Quality Assurance Procedure

DOCUMENTS AND PARAMETERS PROCESS AND CONTROL

Abstract
This document describes the procedures and responsibilities involved in the preparation, review, approval, release and revision of the LHC Project parameters and documents relating to management, quality assurance, engineering, contracting, fabrication, assembly, test, installation, operations and maintenance.

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## History of Changes

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1. PURPOSE

To provide a procedure for the preparation, verification, review and approval, release and revision of LHC Project configuration parameters and documents, and to identify further detailed documents covering specific aspects of the document handling process.

2. SCOPE

The procedure is applicable to all parameters and documents that are either part of the LHC configuration baseline, or closely related to the baseline, and relevant to the following Project activities:

- Management.
- Quality assurance.
- Engineering.
- Contracting.
- Fabrication, Assembly, Test, Installation.
- Operations, Maintenance.

The detailed list of documents to which the procedure is applicable is found in "Document Types and Naming Conventions" [ 1 ].

This document does not apply to LHC Project Reports and LHC Project Notes or to engineering drawings.

LHC Project Reports and LHC Project Notes give important conceptual and background information about the LHC, and can be mentioned for reference, but they are not part of the LHC baseline.

Engineering drawings are covered by the document "Drawing Management and Control" [ 2 ].

3. POLICY

The present document handling policy is based on and details the policy defined in "Quality Assurance Policy and Project Organisation" [ 3 ].

The LHC document handling policy aims to ensure that:

- All documents and parameters that are part of the LHC configuration baseline are managed and controlled.
- The processes and tools used for the document handling are documented and supported.
- Common procedures and tools are established where necessary to facilitate communication between the teams involved in the LHC construction process, and to ensure an economic use of resources.
- All baseline parameters and documents are made available to all personnel involved in the Project at the appropriate time.

These objectives are implemented by meeting the following requirements:

- Documents shall be uniquely identified, with structured ‘human readable’ document numbers and ‘computer readable’ identifiers as described in "Document Types and Naming Conventions" [ 1 ].
- Documents shall have a standardised layout, supported by the use of templates.
Documents shall be registered and released in the Engineering Data Management System (EDMS) of the Project, and be accessible via the World Wide Web (WWW) interface of this system.

Document electronic files shall be stored in a controlled way, ensuring documented storage structures and responsibility assignments.

New and updated documents and parameters shall be approved at appropriate levels before being included in the LHC configuration baseline.

Documents and parameters released to the baseline shall only be changed according to a defined procedure.

The implementation of the above policy is described in a set of documents covering document handling for LHC. In addition to the present procedure, these documents are in particular:

- "Document Types and Naming Conventions" [1]
- "Document Standards"[4]

4. ROLES AND RESPONSIBILITIES

Managers and supervisors at CERN, Institutes and Contractors shall ascertain that personnel affected to the preparation, verification, review and approval, and changes to documents are aware of and understand the procedures described in the present document.

The LHC Project organisation is described in "Quality Assurance Policy and Project Organisation" [3]. The following roles are involved with document handling in various ways:

- Authors.
- Editors.
- Controllers.
- LHC approval groups.
- LHC Project Committees.

Each of these roles is further elaborated in the following sections.

Responsibilities relating to the handling of parameters are presented in chapter 7.

4.1 DOCUMENT AUTHORS

Document authors are individuals with the technical knowledge to define the contents of documents. Their responsibilities relating to document handling are:

- To prepare the structure and contents of documents.
- To classify documents as project or group level document.
- To submit the documents for review at appropriate level, and ensure subsequent necessary updates.
- To ensure consistency between the document contents and the current LHC baseline.
- To manage document changes in accordance with "Configuration Management-Change Process and Control" [6].
4.2 DOCUMENT EDITORS

The editors of documents, usually qualified secretaries, are involved with the layout and administrative handling of the documents. Their responsibilities relating to document handling are:

- To lay out documents in accordance with the appropriate standard, using the relevant templates, or checking the document layout if it has been set up by the author.
- To verify that referenced and annexed documents, in particular engineering drawings, have been properly approved and released.
- To ensure the correct identification of documents as described in "Document Types and Naming Conventions" [1].
- To register documents in the EDMS.
- To prepare on-line copies.
- To store electronic document native files and on-line copies in the EDMS.
- To update documents with the appropriate signatures when approved.
- To update document status in the EDMS.

When necessary these tasks are carried out with the assistance of the LHC baseline administrator.

4.3 DOCUMENT CONTROLLERS

Controllers are individuals in charge of a Project organisational unit, or in charge of an LHC work package. Their responsibilities regarding document handling are:

- To verify and give the release authorisation of group level documents.
- To verify project level documents before they are submitted for review and approval to the relevant approval group or project committee.

In the case of a conflict between two or more groups involved in the production of one document, the relevant Project Committee shall assign the responsibilities.

4.4 LHC APPROVAL GROUPS

Approval groups are made up of individuals in charge of physically or logically interrelated LHC systems, sub-systems or assemblies. They may include individuals without executive responsibilities in the Project but with expertise in a specific domain.

An approval group leader, usually designated by the Chairman of a Project Committee manages approval groups.

Approval group leaders have the following responsibilities:

- To manage the group's membership.
- To assist document authors in selecting documents to be submitted to the group for review and approval.
- To evaluate the comments made by group members, deciding on the approval or rejection of reviewed documents.
- To authorise minor corrections, based on the comments of group members, prior to the release of documents submitted for review.

Approval group members have the following responsibilities:

- To review documents and give written and timely comments to the approval group leader.
4.5 LHC PROJECT COMMITTEES

The LHC Project Committees have the following responsibilities concerning document handling:

- To assign approval groups, their leaders and members.
- To review and approve project level documents and parameters submitted to them.
- To ensure a consistent LHC baseline, i.e. that all documents and parameters released to the baseline are consistent with each other.
- To resolve conflicts in cases of parameter or document handling implicating more than one organisational unit.

5. DOCUMENT AND PARAMETER MANAGEMENT OVERVIEW

5.1 ENGINEERING DATA MANAGEMENT SYSTEM OVERVIEW

In order to maintain control and to ensure an adequate level of support with limited resources it is necessary to have a defined and limited set of tools used for document preparation, review and approval, viewing, printing and maintenance.

The LHC Project uses an Engineering Data Management System (EDMS) to manage all the official technical information and documentation related to the Project (see figure 1).

This system provides users with a single view of the Project documentation while in fact there are several databases and applications assembled together using WWW interface technology. The underlying database system used is Oracle \(^1\), the official database system of CERN. The three principal software application programs used to manage the Project documentation in EDMS are:

- CADIM/EDB \(^2\), a commercial EDMS.
- The CERN Drawing Directory \([7]\).
- A specific Oracle application used to manage LHC main parameters, and system and sub-system parameters.

The EDMS manages LHC structures to which all the different types of documents and parameters used to define, manufacture, install and maintain the LHC are attached. The structures can be navigated either with the native CADIM/EDB interface or with the TuoviWDM \(^3\) WWW interface. More information on TuoviWDM can be found on the WWW, see \([8]\).

5.1.1 CADIM/EDB

The CADIM/EDB application provides tools to store and retrieve technical information about the Project in a structured fashion.

The following documents are all stored in this system:
- Schedules.
- Minutes of LHC Project Committee meetings and other co-ordination meetings.
- Project Organisation Charts.
- Quality Assurance documents, including templates.
- Technical Illustrations.

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\(^1\) ORACLE is a registered trademark of Oracle Corporation  
\(^2\) CADIM/EDB is a registered trademark of Eigner and Partner GmbH  
\(^3\) TuoviWDM is a Helsinki Institute of Physics-CERN joint venture project
5.1.2 CERN DRAWING DIRECTORY

CDD is a CERN-built Oracle application with a WWW interface, used to manage CERN's drawing repository. It is described in the "CDD Manual" [7] and in "Drawing Management and Control" [2].

All the LHC Project engineering drawings are stored in this system.

5.1.3 LHC PARAMETER DATABASE

The main parameters of LHC and its systems and sub-systems main parameters are all stored in an Oracle database. This database is a part of the LHC configuration baseline.

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**Figure 1: Drawings, Documents and Parameters in EDMS**
5.2 DOCUMENTS, DRAWINGS AND PARAMETERS RELATIONSHIP

Released parameters, i.e. parameters that have been reviewed and approved, are available in the parameter database. They may be copied from the parameter database into engineering drawings and documents. When a parameter value is updated in the database, the value used in a document or drawing becomes obsolete. As it would not be practical to update all drawings and documents whenever a parameter value is changed, it must be understood that the actual, up-to-date value of all parameters is to be found in the parameter database. This should be clearly indicated in documents and drawings where appropriate.

The situation is similar for engineering drawings referenced in documents. If the intention of the document is to direct the reader to the latest up-to-date revision of the drawing, the reference should be made to the drawing number without the revision index.

On the contrary, if the document is intended for the procurement or manufacture of an item, the reference should be made to the exact revision of the drawing.

![Diagram showing the relationship between engineering specifications, engineering drawings, EDMS, CDD, CADIM, EDB, and PARAM DB.](image)

**Figure 2: Documents, Drawings and Parameters Relationship**

5.3 DOCUMENT PREPARATION TOOLS AND PLATFORMS

The computer platforms and applications used for preparing LHC documents are described in "Document Standards" [4].
5.4 DOCUMENT FORMATS

Documents are stored in two different electronic formats:
- **Native files** are those created with a text processing application and editable with this application, for example MSWord.
- **On-line copies** are derived from the native files and are suitable for viewing and printing on a variety of computer platforms. They cannot be edited.

More details about document formats are presented in “Document Standards” [4].

6. DOCUMENT HANDLING PROCESS

6.1 CLASSIFICATION OF DOCUMENT

All documents are classified as being either **project level** documents, or **group level** documents.

This classification has an impact on the review and approval process applicable documents.

Documents shall be classified as either project level or group level documents by the author(s) based on the criteria given in sections 6.1.1 and 6.1.2.

In case of classification difficulties, the Group leader of the author(s) shall decide which document level is applicable.

6.1.1 PROJECT LEVEL DOCUMENTS

**Project level** documents are those documents containing information of general interest for the LHC project activities.
- All documents concerning the LHC performance.
- All documents describing principal items and parent items of principal items in the LHC product breakdown structure (PBS).

6.1.2 GROUP LEVEL DOCUMENTS

Group level documents and parameters are those documents and parameters containing information on a single LHC system, sub-system, assembly or part, placed under the sole responsibility of an organisational unit such as a CERN group, and with no interface to other systems, sub-systems, assemblies or parts.

6.2 DOCUMENT PREPARATION

The document handling process, from preparation to approval, is illustrated in figure 3. The steps of the process are detailed in the following sections.
Figure 3: Document handling process
6.2.1 DOCUMENT STRUCTURE AND CONTENTS
The structure and contents of new documents shall be supplied by the author. This may be done using the appropriate word-processing template, or the contents can be supplied to the document editor as unformatted text, tables and so on, to be put in the appropriate format by the editor.
In both cases the document structure provided by the template should be taken into consideration by the author.

6.2.2 DRAFT PREPARATION
Once the structure and contents are ready, the document can be laid out by the editor. The editor shall take care to ensure that:
- The document is prepared with an approved computer application as described in "Document Standards" [4].
- The document is based on an approved template.
- The front page is completed with the appropriate identification information.
- The document change history is documented.
To achieve an adequate level of quality and to guarantee the long-term maintainability of documents, it is highly recommended that document's editing is delegated to qualified professional secretaries.

6.2.3 AUTHOR'S REVIEW
The editor shall forward the draft to the author to be reviewed. The review shall ascertain that the document is complete, that it describes what was intended, and that it conforms to the appropriate document standard. This is an informal review and corrections do not need to be documented.

6.2.4 DOCUMENT REGISTRATION IN EDMS
When ready the document shall be registered in the EDMS system by the editor. Documents are registered by entering the document's descriptive data into the EDMS. Based on the chosen equipment code and document type, see [1], the EDMS will return a full document name and an EDMS number. Both name and number shall be entered on the document in the appropriate locations as indicated by the template.
At this stage in the document's life cycle, its descriptive data is accessible from the EDMS but not the document itself. The document is given the status "IN WORK".

6.2.5 DOCUMENT STORAGE IN EDMS
When the document is ready for review and proposal the editor shall store the draft version of the document in the EDMS. This is carried out in four steps:
- The preparation of an on-line copy of the document.
- The storage of the native file in the appropriate location.
- The storage of the in-line copy in the appropriate location.
- The change of the document's status to 'UNDER APPROVAL'.

6.3 DOCUMENT REVIEW AND APPROVAL
All documents are subject to a review and approval process before they are released for distribution.
The review and approval process comprises one or two stages. Each stage of the process is recorded on the document with the name of the person and the date when the operation is carried out.

The review and approval process applicable to a document is dependent on the document's level as follows:

- **Group level documents** shall be submitted to a controller's **verification** prior to their release.
- **Project level documents** shall be submitted to an approval group or **Project Committee review and approval**, in addition to the controller's verification.

### 6.3.1 CONTROLLER'S VERIFICATION

The controller's verification is carried-out by the controller, at the request of the author. The controller shall forward his suggested corrections and comments to the author.

The action following the controller's verification depends on the document level:

- **Group level documents** shall be updated by:
  - adding the controller's signature and the date of verification.
  - changing revision index to 1.0 and removing the **-draft** indication.

The document shall then be released as described in section 6.4.

- **Project level documents** shall be updated by adding the controller's signature and the date of verification.

The document shall then be submitted to the review and approval as described in the next section. In case of difficulties selecting the appropriate approval group, the Technical Coordination Committee can give assistance.

### 6.3.2 PROJECT CO-ORDINATION APPROVAL

The purpose of the project co-ordination approval is to ensure that all parties concerned in any way by what is described in a document are aware of the document's content and are given the opportunity to make comments and to propose changes.

In this process the document is reviewed by a number of **approval group members**. They shall forward their comments to the **approval leader** whose task it is to evaluate the comments, and take the final decision to approve or reject the document.

It is understood that approval group members, who do not submit any comments within the time set for the approval, are deemed to have accepted the document without comments.

The project co-ordination approval is started by the approval group leader at the request the author.

At the end of the time set for the review, the approval group leader shall decide take the decision to:

- Release the document with no changes.
- Release the document with minor corrections.
- Reject the document.

Minor corrections, such as the correction of transcription errors, can be made to the document, under the responsibility of the approval group leader.

In case major corrections are required the approval group leader shall send the document back to its author with a summary description of the changes required.

In case the document is rejected, the approval group leader shall notify the author and the controller of the reasons for the rejection.
When reviewing and approving documents, special attention shall be given to ensuring consistency between the document contents and the current LHC baseline.

Once approved project level document shall proceed to the release process described in the next section.

6.4 DOCUMENT RELEASE

The document release process is the set of actions required to make a document available to everyone in the EDMS. The process is shown in figure 4 and the detailed steps are described below.

- Prepare the document's on-line copy.
- Store the on-line copy in the EDMS.
- Update the document status to "RELEASED".
- Delete draft versions from the EDMS.

Figure 4: Document Release Process

7. PARAMETERS HANDLING PROCESS

7.1 RESPONSIBILITIES

The Parameter and Layout Committee has the overall responsibility to review and approve all project level parameters.
7.2 PARAMETERS CLASSIFICATION

Parameters shall be selected and classified as either project level or group level parameters by the Parameter and Layout Committee (PLC) Chairman, in collaboration with the appropriate groups.

7.2.1 PROJECT LEVEL PARAMETERS

The Project level parameters are:

1. All the main parameters defining the LHC and the injector chain layouts and beam performance.
2. All the LHC systems parameters that have an effect on the LHC performance.
3. All the LHC systems parameters which may affect the LHC performance through indirectly induced changes on other systems.

These definitions apply to the following LHC systems:

- Magnet.
- Cryogenic.
- Powering.
- Vacuum.
- Survey.
- Beam losses and cleaning.
- RF and feedback.
- Injection and transfer lines.
- Ejection and dump.
- Instrumentation and controls.

7.2.2 GROUP LEVEL PARAMETERS

Group level parameters are all the parameters of the LHC systems and sub-systems that relate to the design of these systems and sub-systems and have no effect on the LHC performance or on other systems.

7.3 PARAMETER DEFINITION

The group in charge of the system or sub-system to which the parameters belong shall define parameters in a project level or group level document, typically an engineering specification or an engineering drawing.

7.4 PARAMETER REVIEW AND APPROVAL

The review and approval process applicable to parameters is similar to the review and approval process of documents. It is dependent on the parameter classification level:

**Group level parameters** shall be verified by the group leader charge of the system or sub-system to which the parameters belong.

**Project level parameters** shall be reviewed and approved by the Parameter and Layout Committee in addition to the group leader verification. The result of the review and approval shall be documented in the PLC minutes.
7.5 PARAMETER RELEASE

Once approved, parameters shall be made available in the Parameter and Layout Committee WWW pages.
No information shall be extracted from any document or database and presented as an official LHC configuration parameter without informing the author of the document or database.

7.6 PARAMETER CHANGES

A formal Engineering Change Request (ECR) is required to initiate a modification of a parameter when that parameter has been released and has become an official LHC configuration parameter. The ECR shall be prepared and processed in accordance with the "Configuration Management- Change Process and Control" [6].

8. ANNEXES

A1 Overview of document verification, review and approval

9. RELATED DOCUMENTATION

[1] LHC-PM-QA-202.00 Document Types and Naming Conventions
[2] LHC-PM-QA-305.00 Drawing Management and Control
[3] LHC-PM-QA-100.00 Quality Assurance Policy and Project Organisation
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### Annex A1: Overview of Document Verification, Review and Approval

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<tr>
<td>Minutes of meetings</td>
<td>PE in charge of the equipment</td>
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