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| Title: | Performing Factory Acceptance Test (FAT) or Site Acceptance Test (SAT Aa, Ab, Ba, or Bb) |
| Purpose: | Specify the process of Acceptance Tests (FAT and SAT) |
| Organizational unit: | Quality Assurance (QUA) |
| Valid for: | Project "FAIR Accelerator and Experiments" |
| Key performance indicators: | |

Document history:

| Version | Created, date | Reason for modification |
|---------|-------------------------|--|
| V 1.0 | W. Bonin, 20.5.2015 | Original, transferred from Q-AA-QA-0001 and refined |
| V1.1 | W. Bonin, 11.6.2015 | Added list of FAT requirements |
| V2.0 | W. Bonin, 15.10.2015 | Expanded by including SATs |
| V3.x | W. Bonin, 28.04.2017 | Elaborated on SAT Aa and Ab, additions about test equipment and test finalization, valid for project FAIR |
| V3.0 | A. Fröhlich, 28.6.2017 | Adapted to General Specs |
| V004 | D. Grünberg, 23.10.2019 | Adaptation of document number incl. referenced documents; release of acceptance protocol without physical signatures |
| V005 | D. Freire, 11.03.2020 | The responsible for approving an Acceptance Record is the SPL |
| V006 | D. Freire, 08.06.2021 | General improvements to formulations, incorporation of the template for the inspection and test plan and a reference to the "conditionally accepted" |
| V007 | D. Grünberg 01.07.2021 | Update of the document number of the test plan template |

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1 Purpose

The **FAT** is the final test executed at the site of the manufacturer of a component or a system. Testing will be against the specifications mentioned in the contract and valid at the time the order was placed.

A FAT shall be performed for each specified component to be used in the FAIR facility. Only components which passed this test (or got a concessional release as explained below) may be shipped. For series production, the WPL and QUA may mutually agree on rating the production running evidently steady enough to skip FATs with participation of FAIR or GSI for future deliveries of this component or module. This decision must be documented.

The stages of **SAT** are tests of said component executed at the site of GSI or FAIR, respectively (cf. General Specs F-GS-E-05 and F-GS-F-01). After commercial goods receipt, the:

- **SAT Aa** is the incoming goods inspection. The scope of inspection is specified by the WPL as agreed upon with the AN and QUA. At least a superficial visual inspection and the read-out of transport sensors must be done before unloading.
- **SAT Ab** is the in-depth inspection of the technical function. With SAT Ab completed, the component may be moved to its final position in the accelerator; if, however, it is going to be stored for several months or longer, parts of SAT Ab shall be repeated after storage and before said moving.
- **SAT Ba** encompasses all tests at said final position though without the beam; these must be passed to allow testing the component with beam thereafter.
- **SAT Bb** includes all tests with the beam; these are required for getting the release to use said component in regular accelerator operation.

2 Definitions and Abbreviations

| Abbreviation | Explanation |
|--------------|---|
| AID | Article ID (for components and systems) |
| AN | Contractor |
| CDR | Conceptual Design Review (M6) |
| CID | Component ID (for components and systems) |
| DMS | Document Management System |
| FAT | Factory Acceptance Test (M9) |
| FDR | Final Design Review (M7) |
| NCR | Nonconformity Report |
| PSP Code | Project Structure Plan Code |
| QUA | Quality Assurance |
| SAT | Site Acceptance Test (M10, M11) |
| SPL | Sub Project Leader |
| WPL | Work Package Leader |

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3 Responsibilities

See section 5 “Process Flowchart”.

4 Description of the Procedure

Preparation of FAT or SAT: Based on the valid contract or order, the applicable technical specifications shall be identified. The specific requirements shall be extracted and documented in a suitable way (e.g. in test instructions, F-FO-QUA-en-0010). These requirements may include proving the existence of specific things (e.g. documents) or qualities (e.g. the component being free from burrs) or measuring specified features (e.g. electrical or dimensional properties).

In particular, check that the necessary test equipment (instruments and setups) is listed. These measuring systems must be available on-site for the test, shall be calibrated and capable of controlling the required values and tolerance bands (see test equipment capability, F-VA-QUA-en-0031). Where such equipment is missing, it must be supplied well in advance of the due tests (see F-VA-QUA-en-0022). These requirements as well as the documentation of test results have to be documented in the test plan (see F-FO-QUA-bl-Template_Inspection_Plan_Results). Make sure that AID and CID are mentioned on the document

At the CDR, the AN has to present the corresponding test and inspection plan agreed with the WPL (see F-FO-QUA-bl-Template_Inspection_Plan_Results).

At the FDR, the test plan agreed between the WPL and AN must be approved for the FAT. Test instructions shall be available for the required tests – they must be released as well (see F-VA-QUA-en-0003). The test plan for the SATs agreed with QUA shall be presented at the FDR as well.

8 weeks before scheduled delivery of the component (according to the valid project schedule at FDR), the test instructions for SAT Aa and Ab shall be released, at latest.

8 weeks before scheduled setup of the component in the accelerator (according to the valid project schedule), the test instructions for SAT Ba and Bb shall be released, at latest.


Executing an acceptance test, the requirements taken from the test instructions will be checked step by step. For these checks, capable test equipment is inevitably required (cf. F-VA-QUA-en-0031). The results of each test step shall be recorded.

In the **evaluation**, each observation will be compared with the corresponding required value; the result of this comparison will be rated: within applicable tolerance specified it is OK, outside it is NOT OK.

In real life, the test result may be out of specified tolerance but rated as “still acceptable” or “usable” by the WPL and QUA. This may, by way of exception, lead to a concessional release once; in any such case, however, a NCR must be written by the WPL (see F-VA-QUA-en-0030). If the specifications of the required value and/ or the tolerances turn out being wrong in this course, the respective specs or drawings shall be corrected immediately (see F-VA-QUA-de-0003 “Control of Documents” and F-VA-CMD-en-0011 “Change Management”).

The respective FAT/ SAT is considered approved if all the tests listed in the test plan have been passed or an NCR was created in which the deviation was classified as acceptable.

Otherwise applies: If a test result of an individual test does not meet the requirements, the respective FAT / SAT is not passed.

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The test results have to be documented in the inspection plan (see F-FO-QUA-bi-Template_Inspection_Plan_Results) or on suitable test reports. The WPL ensures that the test results meet the requirements and, if necessary, have been checked by the person responsible for the interface, then releases the documents in the DMS.

The WPL also checks whether the documents from the design creation in the DMS are complete and approved.

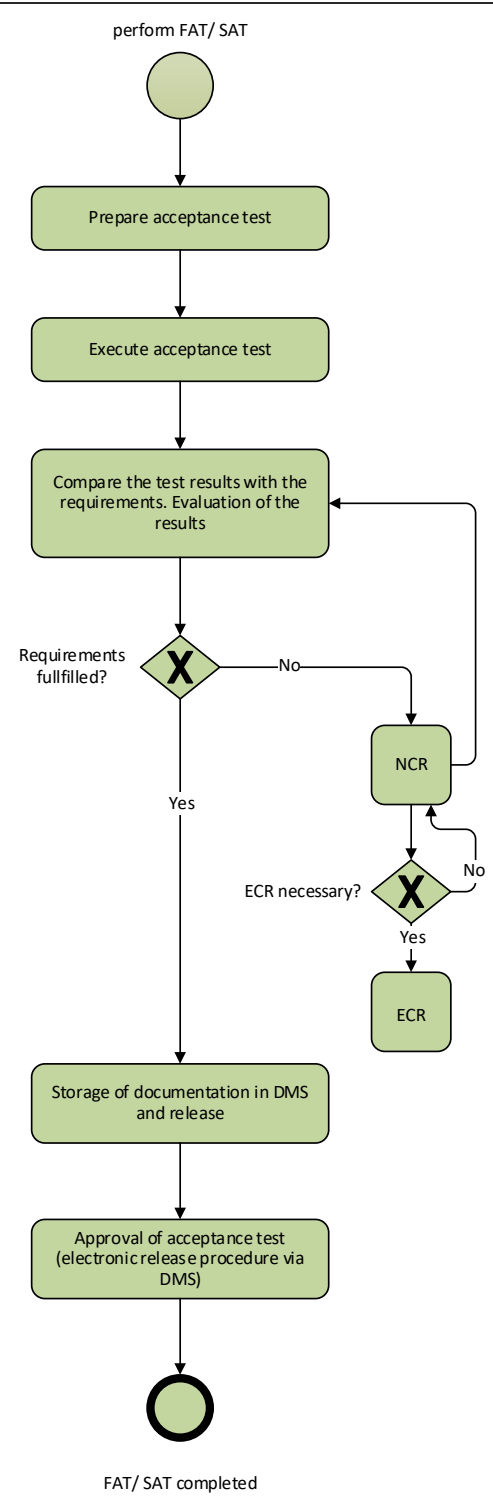
The overall result must be recorded on the acceptance record (F-FO-QUA-bi-0002) and uploaded to the DMS. In addition to the required participants SPL and QUA, the WPL invites other necessary specialists for the approval. The SPL is responsible for the approval and release of the acceptance record in DMS. However, he can delegate this task to the WPL.

Conditionally Accepted: The milestone for the respective FAT/ SAT is only fulfilled if the acceptance record was "Accepted". In the case of a "Conditionally Accepted", the reasons must be described in the comments field. In addition, a date must be specified by which the necessary improvements/ repairs must be completed. Accepted deviations do not lead to a "conditionally accepted" as they always have to be documented and accepted in an NCR. In this case, "Accepted" must be ticked in the acceptance report.

The WPL reports the successful acceptance tests to Purchasing (EKM) or the In Kind Office (IOP).

Hint: When updating the MS project plan, insert within the field "Notes" the link to the acceptance record.

5 Process Flowchart

| Input / Output, Anmerkungen | Ablaufschritte | R | A | C | I |
|--|---|---|---|--|--|
| <p>Acceptance test due</p> <p>Input: Testplan, specifications and further parts of contract, test instructions Output: prepared test records, Templates: F-FO-QUA-bl-0002, F-FO-QUA-en-0010</p> <p>Input: prepared test records Output: test records filled in</p> <p>Input: test records filled in, test plan, specifications and further parts of contract, test instructions Output: Acceptance record filled in</p> <p>Input: Are the requirements fulfilled? Output: Overall result decided</p> <p>Execution of NCR procedure according to VA: F-VA-QUA-en-0030 or VA from AN</p> <p>Execution of ECR procedure according to VA: F-VA-CMD-en-0011</p> <p>Input: all test records, NCRs and ECRs Output: Documents in DMS stored</p> <p>Input: Prepared „Acceptance Record“ according to template F-FO-QUA-bl-0002 Output: Complete and correct Documentation in DMS</p> | <p>perform FAT/ SAT</p>  <pre> graph TD Start(()) --> Prepare[Prepare acceptance test] Prepare --> Execute[Execute acceptance test] Execute --> Compare[Compare the test results with the requirements. Evaluation of the results] Compare --> Dec1{Requirements fulfilled?} Dec1 -- No --> NCR[NCR] Dec1 -- Yes --> Storage[Storage of documentation in DMS and release] NCR --> Dec2{ECR necessary?} Dec2 -- Yes --> ECR[ECR] Dec2 -- No --> Compare ECR --> Compare Storage --> Approval[Approval of acceptance test (electronic release procedure via DMS)] Approval --> End((())) </pre> <p>FAT/ SAT completed</p> <p>Process details and acceptance criteria may differ for the FAT and the SAT Aa, Ab, Ba and Bb.</p> | <p>AN/ WPL</p> <p>AN/ WPL</p> <p>WPL</p> <p>SPL</p> <p>AN/ WPL</p> <p>AN/ WPL</p> <p>AN/ WPL</p> <p>SPL WPL QUA</p> | <p>SPL</p> <p>SPL</p> <p>SPL</p> <p></p> <p>SPL</p> <p>SPL</p> <p>SPL</p> | <p>QUA</p> <p>QUA</p> <p>QUA AN</p> <p>QUA</p> <p>QUA</p> <p>QUA</p> | <p></p> <p></p> <p></p> <p>WPL</p> <p></p> <p></p> <p>EKM IOP AN QUA</p> |

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6 Legal Requirements and Applicable Standards

For GSI and FAIR the general requirements for health, safety and environmental protection apply. As well as applicable documents mentioned in the contract, GS, DS, etc.

7 Other Applicable Documents

- F-GS-E-05e General Technical Specifications for Experiments
- F-GS-PMO-en General Specification for the Accelerator
- F-VA-QUA-en-0003 Control of Documents
- F-VA-QUA-en-0004 Control of Records
- F-VA-QUA-en-0006 Design Reviews
- F-VA-QUA-en-0022 Acquisition and Monitoring of Test Equipment
- F-VA-QUA-en-0030 Dealing with Non-conformities
- F-VA-QUA-en-0031 Capability of Test equipment
- F-VA-CMD-en-0011 Change Management
- F-FO-QUA-bl-0002 Template for Acceptance Record
- F-FO-QUA-bl-Template_Inspection_Plan_Results Template for an Inspection Plan
- F-FO-QUA-en-0010 Template for a Test Instruction
- F-FO-QUA-bl-0013 Template for a List of Required Documents
- „Betriebsordnung für die Beschleuniger und Experimentiereinrichtungen der GSI“ in Intranet
- All documents listed as applicable in the contract or order, respectively
- Applicable standards and legal regulations, also if not mentioned explicitly in the contract or order (in this matter, see DIN EN ISO 9001 and DGUV Information 202-002 as well)