



Organisation Européenne pour la Recherche Nucléaire  
European Organization for Nuclear Research

Laboratoire Européen pour la Physique des Particules  
European Laboratory for Particle Physics



# CERN SAFETY REQUIREMENTS FOR PRESSURE EQUIPMENT

# Topics

CERN Safety requirements for SC Cavities and CryoModules:

- CERN Rules - Mechanical Safety
- European Pressure Directive
- Harmonised Standards
- MoU: CERN - International Collaborations

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# Safety Rules for the Domain of Mechanical Safety

The objective of CERN Safety Rules is to ensure a high level of Safety commensurate with relevant Safety practice in Europe.

CERN Safety rules take into account the intergovernmental status of the Organization and apply throughout its site.

**SAPOCO 42:** defines the Organization's policy concerning all aspects of Safety:

- 1) occupational health and safety,
- 2) environmental protection,
- 3) safety of equipment and installations,
- 4) operational safety.

# Safety Regulation SR-M Mechanical Equipment

This Safety Regulation defines *standard equipment* and *special equipment*.

It lists the binding general requirements for mechanical equipment during its life-cycle, from design to decommissioning.

**“standard equipment”** : mechanical equipment, not considered of high Safety relevance, falling within the scope of the applicable European Directives and which, due to its designated function, can comply with them.

**“special equipment”** : mechanical equipment which, due to its designated function, cannot comply with European Directives; standard mechanical equipment classified by the Department as equipment of high Safety relevance.

# GSI-M3 Special Mechanical Equipment

## *2.1.2 Design assumptions, safety factors and references*

All main design assumptions, including choice of the safety factors, must be fully described and justified in a [design report](#), together with the results of the calculations.

Whenever applicable, existing Codes or Standards must be used.

Should complementary measures during fabrication or testing be needed, they must be described in the design report.

## *3.1 Initial inspection and test*

Prior to its first use special mechanical equipment must be inspected and tested according to the inspection and testing program defined in the design report and agreed upon with the Safety Commission.

# GSI-M3 Special Mechanical Equipment

## *Design report (list non-exhaustive):*

1. Risk assessment (mechanical hazards, cryogenic hazards and oxygen deficiency hazard)
2. Conceptual design and manufacturing drawing and diagrams of components, sub-assemblies, circuits, etc
3. Results of design calculations made, examinations carried out (visual, welds, pressure tests, leak testing, etc)
4. P.I.D (Process and Instrumentation drawings)
5. Material certificates
6. Welding procedures and welders qualification according to EN
7. Calculations for dimensioning safety valves. The safety devices shall be CE certified according to the PED 97/23/EC, category IV (accepted by a Notified Body).

# GSI-M2 Standard Pressure Equipment

## *8. Safety File*

The Department must prepare and update a Safety File. The Safety File is kept by the Department, and made available to the Safety Commission upon request.

The Safety File shall contain, at least:

- risk assessment;

- technical specifications;

- documents and certificates related to the procurement of the equipment;

- certificate of commissioning and authorization to put the equipment into service;

- operating procedures and instructions;

- periodic inspections and maintenance programs;

- records of executed inspections and maintenance;

- records of possible operation stoppages due to lack of Safety;

- Specific Safety Instructions if applicable.

# Pressure Equipment Directive 97/23/EC

The directive is under effect since 29 November 1999, for:

- Design
- Manufacturing
- Evaluation of the conformity of equipment and assemblies designed to contain fluids, gas or liquid.

The purpose of the directive is to ensure that the equipment is safe and is designed and constructed so that it can be used, adjusted and maintained throughout all phases of its life without putting persons at risk.



# Pressure Equipment Directive 97/23/EC

The manufacturer of the equipment evaluates the risks according to :

## The type of equipment or assemblies

- Vessels
- Generators
- Piping

## The physical nature of the contained fluid:

- Gas
- Vapor or high pressure hot water
- Liquid

## The level of danger of the contained fluid:

- Group 1: dangerous fluids
- Group 2: other fluids

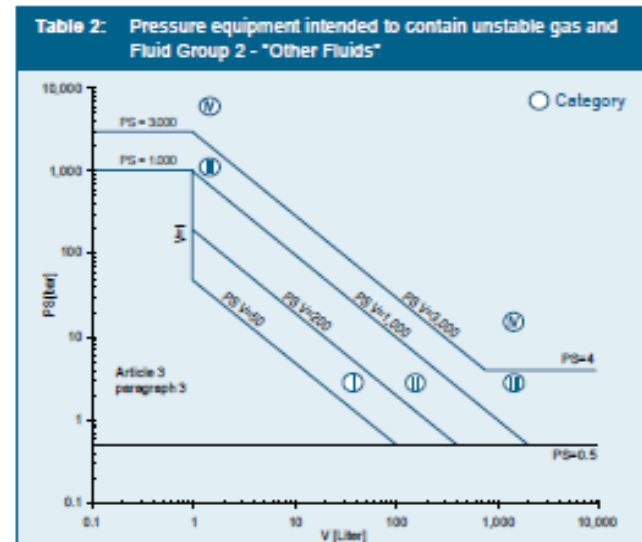
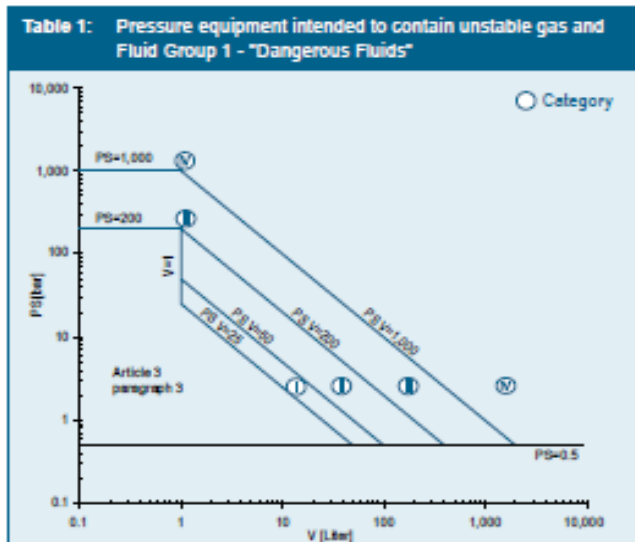
## The equipment's service features:

- Pressure and volume
- Nominal size (piping)
- Product: service pressure x volume (in bar/l)
- Temperature greater than 110 °C

# Pressure Equipment Directive 97/23/EC

Following the risk evaluation, the manufacturer then classifies the equipment in a risk category from I to IV (I for the least risk).

## Annex II:



Evaluation of conformity is then made according to different modules defined in **Annex III** of the PED.

# Harmonised Standards

The Directives set out the ESHR's (Essential Safety Health Requirements) written in general terms.



The harmonized standards define the technical specifications that a manufacturer must follow to be in conformity with the corresponding ESHR of the Directive.

They represent European technical convergence and understanding.

Harmonised standards are not mandatory, however their application provides presumption of conformity to the European Directives.

In general, the "old" codes (AD- Merkbblätter, CODAP, ASME, etc.) remain in place as design codes.

However, in addition to the code requirements, all ESR's of the PED must also be satisfied.

This means that any of these design codes may be used as a design basis anywhere within the EU, provided that the requirements of the PED for ESR's and fabrication are met.

# Harmonised Standards with PED 97/23/EC

Pressure equipment	Harmonized standard meeting requirements of Directive 97/23/EC
Unfired pressure vessels	EN 13445 Unfired pressure vessels
Metallic industrial piping	EN 13480 Metallic industrial piping
Cryogenic vessels	EN 13458 Cryogenic vessels. Static vacuum insulated vessels. Design, fabrication, inspection and testing
Safety devices for protection against pressure	EN 13648 Safety

<http://www.newapproach.org/Directives/Default.asp>

Harmonised Standards are typically structured as follows:

Part 1: General

Part 2: Materials

Part 3: Design and calculation

Part 4: Fabrication and installation

Part 5: Inspection and testing

Part 6: Additional requirements for specific situations

# Design Requirements

## Pressure Test:

- The standard proof test is the hydrostatic pressure test.
- If this is not practical, it may be substituted by a pneumatic test.

The test pressure must be no less than the maximum allowable pressure multiplied by the coefficient **1,43x** and sustained for no less than 30 minutes.

## Safety Valves:

Minimum two safety devices (safety valve / rupture disc). Preferably installed on two different ports and preferably of different types (safety valve and rupture disc). Each safety device shall have enough capacity for safe pressure evacuation in a worst case scenario.

*According to : CERN IS 47 & PED 97/23/EC.*

# MoU CERN – International Collaborations

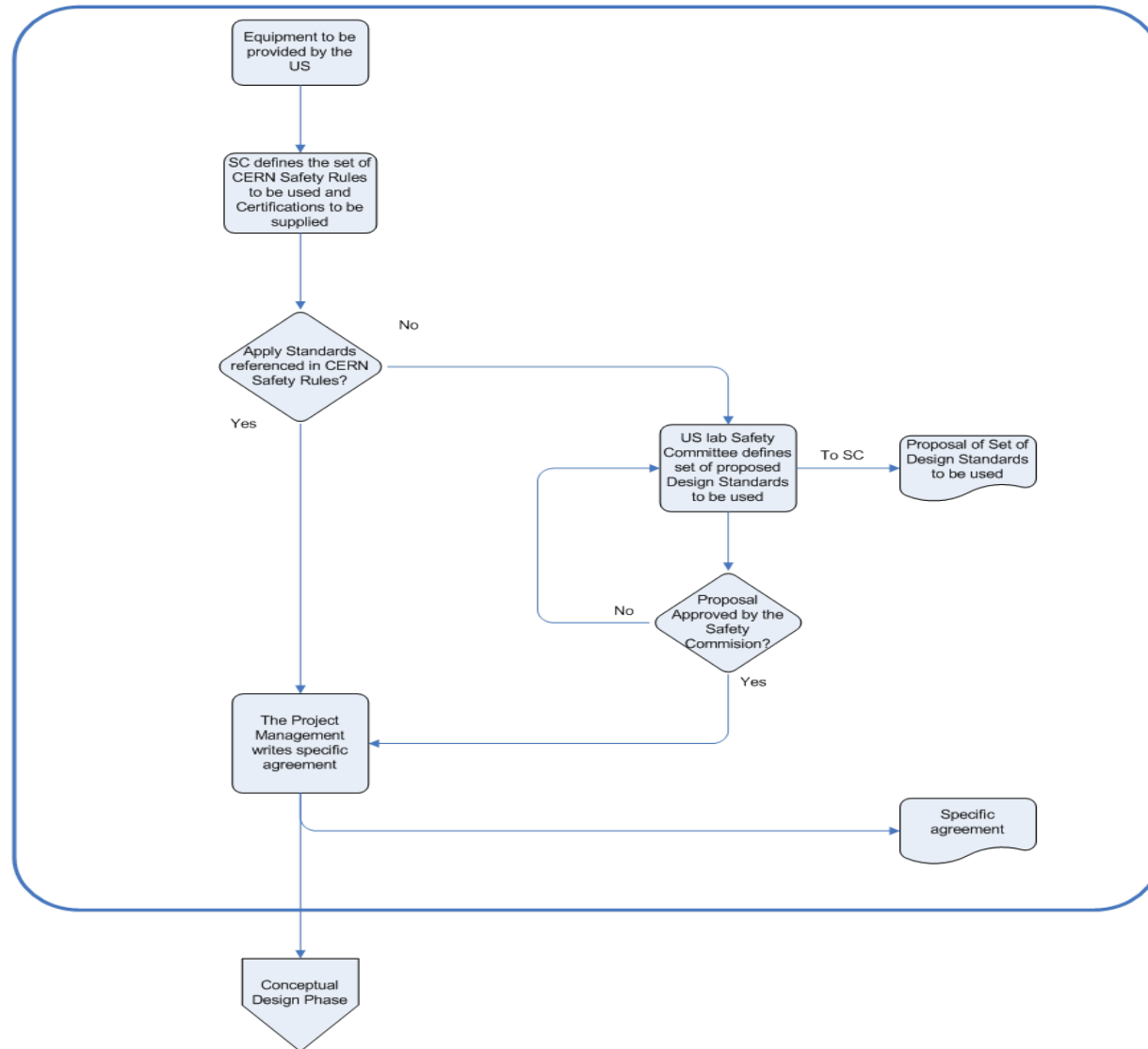
A Memorandum of Understanding is aimed at regulating the interaction between CERN and International Laboratories for what concerns Safety issues of special equipment to be provided by those Labs.

For all equipment to be installed and operated on the CERN site, CERN Safety Rules must be complied with. However, CERN may accept, under certain conditions, that collaborating institutes may use equipment, design standards other than those referenced in CERN Safety Rules.

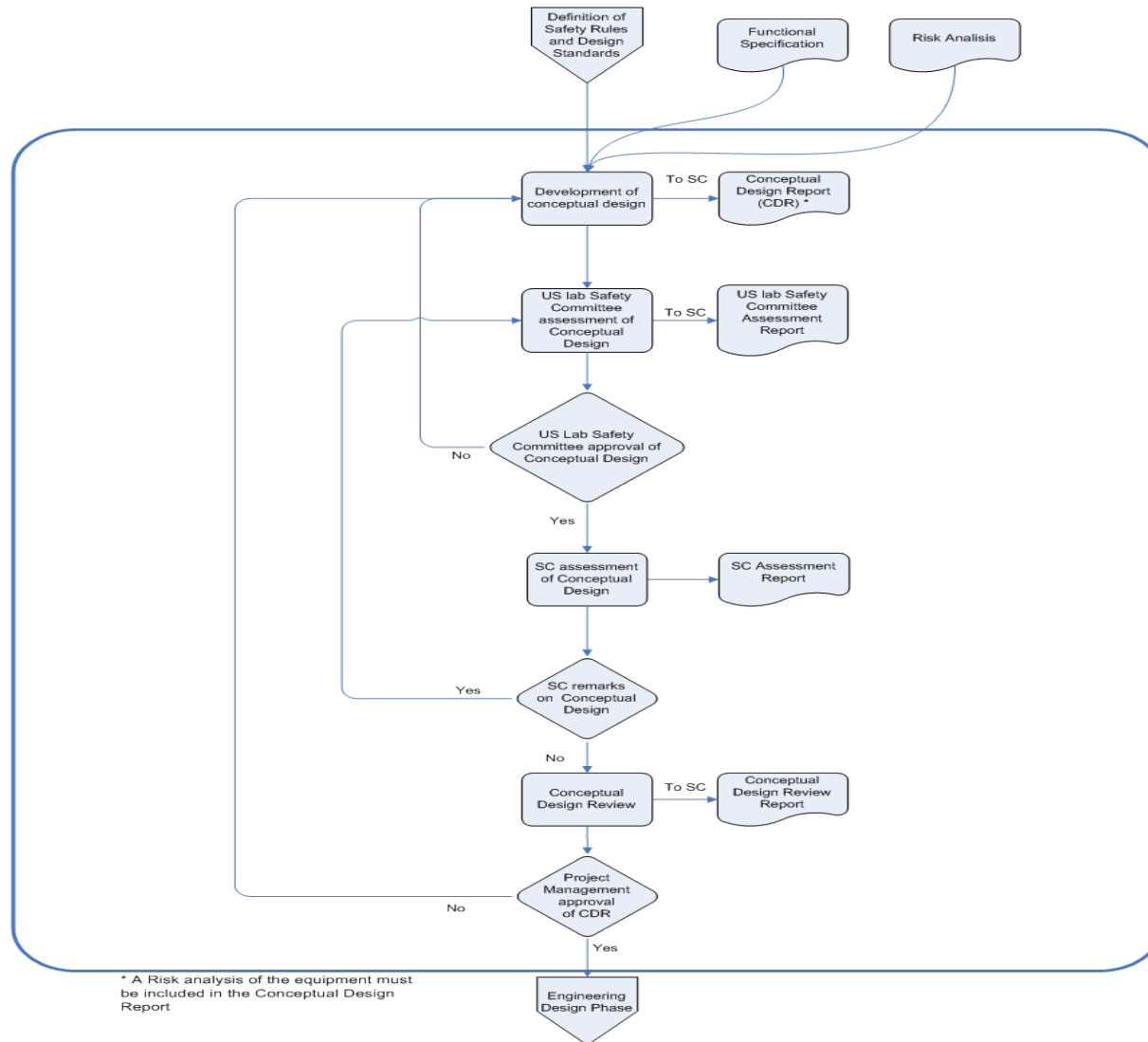
The different phases of the **MoU** are:

- Definition of the set of Safety rules to be used
- Conceptual design
- Engineering design
- Manufacturing design
- Installation and commissioning
- Operation
- Decommissioning

# MoU: Definition of the set of Safety rules to be used

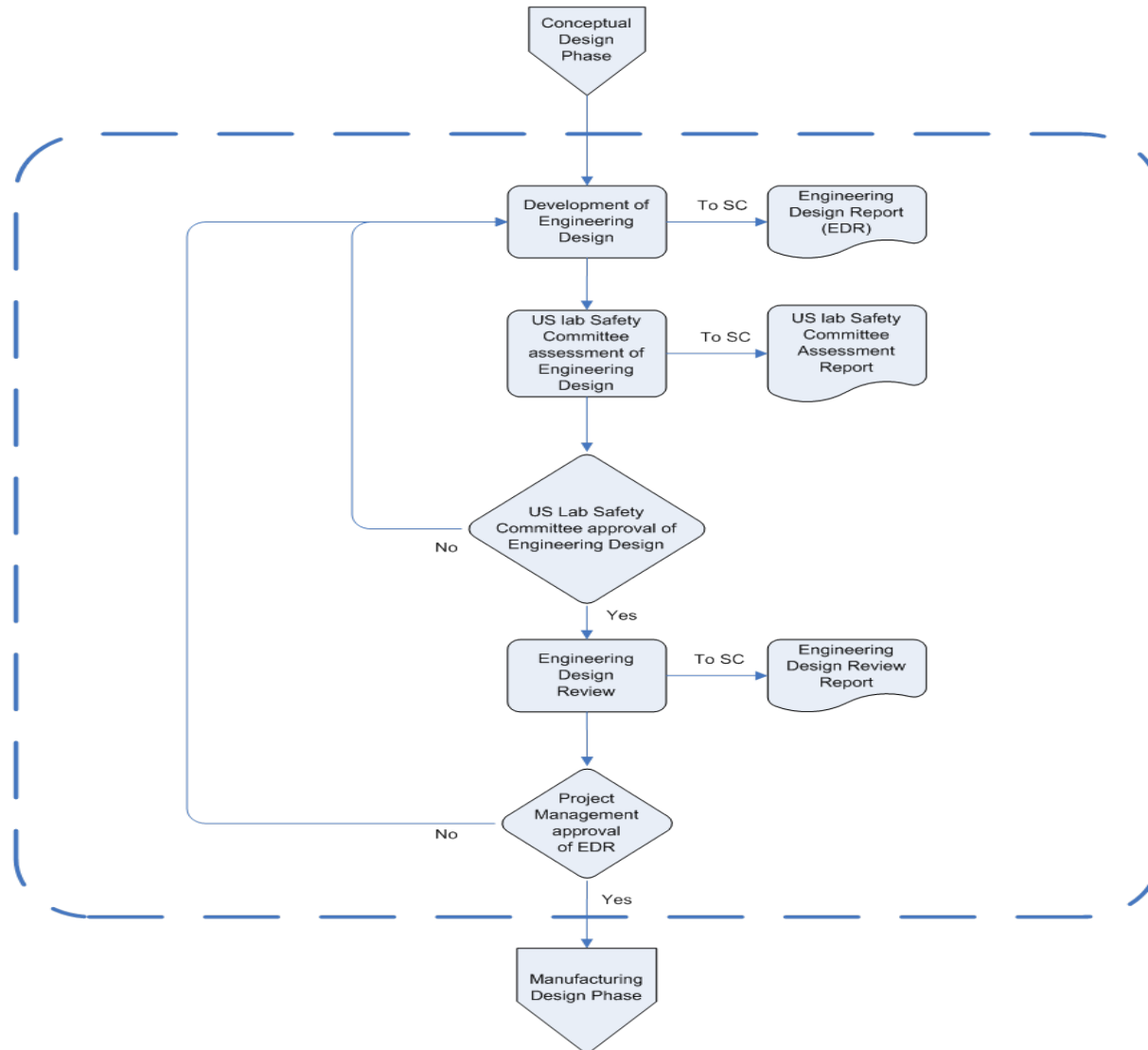


# MoU: Conceptual design phase

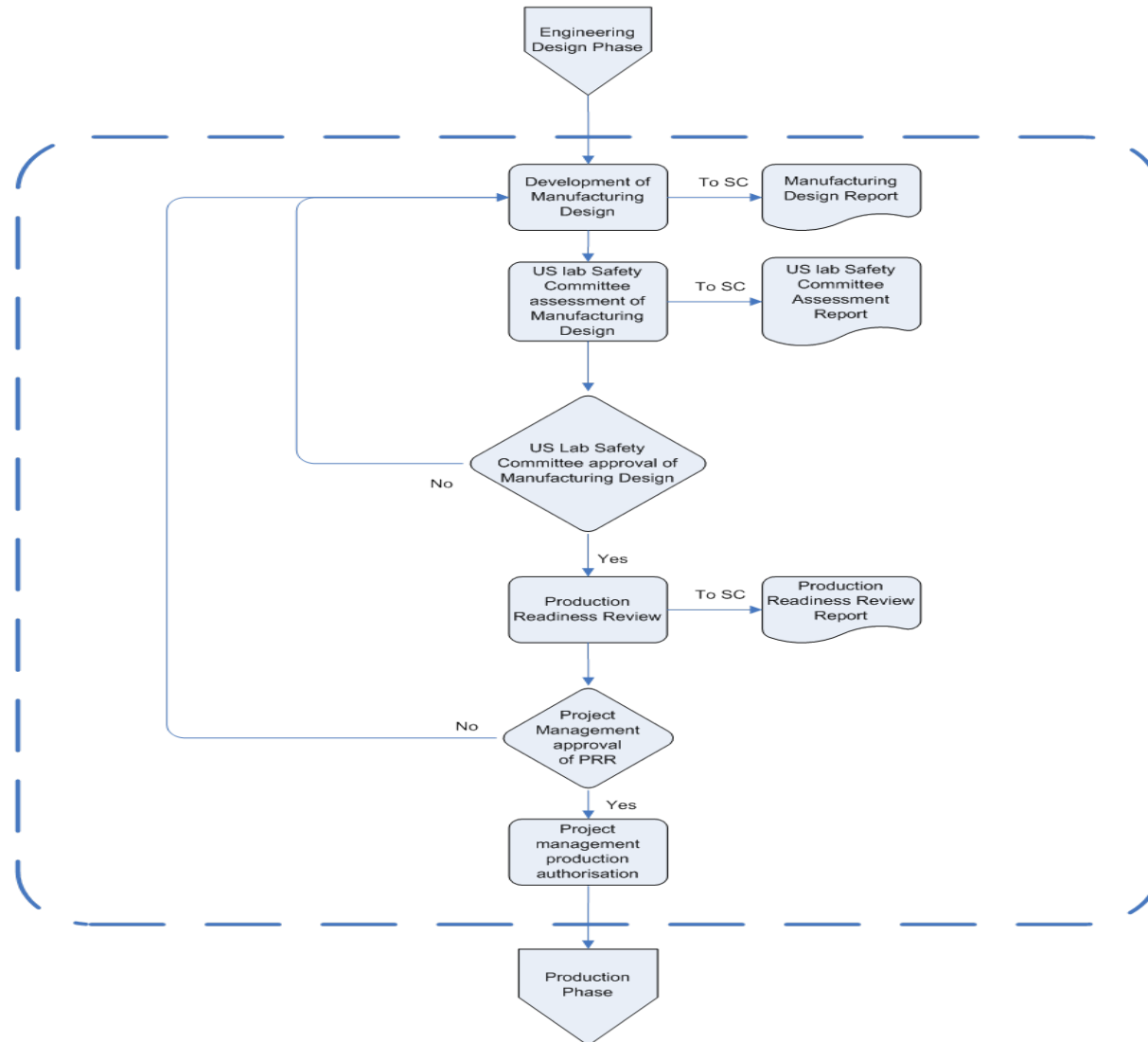




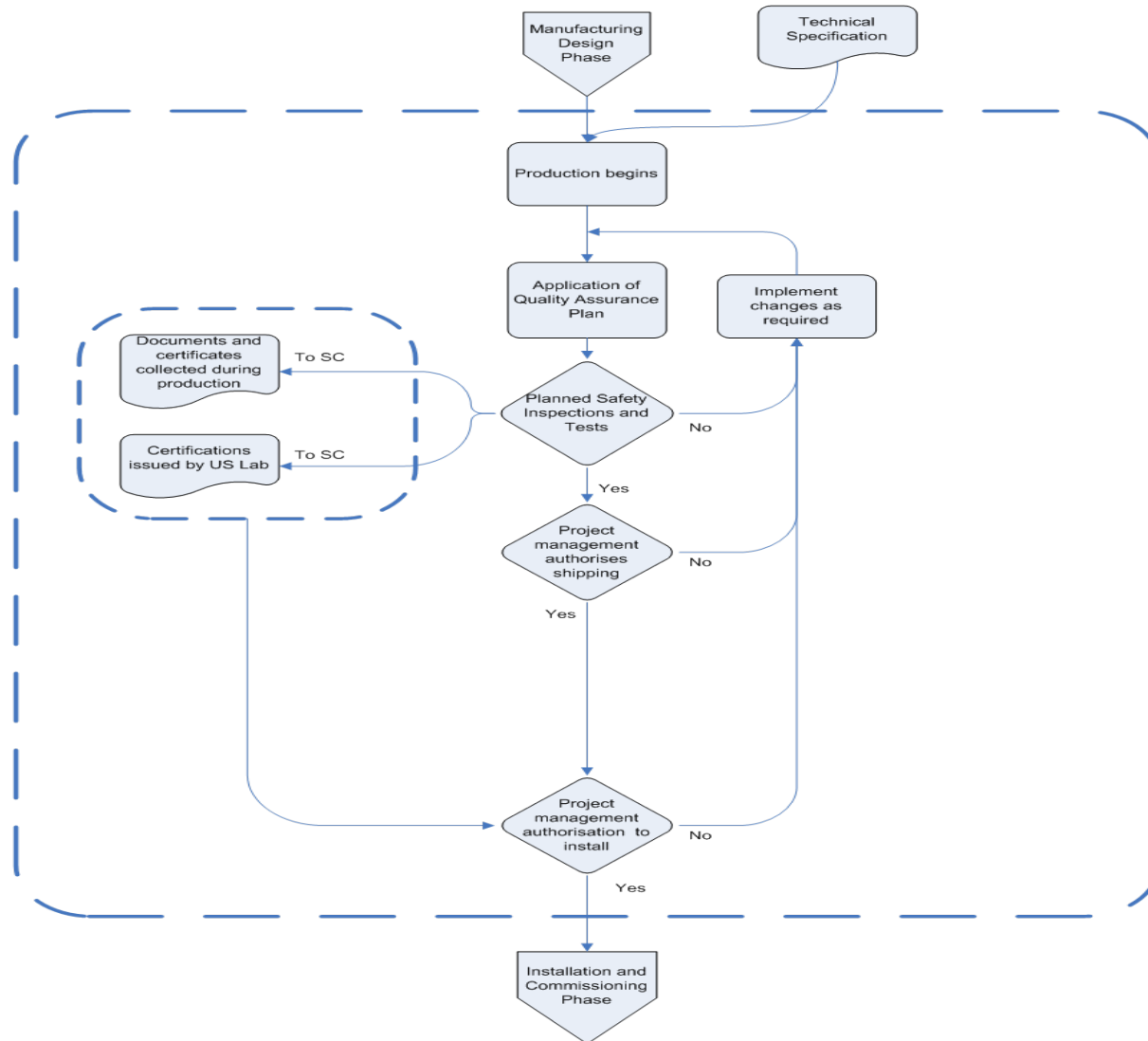
# MoU: Engineering Design Phase



# MoU: Manufacturing Design Phase



# MoU: Production and pre-installation phase



# MoU: Installation and Commissioning phase

