from that of the OS)
- Attach to a network that clients can access
- 500 GB
- NTFS format
- User has local administration rights
- Customer installation instruction document is available

Operational

- User has an ACE node logon with a minimum of power user rights permissions; user also has a personal ACE account and password added through the ACE licensing tool
- Up to 5 users with 3 open sessions each can access the NDA simultaneously
- Exception to ports 11121-11141 on ACE node, clients, and switch's/Smart Hubs to be open on the network

Local ACE

Overview



ACE software resides on an independent drive that can be driven from the system controller, where the CDS resides. Because the drive is connected to the CDS, this method's data integrity is equivalent to preferred 1 method's. Raw data is imported directly into ACE by ACE's Data Manager tool, and data paths are captured in reports to provide data traceability.

ACE software resides on an independent drive that can be driven from the system controller, where the CDS resides. Because the drive is connected to the CDS, this method's data integrity is equivalent to the Network ACE method. Raw data is imported directly into ACE by ACE's Data Manager tool, and data paths are captured in reports to provide data traceability.

Details

ACE is designed to run from a dedicated drive, without leaving a footprint on the host PC. Therefore, it can be connected directly to the system controller (where the CDS resides) without altering the system's qualification status. For additional protection, the drive can be driven by another host PC on the same network; also, the drive can remain on site with the customer for use by the Agilent Field Service Engineer (FSE) during service deliveries only.

Alternative Method

This method requires customer pre-approval due to data integrity implications and only applies in scenarios like the following:

- ACE software is not run from a PC directly connected to the customer CDS, such as the FSE's laptop. System data files are transferred indirectly from the CDS to the FSE laptop instead of directly as done with Network and Local ACE methods.
- Data is acquired using a CDS on the FSE's laptop and transferred directly to ACE. The CDS used in this method is qualified for data collection purposes.

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Introduction

This document describes the MS-specific tests for qualifying the Agilent GCMS systems. These MS-specific tests are performed in addition to the GC core tests as they apply to the system configuration; refer to the *GC Hardware Operational Qualification* document for details.

Model abbreviations used in this document include:

220 int:	220 Ion Trap using internal ionization
240 int:	240 Ion Trap using internal ionization
240 ext:	240 Ion Trap using external ionization

Note: High Mass Tune, Injection Carry Over (ALS only), and RCI Valve Stability tests are NOT INCLUDED in the standard OQ for GCMS but can be ordered as an EXTRA COST TEST.

Injection Precision test is a standard test ONLY for systems without a liquid autosampler or systems that use the Signal to Noise test as the default instead of the Instrument Detection Limit test.

Signal to Noise test is a standard test ONLY when the IDL test – included in the standard OQ for SQs, TQs, and Q-TOFs – is disabled; when IDL is scheduled, the Signal to Noise can be run as an EXTRA COST TEST.

Key: Fixed setpoints/limits Variances allowed

Optional MS-OQ Tests

Select checkboxes on the right and attach this document to your OQ EQP documentation for a record of qualification conditions.

Test	Setpoints and Parameters	Limits (Allowable Range)	Include
Injection Carry Over (ALS only)	See General Tests table	See General Tests table	
High Mass Tune (SQ only)	See SQ Tests table	See SQ Tests table	
RCI Valve Stability (TQ only)	See TQ Tests table	See TQ Tests table	

OQ MS-Specific Test Suite

General Tests

Test	Setpoints and Parameters	Limits
CDS Logon Verification	N/A	Evidence of logon used to collect qualification data
Tune	Autotune function	Tune report shows no errors
Injection Precision	(IVoC is injection volume on column.)	Retention time RSD ≤ 1.00% Area RSD ≤ 5.00%
Injection Carry Over (HSS only)	IVoC (ALS, TQs): 0.5 µL IVoC (ALS, all others): 1.0 µL	Area carry over ≤ 1.00%
Injection Carry Over (ALS only)	IVoC (HSS, Agilent): 1000 µL IVoC (HSS, CTC): 1000 µL	Area carry over ≤ 1.00%
Mass Ratio Precision		Mass 1 area RSD ≤ 5.00% Mass ratio RSD ≤ 5.00%

SQ Tests

Test	Setpoints and Parameters	Limits
Log Amp	N/A	Maximum abundance ≥ 20,000 counts
RFPA	Amu: 1050 m/z (5975/5977)	RFPA voltage ≤ 1,100 mV
	Amu: 800 m/z (5973)	Drift in 5 minutes ≤ 100 mV
High Mass Tune (For G3396A option only)	Amu: 1049 m/z	Amu offset difference (suggested – current) = ± 5
Instrument Detection Limit (IDL; applies to He carrier unless otherwise noted)	(IVoC is injection volume on column.) IVoC (ALS): 1.0 µL	Area RSD ≤ 13.00% (5977E/A/B SQ, SS source)
		Area RSD ≤ 7.00% (5977C SQ, SS source)
		Area RSD ≤ 10.00% (5977A/B/C SQ, diff. pump, inert source)
		Area RSD ≤ 8.00% (5977A/B/C SQ, turbo, inert source)
		Area RSD ≤ 5.00% (5977A/B/C SQ, turbo, ext source)
		Area RSD ≤ 8.00% (5977B SQ, high efficiency source)
		Area RSD ≤ 5.00% (5977C SQ, high efficiency source)
		Area RSD ≤ 17.00% (5977A/B/C SQ, hydro inert source, H ₂ carrier)
Retention time RSD ≤ 1.00%		
IDL: statistically derived at 99% confidence level from the area precision of six sequential splitless injections using an ALS and a specific OFN standard.		
Signal to Noise (MS-EI and ALS or manual injection)	Signal height is divided by rms baseline noise for known concentration and conditions	S/N ≥ 60 (5973 Inert)
		S/N ≥ 10 (5973A)
		S/N ≥ 20 (5973N)
		S/N ≥ 60 (5975B, diffusion pump)
		S/N ≥ 140 (5975B, turbo pump)
		S/N ≥ 80 (5975C, diffusion pump, He)
		S/N ≥ 40 (5975C, diffusion pump, H ₂)
		S/N ≥ 160 (5975C, turbo pump, He)
		S/N ≥ 80 (5975C, turbo pump, H ₂)
		S/N ≥ 160 (5975C inert XL, TAD diffusion pump, He)
		S/N ≥ 40 (5975C inert XL, TAD diffusion pump, H ₂)
		S/N ≥ 320 (5975C inert XL, TAD turbo pump, He)
		S/N ≥ 80 (5975C inert XL, TAD turbo pump, H ₂)
		S/N ≥ 80 (5977A, diffusion pump, SS source)
		S/N ≥ 1200 (5977A/B, turbo pump, extractor source)
		S/N ≥ 80 (5977A/B, turbo pump, SS source)
		S/N ≥ 240 (5977A/B/C, diffusion pump, inert source)
		S/N ≥ 480 (5977A/B/C, turbo pump, inert source)
		S/N ≥ 240 (5977B, turbo pump, high efficiency source)
		S/N ≥ 4000 (5977C, turbo pump, extractor source)
S/N ≥ 1600 (5977C, turbo pump, high efficiency source)		
S/N ≥ 2000 (5977A/B/C, turbo pump, hydro inert source, H ₂ carrier)		
S/N ≥ 480 (5977C, turbo pump, SS source)		
S/N ≥ 80 (5977E, diffusion pump)		
S/N ≥ 80 (7820 MS, diffusion pump)		
Signal to Noise (MS-EI and HSS injection)	Signal height is divided by rms baseline noise for known concentration and conditions	S/N ≥ 4000 (5977A/B/C, turbo pump, hydro inert source, H ₂ carrier, x697 HSS)

Test	Setpoints and Parameters	Limits
Signal to Noise (MS-PCI using CH ₄ with an ALS or manual injection)	Signal height is divided by rms baseline noise for known concentration and conditions	S/N ≥ 75 (5973A/N/Inert)
		S/N ≥ 80 (5975A)
		S/N ≥ 125 (5975B, turbo pump)
		S/N ≥ 125 (5975C, turbo pump, He)
		S/N ≥ 125 (5975C Enhanced, turbo pump, He)
		S/N ≥ 125 (5977A/B/C)
Signal to Noise (MS-NCI using CH ₄ with an ALS or manual injection)	Signal height is divided by rms baseline noise for known concentration and conditions	S/N ≥ 500 (5973A/N/Inert)
		S/N ≥ 125 (5975A)
		S/N ≥ 300 (5975B, turbo pump)
		S/N ≥ 600 (5975C, turbo pump, He)
		S/N ≥ 600 (5977A/B/C)

TQ Tests

Test	Setpoints and Parameters	Limits
<i>Limits apply to Helium carrier gas unless otherwise noted.</i>		
Instrument Detection Limit	(IVoC is injection volume on column.) IVoC (ALS): 1.0 µL	Area RSD ≤ 5.00% (7000B TQ, EI extractor source)
		Area RSD ≤ 12.00% (7000C/D/E TQ, EI extractor source)
		Area RSD ≤ 26.00% (7000E TQ, hydro inert source, H ₂ carrier)
		Area RSD ≤ 9.00% (7010A/B/C TQ, high efficiency source)
		Area RSD ≤ 16.00% (7010A/B/C TQ, high efficiency source 2.0)
		Area RSD ≤ 13.00% (7010D TQ, high efficiency source 2.0)
		Retention time RSD ≤ 1.00%
		IDL: statistically derived at 99% confidence level from the area precision of six sequential splitless injections using an ALS and a specific OFN standard.
RCI Valve Stability (7010's with RCI valves)	N/A	Minimum: > average response x 0.8 Maximum: < average response x 1.2
Signal to Noise (MS-EI and ALS or manual injection)	Signal height is divided by rms baseline noise for known concentration and conditions	S/N ≥ 80 (7000A, EI source)
		S/N ≥ 400 (7000B, EI source)
		S/N ≥ 1500 (7000C/D/E, extractor source)
		S/N ≥ 8000 (7010A/B/C, high efficiency source)
		S/N ≥ 8000 (7010A/B/C/D, high efficiency source 2.0)
Signal to Noise (MS-PCI using CH ₄ with an ALS or manual injection)	Signal height is divided by rms baseline noise for known concentration and conditions	S/N ≥ 2000 (7000B/C/D/E)
		S/N ≥ 2000 (7010A/B/C/D)

Q-TOF Tests and Scan Verification Masses

Test	Setpoints and Parameters	Limits
Scan Verification	See Scan Verification Known Masses table	Accuracy for mass 1 ≤ 15.0 ppm Accuracy for other used masses ≤ 3.0 ppm
Resolution	N/A	Resolution ≥ 10000 (7200 Series)
		Resolution ≥ 25000 (7250A)
Instrument Detection Limit (IDL; applies to He carrier unless noted)	(IVoC is injection volume on column.) IVoC (ALS): 1.0 µL	Area RSD ≤ 8.00% (7200A/B)
		Area RSD ≤ 20.00% (7250A)
		Retention time RSD ≤ 1.00%
		IDL: statistically derived at 99% confidence level from the area precision of six sequential splitless injections using an ALS and a specific OFN standard.
Signal to Noise (MS-EI and ALS or manual injection)	Signal height is divided by rms baseline noise for known concentration and conditions	S/N ≥ 1600 (7200A/B)
		S/N ≥ 1600 (7250A)
Signal to Noise (MS-PCI using CH ₄ with an ALS or manual injection)	Signal height is divided by rms baseline noise for known concentration and conditions	S/N ≥ 1200 (7200A/B)
		S/N ≥ 1200 (7250A)

Test	Setpoints and Parameters	Limits
Signal to Noise (MS-NCI using CH ₄ with an ALS or manual injection)	Signal height is divided by rms baseline noise for known concentration and conditions	S/N ≥ 240 (7250A)

Scan Verification Known Masses	PFTBA (Q-TOF, EI)	PFTD (Q-TOF, PCI)	PFTD (7250A Q-TOF, NCI)
1	68.99466	68.99466	184.9842
2	130.99147	118.99150	282.9822
3	218.985077	146.98640	350.9696
4	263.98657	266.98621	448.9675
5	413.97696	284.97681	516.9549
6	463.97379	312.97171	N/A
7	501.97058	334.97360	N/A
8	613.96417	432.97159	N/A
9	N/A	500.95889	N/A
10	N/A	598.95697	N/A

Ion Trap Tests

Test	Setpoints and Parameters	Limits
Signal to Noise (MS-EI and ALS or manual injection)	Signal height is divided by rms baseline noise for known concentration and conditions	S/N ≥ 50 (220 int)
		S/N ≥ 20 (240 int)
		S/N ≥ 30 (240 ext)
Signal to Noise (MS-PCI using CH ₄ with an ALS or manual injection)	Signal height is divided by rms baseline noise for known concentration and conditions	S/N ≥ 20 (220 int)
		S/N ≥ 50 (240 int)
		S/N ≥ 10 (240 ext)
Signal to Noise (MS-NCI using CH ₄ with an ALS or manual injection)	Signal height is divided by rms baseline noise for known concentration and conditions	S/N ≥ 50 (240 ext)
Ion Trap Preparation	Trap: 150.0°C Manifold: 40.0°C Transfer line: 230.0°C Ion source: 80.0°C (240 ext)	Temperature accuracy for all zones ≤ 10.0°C
		Turbo current ≤ 350 mA (220 int)
		Turbo current ≤ 300 mA (240 int & ext)
		High mass noise ≤ 10 counts
Mass Calibration Verification	Mass 1: 69 Mass 2: 131 Mass 3: 264 Mass 4: 414	Mass 1 abundance = 100.0% (220, 240 int)
		Mass 1 abundance ≥ 25.0% and ≤ 80.0% (240 ext)
		Mass 2 abundance = 100.0% (240 ext)
		Mass 2 abundance ≥ 25.0% and ≤ 80.0% (220, 240 int)
		Mass 3 abundance ≥ 15.0% and ≤ 75.0%
		Mass 4 abundance ≥ 2.0%

Test Design and Rationale

Overview

Many GMP/GLP enforcement agency inspectors now ask firms to provide a risk assessment of their equipment and computer systems plus a science-based rationale for subsequent validation and qualification testing.

GENERAL RISK STATEMENT: Any laboratory chemical system used for raw material testing or final drug product / medical device testing in GMP or used in formal GLP studies will likely fall into a HIGH RISK category. This risk assessment will imply the need for IQ & OQ & on-going qualification. ANY USER SPECIFIC RISK ANALYSIS SUPERCEDES THIS GENERAL RISK STATEMENT.

The rest of this section outlines the science-based rationale for each test in the Agilent hardware OQ plus a brief test design and procedure description.

The recommended set of hardware OQ tests described in this EQP derives from Agilent's interpretation of FDA, USP, and GAMP guidelines and other authoritative expert literature.

OQ test design incorporates both modular and holistic testing, which is a proven and regulatory acceptable approach. When applicable, direct metrology is used to test pump flow rates and thermal-controlled column compartments, for example. Holistic chemical testing is used to evaluate critical instrument characteristics.

When applicable, certified reference standards and calibrated equipment are used.

Considering the number of setpoints, parameters, and conditions of each recommended OQ test, the proven concepts of worst case, range, and representative have been applied. If a property or characteristic is known to have its worst performance at one end of a range of use, this is the setpoint that should be tested and other setpoints are not required. If a property or characteristic has no known worst case, testing at the high and low points of the range of use is required. If there are too many possible use cases and conditions to realistically test (and none is a worst case), a representative sample for test is the best approach.

CDS Logon Verification

Description: To satisfy the attributable requirement of ALCOA+, evidence of the logon used to collect data must be provided.

Procedure: The test uses a screen capture to document who is logged on to the software that controls the instrument being qualified. The capture is automatically included with this test in the EQR.

Ion Trap Preparation

Description: Preliminary checks are run to make sure the ion trap is in a state to successfully run the OQ tests.

Procedure: Built-in software tests evaluate the state of the ion trap.

Log Amplifier

Description: A linear output detector is critical for quantitative analysis. The log amplifier amplifies the output of the detector in proportion to the logarithm of the input current.

Procedure: This procedure determines the performance of the MS system log amplifier. It verifies operation of the log amplifier and functionality of the main board, instrument control card, and ChemStation.

RFPA

Description: The GCMS detector requires functioning radio frequency power amplification to ensure ion selection. This test verifies the stability of the optimized voltage by applying a combined direct current (DC) and radio frequency (RF) signal to two pairs of four hyperbolic surfaces. The magnitude of the RF voltage determines the mass-to-charge ratio of the ions that pass through the mass filter and reach the detector.

Procedure: The RFPA voltage is first minimized. After this, the RFPA voltage is ramped for a specified time at a high mass, and then the voltage drift is calculated.

Resolution

Description: This test uses a traceable standard to determine the mass resolution of the Q-TOF instrument.

Procedure: The tune results are used to achieve the results.

Mass Calibration Verification

Description: This test verifies the relative abundances of specific masses compared to the base peak (100%) for ion traps.

Procedure: The calibration gas spectrum determines the relative abundance of specific masses compared to the base peak (100%).

Tune

Description: Calibration of mass range is critical in qualitative mass spectrometry.

Procedure [Agilent MS only]: The built-in Agilent autotune feature is performed. The masses used for the test are 69, 219, and 502 rough-rounded numbers. This determines the proper calibration of the MS and ensures that the masses are correctly reported across the entire mass range of the instrument.

Signal to Noise

Description: Sensitivity of MS detection is a critical performance feature in quantitative and qualitative analysis. A signal-to-noise value of a representative compound at known concentration provides sensitivity statistics.

Procedure: A traceable standard is injected and signal to noise is calculated.

Injection Precision

Description: System precision is critical for accuracy of quantitation. Autosampler performance and MS ionization contribute to GCMS system precision.

Procedure: An initial stabilizing injection is made, followed by six repeat injections of a traceable standard and a final blank injection. The % RSD of the six injections is calculated to provide precision statistics.

Injection Carry Over

Description: Low carry over from a previous injection is critical for accuracy and reliability of qualitative analysis. For headspace samplers, the engineering condition contributes to carry over performance, so this is a core OQ test for these samplers.

For liquid samplers, carry over performance is contingent on many variable factors independent of the engineering condition of the GC system. Many different syringe wash programs are available that can eliminate carry over. These are user selectable and may be application specific. The condition of the injection syringe is the only controllable engineering factor. The injection syringe is typically replaced for new during PM before OQ. Therefore, the carry over test for liquid samplers is offered only as an optional extra fee test in a customer-configured EQP.

Procedure: The blank injection after the six repeat injections of the precision test is evaluated for carry over, and the result is expressed as a percentage.

Mass Ratio Precision

Description: Constant ionization is critical for accuracy of quantitation.

Procedure: Data for this test is collected during the injection precision test. From each run, two masses are extracted from the total ion chromatogram (TIC) and the ratio is calculated. The % RSD of the six injections is calculated for the mass 1 area injection precision and mass ratio precision.

High Mass Tune

Description: Calibration of mass range in EI mode is critical in qualitative mass spectrometry.

Procedure: A traceable checkout standard is used to determine the operation of the MS in the high-mass range. Based on the result from the run, the tune parameters are updated for optimum performance in the high-mass range.

Instrument Detection Limit (IDL)

Description: This test uses a traceable standard to determine injection precision and IDL.

Procedure: The mean, standard deviation, and %RSD of six standard injections are calculated. Using the area RSD and the known amount injected onto the column, the instrument detection limit is calculated (IDL is not set but based on the area RSD limit). This amount returns a peak in the chromatogram, which is detectable and distinguishable from the background with a 99% probability.

RCI Valve Stability

Description: Reference compound ionization stability is critical throughout a run if the RCI valve is used during analysis.

Procedure: The reference compound signal is monitored at specific conditions over a 15-minute period. Stability is determined as minimum and maximum responses within a range around the average response. This test for 7010 TQs with an RCI valve is offered only as an optional extra fee test in a customer-configured EQP.

www.agilent.com/chem/qualification

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