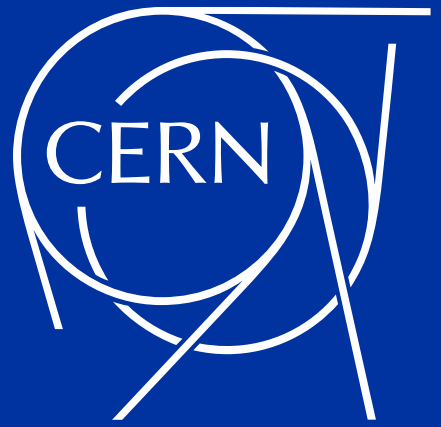


Electrical Safety Project

WP3 - Systems Compliance with Standards

L. SCIBILE and R. SIMPSON for WP3

15-11-2024

Content

- WP3 – Scope, mandate and deliverables
- WP3 – Strategy
- WP3 – Plan
- WP3 – Deliverables
- WP3 – Work to date
- WP3 – East Area Pilot
- WP3 – Resources
- WP3 – Contributor help required
- WP3 – Conclusions

WP3 – Scope, mandate and deliverables

MANDATE:

- Link with the equipment groups, ATS groups & projects to facilitate the application of appropriate standards within the ATS.
- Give support to the process defined by WP2.

SCOPE:

- **Accelerator equipment and installations**:
  - Accelerators complex: injectors, LHC and transfer lines.
  - Experimental areas: EA, NA, ISOLDE/HIE- ISOLDE, CLEAR, NTOF, AD, HiRadMat.
  - ATS projects: HL-LHC, AWAKE, NA-CONS.
  - Machine buildings linked to the accelerators complex.
- Equipment **to be installed/consolidated** in the future (being designed/manufactured).

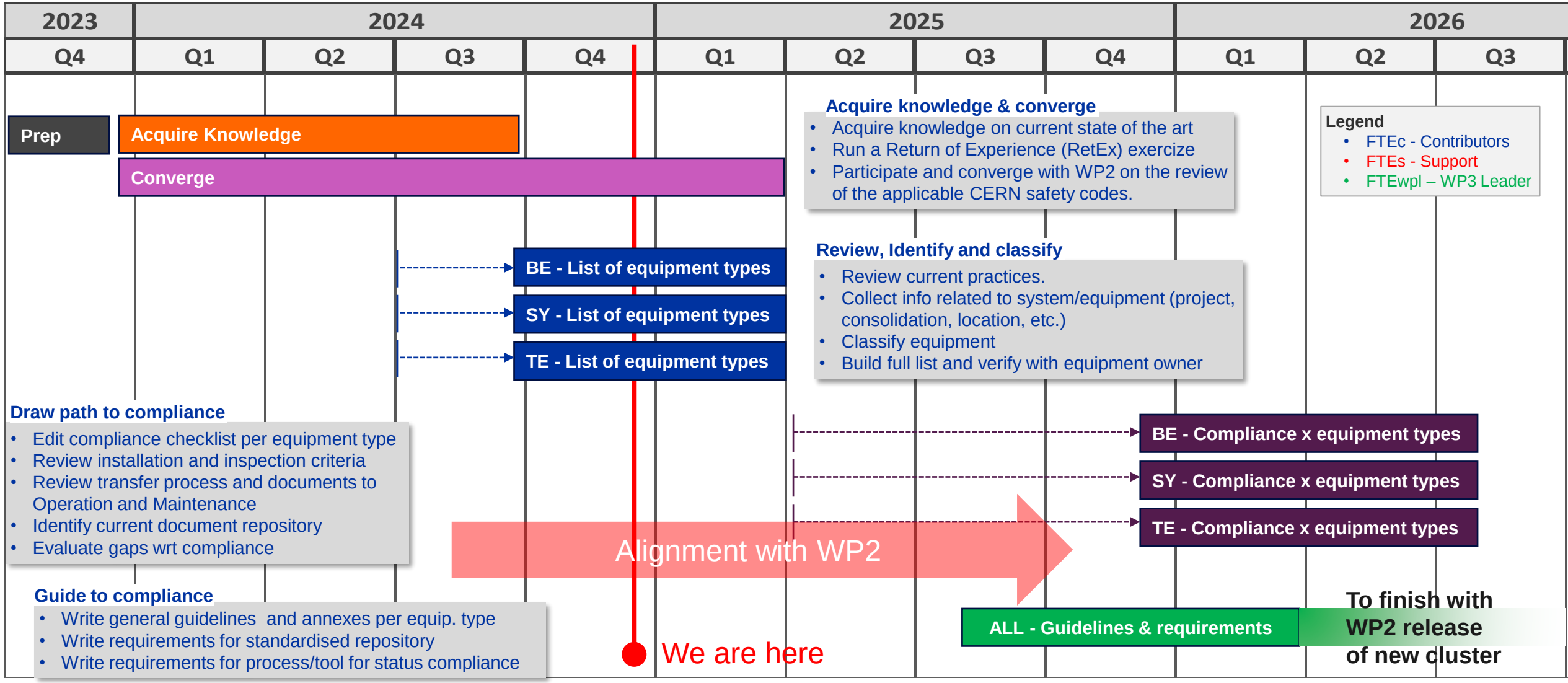
WP3 – Strategy

The aim of the WP3 is to provide the means to achieve Electrical Safety Compliance to all EQUIPMENT and INSTALLATIONS in the accelerator complex.

This will be done by:

1. **Acquiring knowledge** on current state of the art in Electrical Safety Compliance and **running a Return of Experience (RetEx) exercise** on CERN compliance certification process.
2. **Reviewing** current practices in departments.
3. **Participate and converge** with WP2 on the review of the applicable CERN safety codes.
4. **Editing a guideline to compliance for EQUIPMENT and INSTALLATIONS**
5. **Providing requirements** for a **standardised repository** for the compliance documentation to WP6.
6. **Providing requirements** for a **system/tool** that allows to retrieve the “compliance” status to WP6.

ESP WP3 Plan – Update Nov-2024



Deliverables

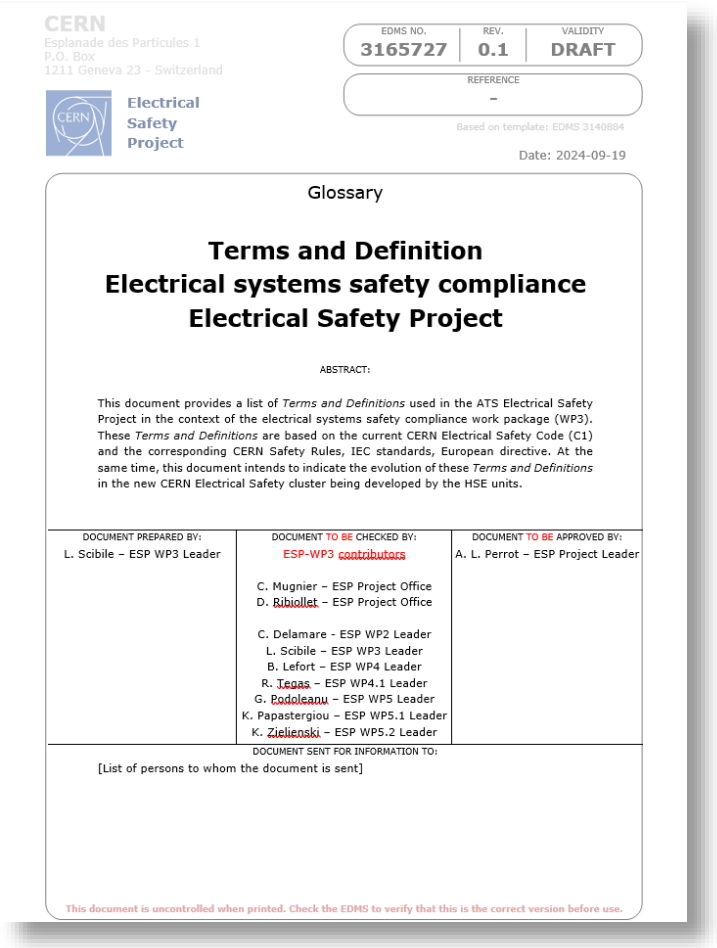
2024

EDMS 3190977	Checklist – **Equipment**	IN WORK (DEC 2024)
EDMS 3190978	Checklist – **Installations**	IN WORK (DEC 2024)
EDMS 3165727	Terms and Definitions	INTERNAL REVIEW

2025

EDMS 3190974	Guidelines – **Equipment**	Not started
EDMS 3190975	Guidelines – **Installations**	Not started
TBD	WP6 Requirements– Standardised repository	Not started (Q3 2025)
TBD	WP6 Requirements – Processes and Tools	Not started (Q3 2025)

WP3 - Terms and Definition document



CERN
Esplanade des Particules 1
P.O. Box
1211 Geneva 23 - Switzerland

Electrical Safety Project

EDMS NO.	REV.	VALIDITY
3165727	0.1	DRAFT

REFERENCE
-

Based on template: EDMS 3140884

Date: 2024-09-19

Glossary

Terms and Definition
Electrical systems safety compliance
Electrical Safety Project

ABSTRACT:

This document provides a list of *Terms and Definitions* used in the ATS Electrical Safety Project in the context of the electrical systems safety compliance work package (WP3). These *Terms and Definitions* are based on the current CERN Electrical Safety Code (C1) and the corresponding CERN Safety Rules, IEC standards, European directive. At the same time, this document intends to indicate the evolution of these *Terms and Definitions* in the new CERN Electrical Safety cluster being developed by the HSE units.

DOCUMENT PREPARED BY:	DOCUMENT TO BE CHECKED BY:	DOCUMENT TO BE APPROVED BY:
L. Scibile – ESP WP3 Leader	ESP-WP3 contributors C. Mugnier – ESP Project Office D. Ribiollet – ESP Project Office C. Delamare - ESP WP2 Leader L. Scibile – ESP WP3 Leader B. Lefort – ESP WP4 Leader R. Tegas – ESP WP4.1 Leader G. Podoleanu – ESP WP5 Leader K. Papastergiou – ESP WP5.1 Leader K. Zielienski – ESP WP5.2 Leader	A. L. Perrot – ESP Project Leader

DOCUMENT SENT FOR INFORMATION TO:
[List of persons to whom the document is sent]

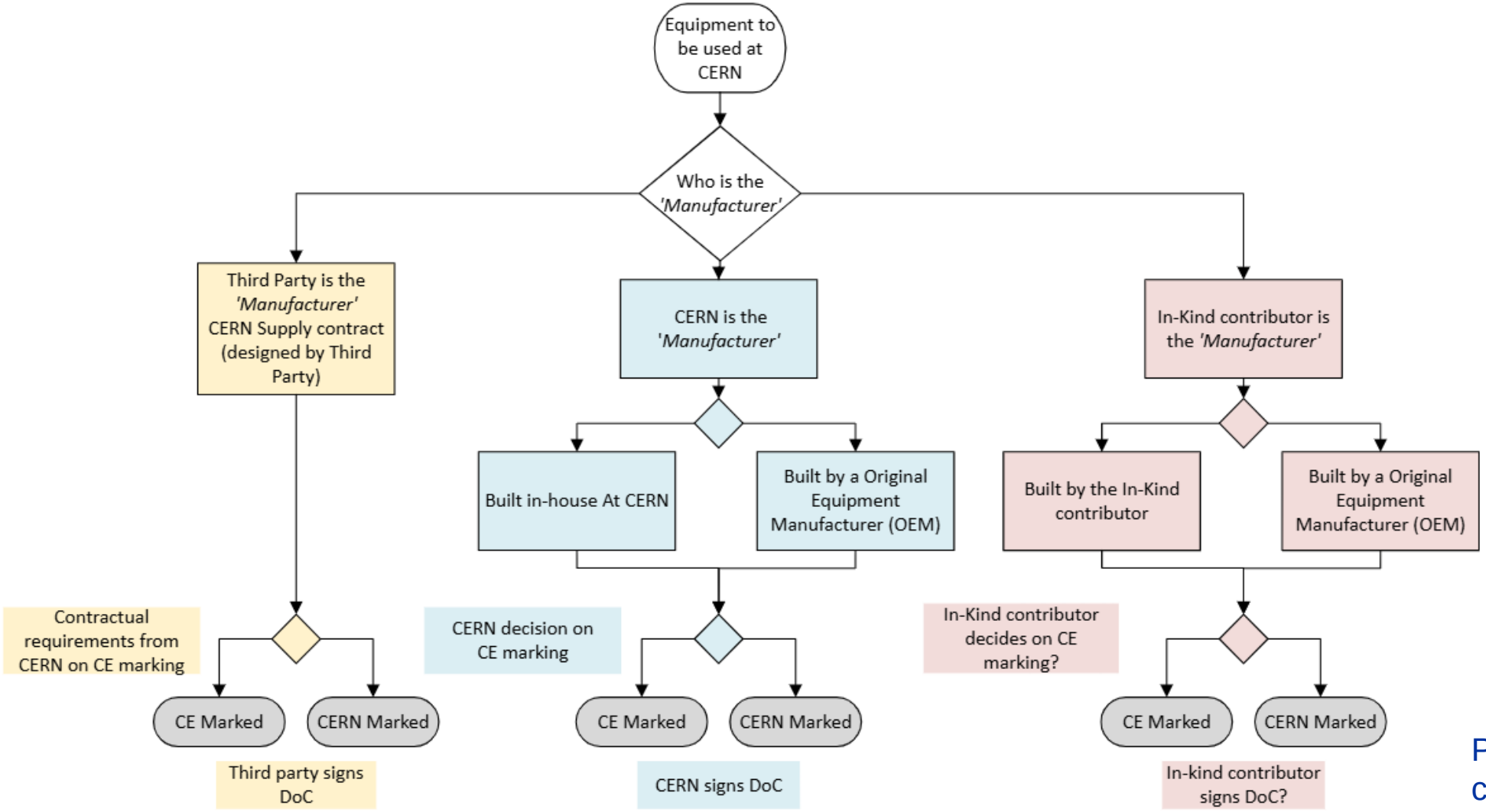
This document is uncontrolled when printed. Check the EDMS to verify that this is the correct version before use.

EDMS 3165727

TABLE OF CONTENTS

1. INTRODUCTION 4
2. TERMS AND DEFINITIONS 4
2.1 Equipment - Electrical ('équipement électrique') 4
2.2 Installation - Electrical ('installation électrique') 4
2.3 Network - Electrical ('réseau électrique') 5
2.4 System ('système') 5
2.5 System Electrical ('système électrique') 5
2.6 Manufacturer as defined in EU directive – or equivalent 5
2.7 Supplier – Original Equipment Manufacturer (OEM) 6
2.8 Declaration of Compliance (DoC) 6
2.9 Standard equipment (electrical) 7
2.10 Non-standard equipment (electrical) 7
2.11 Equipment (electrical) built in-house 8
2.12 In-kind contribution (Electrical equipment) 8
2.13 Self-declaration 8
2.14 Technical file (for Electrical Safety Conformity) 8
2.15 Equipment Manual or instructions 9
2.16 Initial safety inspection 9
2.17 Periodic safety inspection 9
2.18 CE Marking 9
2.19 CERN Marking 9
3. ACRONYMS 10
4. REFERENCES 10

WP3 – System/equipment classification



Presented to WP3 contributors 28/10/2024

Equipment compliant to CERN rules

- General description?
- Instructions & Safety information?
- Risk assesment?
- Calculations?
- Test & inspection reports?
- Standards applied?
- Drawings?

+

DECLARATION OF CONFORMITY

Model: XXXXXX

Standards:

IEC XXXXX

IEC XXXXX

Manufacturers Signature

Presented to WP3 contributors 28/10/2024

Installation compliant to CERN Rules

For all **Equipment**

CE

OR

ELECTRICAL SAFETY COMPLIANT
DATE: DD/MM/YYYY

Operational Instructions (Safety)

Equipment catalogue

Test & Inspection reports

Drawings

Technical file

+

HSE
Occupational Health & Safety and Environmental Protection Unit

Rapport

INSPECTION ELECTRIQUE A LA DEMANDE

BATIMENT 193 ALPHA

LIGNE AIMANT ET RACK

Matériel inspécté dans S-G22:

- Ligne d'aimants A,B,C,D,E

- Equipements installés dans les racks XYAGNE 1, 2, 3, 4, 8, 9 et 10

Page 1 de 6

HSE Initial Inspection?

Attestation de conformité

INSTALLATION:

XXXXXX

Standards:

NF C15-100

Signed for on behalf of CERN

Signature

Presented to WP3 contributors 28/10/2024

Checklist documents – In review

TABLE OF CONTENTS

1. INTRODUCTION 4
2. DOCUMENTS IN THE CHECKLIST 4
2.1 Equipment Description 4
2.2 Instructions and Precautions 5
2.3 Risk Assessment 6
2.4 Calculations 7
2.5 Standards Applied 8
2.6 Assembly Drawing 8
2.7 Circuit Diagram 9
2.8 Declaration of conformity 9
2.9 Test Reports for Quality Assurance 9
2.10 Test Reports for Standards Compliance 10
3. ACRONYMS 10
4. REFERENCES 10
5. ANNEX A : CHECKLIST 10

EDMS 3190977, EDMS 3190978

Presented to WP3 contributors 4/11/2024

Equipment Checklist – In review

Document	Description	Source
Equipment description	Basic description of the equipment, the purpose and general context of the equipment. This should explain the function and operation of the equipment.	LVD (2014/35/EU) Annex III
Instructions and precautions	Instructions for how to use the equipment safely, including safety precautions.	LVD (2014/35/EU) Article 6.7
Risk assessment	An assessment identifying all possible electrical risks and evaluating them with their severity and probability.	LVD 2014/35/EU - Guidelines on the application of the directive - August 2018, page 67 (LVD Annex III)
Calculations	Calculations justifying the design of the equipment, in accordance with standards. E.g., wire guage calculations.	LVD (2014/35/EU) Annex III
Standards applied	A record of the standards used to develop the equipment.	LVD (2014/35/EU) Articles 12,13,14
Assembly drawing	Top level drawing of the equipment.	LVD (2014/35/EU) Annex III
Circuit diagram	Top level circuit diagram of the equipment.	LVD (2014/35/EU) Annex III
Safety justification (if applicable)	Where standards are not available to meet essential safety requirements, engineering justifications must be provided.	LVD (2014/35/EU) Annex III
Declaration of Conformity		LVD (2014/35/EU) Article 15
Test reports for quality assurance	Quality assurance test reports as evidence that the equipment has been manufactured correctly.	LVD (2014/35/EU) Annex III
Test reports for compliance against standards	Test reports used as justification that the equipment meets safety standards.	LVD (2014/35/EU) Article 12, 13, 14

Equipment Checklist - Pre-Pilot exercise for cryogenic equipment in SM18

Equipment compliance – Applied to CRATE

But where to formalize it?

Only partial calculation

No standard applied as none were found

All cards go through a test bench To check if tests are enough

Equipment (CERN marking) Compliance Checklist

Document	Description	Source
Equipment description	Basic description of the equipment, the purpose and general context of the equipment. This should explain the function and operation of the equipment.	LVD (2014/35/EU) Annex III
Instructions & safety information	Instructions for how to use the equipment safely, including safety precautions.	LVD (2014/35/EU) Article 6.7
Risk assessment	An assessment identifying all possible electrical risks and evaluating them with their severity and probability.	LVD 2014/35/EU - Guidelines on the application of the directive - August 2018, page 67 (LVD Annex III)
Calculations	Calculations justifying the design of the equipment, in accordance with standards. E.g., wire guage calculations.	LVD (2014/35/EU) Annex III
Standards applied	A record of the standards used to develop the equipment.	LVD (2014/35/EU) Articles 12,13,14
Assembly drawing	Top level drawing of the equipment.	LVD (2014/35/EU) Annex III
Circuit diagram	Top level circuit diagram of the equipment.	LVD (2014/35/EU) Annex III
Safety justification (if applicable)	Where standards are not available to meet essential safety requirements, engineering justifications must be provided.	LVD (2014/35/EU) Annex III
Declaration of Conformity		LVD (2014/35/EU) Article 15
Test reports for quality assurance	Quality assurance test reports as evidence that the equipment has been manufactured correctly.	LVD (2014/35/EU) Annex III
Test reports for compliance against standards	Test reports used as justification that the equipment meets safety standards.	LVD (2014/35/EU) Article 12, 13, 14

Courtesy T. Barbe, M. Pezzetti

Installation Checklist – In review

Presented to WP3 contributors 4/11/2024

Document	Description	Source
Installation description and purpose	Basic description of the installation, with the purpose and context of the installation.	Code du travail R4215-2
Safety operational instructions and precautions	Instructions for how to safely operate the installation with safety precautions.	NF C15 100-6
Wiring schedule/ 'Carnet de câble'	A document recording the wires used in an installation, detailing the cable type, specifications, etc.	Arreté du 26 décembre 2011 (Annexe III)
Single line diagram	As-built single line diagrams.	Arreté du 26 décembre 2011 (Annexe III)
Risk assessment	Identifies all possible risks and evaluates the probability/severity.	Code du travail R4121-3
Cable and protective device calculations	Calculations that justify the cable sizes and protective device current capacity against NF C15 100-5-52.	Arreté du 26 décembre 2011 (Annexe III)
Drawings of the installation vicinity indicating risks.	Drawings showing the external risks of the locations, e.g., fire or explosion risks in different areas.	Arreté du 26 décembre 2011 (Annexe III)
To-scale site plan showing buried/underground cables.	Drawings showing where equipment and cables are located.	Arreté du 26 décembre 2011 (Annexe III)
Maximum occupancy information for the installation areas	Identifies the areas where maximum occupancy limits apply.	Arreté du 26 décembre 2011 (Annexe III)
List of equipment	A list of all equipment in the installation, with voltages, current, and serial numbers etc.	NF C15 100
Conformity certificates for equipment	Declarations of conformity for all CE marked equipment in the installation.	Arreté du 26 décembre 2011 (Annexe III)
Design technical specifications document	'Cahier des prescriptions techniques ayant permis la réalisation des installations' This records the guidelines, standards, and methods used for the installation.	Arreté du 26 décembre 2011 (Annexe III)
Attestation du conformité		Consuel
Test reports Insulation Resistance	Report of what was tested, and the results obtained.	NF C15 100
Test reports Earth Bonding	Report of what was tested, and the results obtained.	NF C15 100
Test reports IP2X	Report of what was tested, and the results otained.	NF C15 100
Test report for Initial Inspection	Performed by HSE. May cover parts of this list.	Consuel

Presented to WP3 contributors 4/11/2024

Installation Checklist - Pre-Pilot exercise for cryogenic installation in SM18

Installation compliance – Applied to old installation SM18 6kW CP

BOM not available on older projects

I do not think we have the applicable standard from the time of the assembly

To be checked with HSE

Installation Compliance Checklist

Document	Description	Source
Installation description and purpose	Basic description of the installation, with the purpose and context of the installation.	Code du travail R4215-2
Installation Operational and Safety Instructions	Instructions for how to safely operate the installation with safety precautions.	NF C15 100-6
Wiring schedule/ 'Carnet de cable'	A document recording the wires used in an installation, detailing the cable type, specifications, etc.	Arrêté du 26 décembre 2011 (Annexe III)
Single line diagram	As-built single line diagrams.	Arrêté du 26 décembre 2011 (Annexe III)
Risk assessment	Identifies all possible risks and evaluates the probability/severity.	Code du travail R4121-3
Cable and protective device calculations	Calculations that justify the cable sizes and protective device current capacity against NF C15 100-5-52.	Arrêté du 26 décembre 2011 (Annexe III)
Drawings of the installation vicinity indicating risks.	Drawings showing the external risks of the locations, e.g., fire or explosion risks in different areas.	Arrêté du 26 décembre 2011 (Annexe III)
To-scale site plan showing buried/underground cables.	Drawings showing where equipment and cables are located.	Arrêté du 26 décembre 2011 (Annexe III)
Maximum occupancy information for the installation areas	Identifies the areas where maximum occupancy limits apply.	Arrêté du 26 décembre 2011 (Annexe III)
List of equipment	A list of all equipment in the installation, with voltages, current, and serial numbers etc.	NF C15 100
Conformity certificates for equipment	Declarations of conformity for all CE marked equipment in the installation.	Arrêté du 26 décembre 2011 (Annexe III)
Design technical specifications document	'Cahier des prescriptions techniques ayant permis la réalisation des installations' This records the guidelines, standards, and methods used for the installation.	Arrêté du 26 décembre 2011 (Annexe III)
Attestation du conformité		Consuel
Test reports Insulation Resistance	Report of what was tested, and the results obtained.	NF C15 100
Test reports Earth Bonding	Report of what was tested, and the results obtained.	NF C15 100
Test reports IP2X	Report of what was tested, and the results obtained.	NF C15 100
Test report for Initial Inspection	Performed by HSE. May cover parts of this list.	Consuel

4 November 2024 8

Courtesy T. Barbe, M. Pezzetti

Installation Checklist - Pre-Pilot exercise for cryogenic installation in SM18

Installation compliance – Applied to recent installation SM18 35g/s CP

But where to formalize it?

Maybe from EN/EL for up to our cabinet.
Wire inside, no calculation but standard in electrical specs

Applicable? Part of the building?

Applicable?

List of equipment in the BOM, no following of asset & S/N

Not stored formally but all equipment are CE

We have a technical specification but do not record with which version of specs was used during design

We believe installation is OK but no formal reports of tests

Done by HSE not sure where the report is stored

Installation Compliance Checklist

Document	Description	Source
Installation description and purpose	Basic description of the installation, with the purpose and context of the installation.	Code du travail R4215-2
Installation Operational and Safety Instructions	Instructions for how to safely operate the installation with safety precautions.	NF C15 100-6
Wiring schedule/ 'Carnet de cable'	A document recording the wires used in an installation, detailing the cable type, specifications, etc.	Arrêté du 26 décembre 2011 (Annexe III)
Single line diagram	As-built single line diagrams.	Arrêté du 26 décembre 2011 (Annexe III)
Risk assessment	Identifies all possible risks and evaluates the probability/severity.	Code du travail R4121-3
Cable and protective device calculations	Calculations that justify the cable sizes and protective device current capacity against NF C15 100-5-52.	Arrêté du 26 décembre 2011 (Annexe III)
Drawings of the installation vicinity indicating risks.	Drawings showing the external risks of the locations, e.g., fire or explosion risks in different areas.	Arrêté du 26 décembre 2011 (Annexe III)
To-scale site plan showing buried/underground cables.	Drawings showing where equipment and cables are located.	Arrêté du 26 décembre 2011 (Annexe III)
Maximum occupancy information for the installation areas	Identifies the areas where maximum occupancy limits apply.	Arrêté du 26 décembre 2011 (Annexe III)
List of equipment	A list of all equipment in the installation, with voltages, current, and serial numbers etc.	NF C15 100
Conformity certificates for equipment	Declarations of conformity for all CE marked equipment in the installation.	Arrêté du 26 décembre 2011 (Annexe III)
Design technical specifications document	'Cahier des prescriptions techniques ayant permis la réalisation des installations' This records the guidelines, standards, and methods used for the installation.	Arrêté du 26 décembre 2011 (Annexe III)
Attestation du conformité		Consuel
Test reports Insulation Resistance	Report of what was tested, and the results obtained.	NF C15 100
Test reports Earth Bonding	Report of what was tested, and the results obtained.	NF C15 100
Test reports IP2X	Report of what was tested, and the results obtained.	NF C15 100
Test report for Initial Inspection	Performed by HSE. May cover parts of this list.	Consuel

4 November 2024 6

Courtesy T. Barbe, M. Pezzetti

Guidance documents – To be done

EDMS 3190974, EDMS 3190975

Contents

INTRODUCTION **1**
- How to achieve Installation electrical compliance 1
- Levels of Risk 2
- Required documents 2
- Compliance with standards (NF C15 100, NF C13 200) 3

RISK ASSESSMENT **3**

TECHNICAL FILE **4**
- Operating instructions and precautions 5
- Electrical and facility drawings 5
- Calculations 6
- Equipment conformity certificates 6
- Technical specifications 7
- Installation description document 7

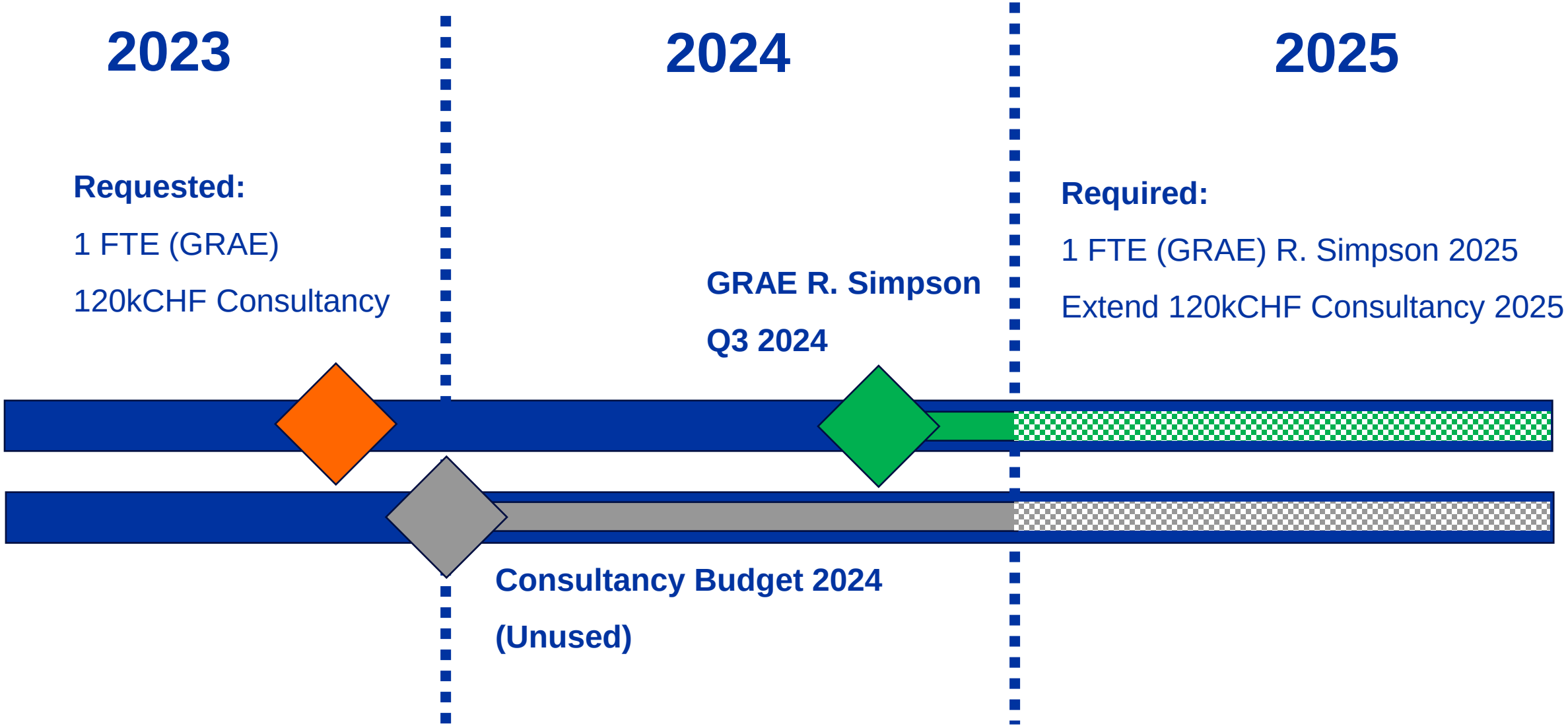
TESTING AND INSPECTION **8**
- Required tests & inspections 8
  - *IP2X* *8*
  - *Earth Bonding* *9*
  - *Insulation Resistance* *10*
  - *Initial Inspection* *11*

APPENDIX A: DOCUMENT TEMPLATES **13**

East Area Pilot for WP3 (Exchange of a Magnet)

- **To be done BEFORE the pilot**
  - Identify and classify what are the Equipment and Installations in the East Area.
  - Identify where information should be stored for the Equipment and Installations involved.
  - Find points of contact and their roles (equipment owners, installation owners, etc).
- **To be done DURING the pilot**
  - Use the checklist to discover what information is available for the involved equipment and installations.
  - Note where information has been found.
  - Approach installation owners and equipment owners to check when information is not available.
- **To be done AFTER the pilot**
  - Perform a gap analysis between the compliance checklists and the what was found during the pilot.
  - Identify the potential consequences and severity of any gaps if an incident were to occur.

WP3 – Resources



Work Required from Contributors 2025

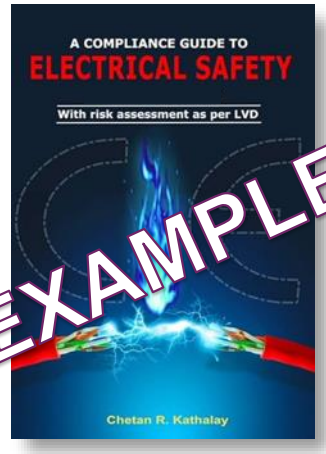
- **Participate in Pilots**
  - Identifying equipment/ installations & their owners
  - Find information and identify gaps
- **Review documents**
  - Checklist review
  - Terms and Definitions review
- **Participate in weekly reviews**
  - Continual feedback of WP3 proposals against current CERN practice

Conclusions

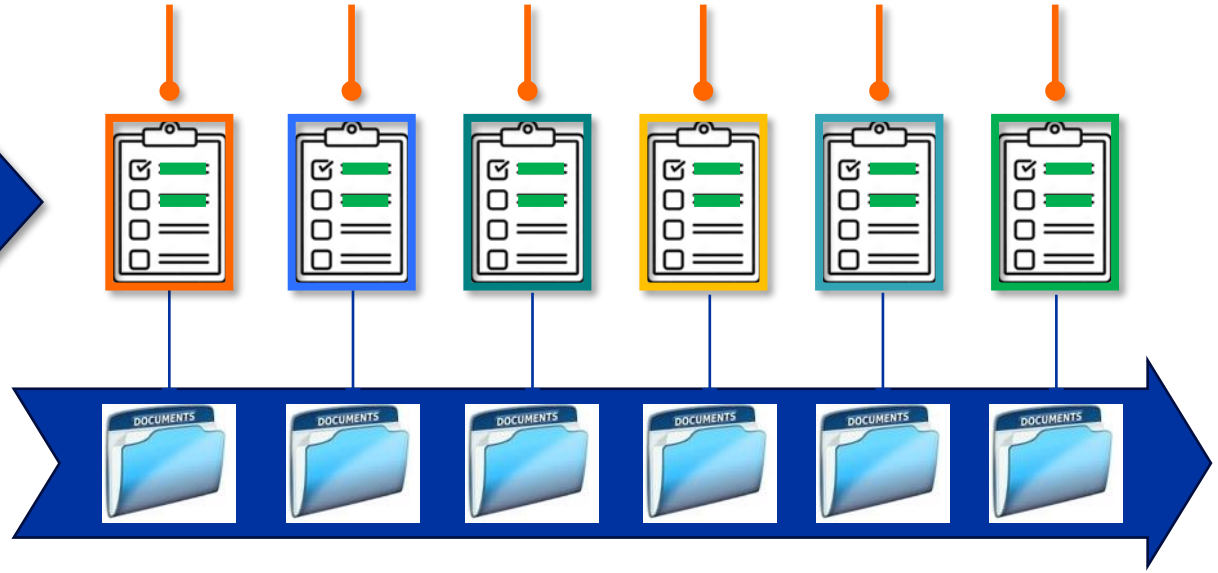
- **Acceleration of activity with the arrival of Rui.**
- **Next steps are:**
  - **Completing the Checklist document and sending for review**
  - **Responding to comments on the Terms and Definition document**
  - **Begin writing the Compliance Guidelines Documents**
  - **Running the cryo-SM18 and East Area pilot** and extract relevant for the preparation of the guidelines.
  - **Participate and converge with WP2** on the review of the applicable CERN safety codes.

Spare slides

WP3 – (1) Guidelines

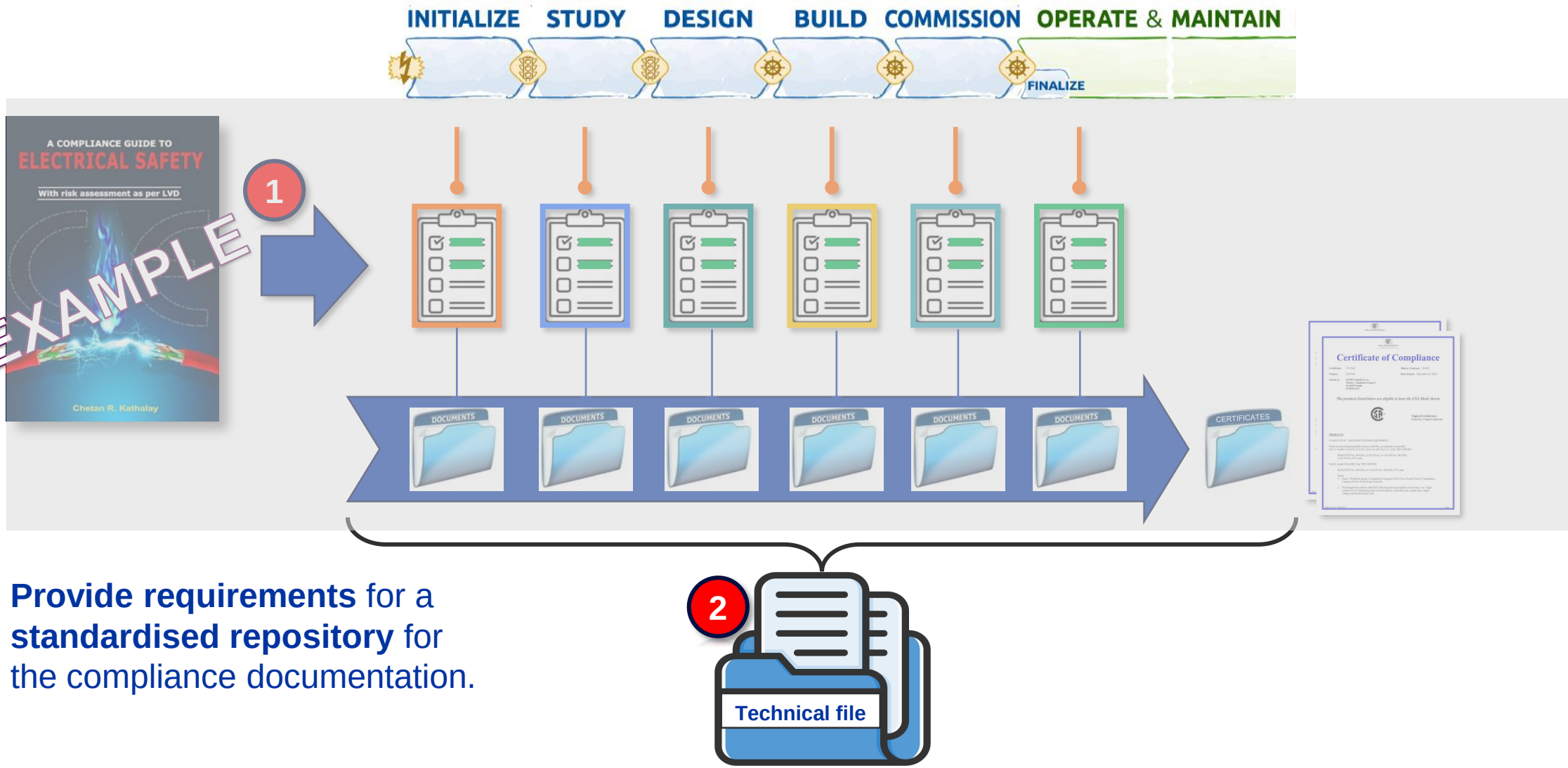


1



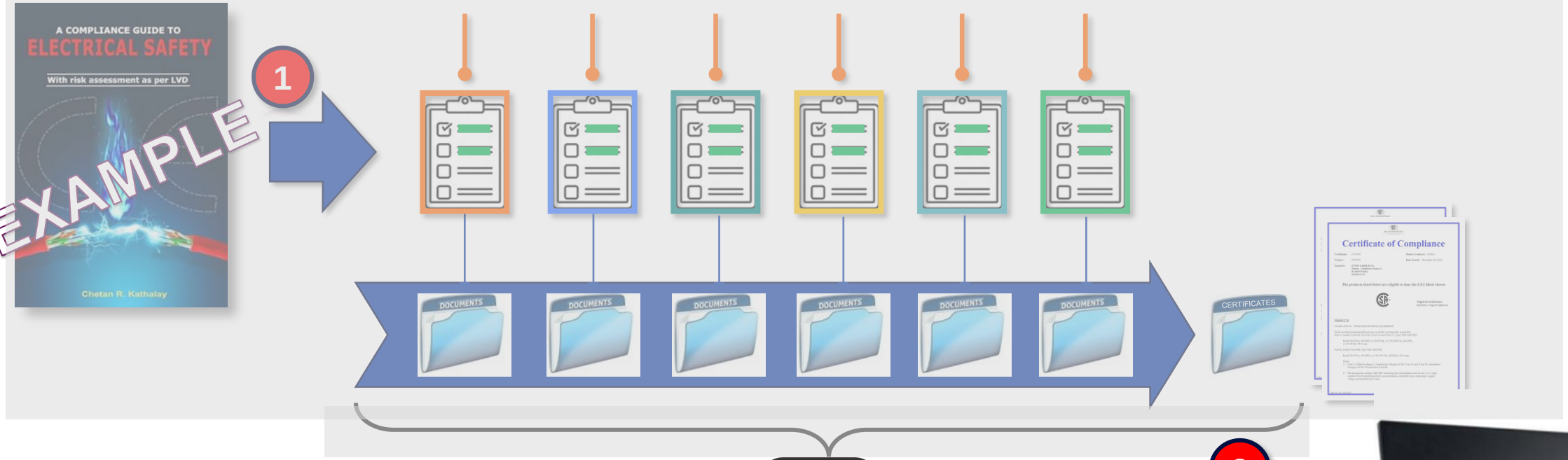
A guideline to compliance per **equipment type** for all staff involved in the lifecycle activites leading to having a new electrical system in Operation.

WP3 – (2) Standardised repository

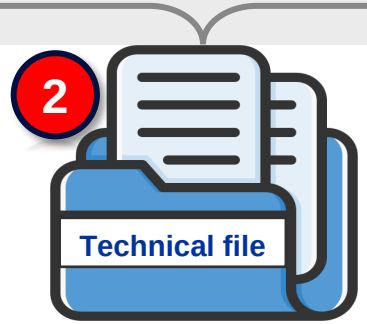


Provide requirements for a **standardised repository** for the compliance documentation.

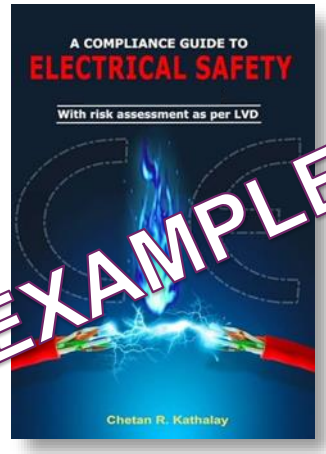
WP3 – (3) System/tool



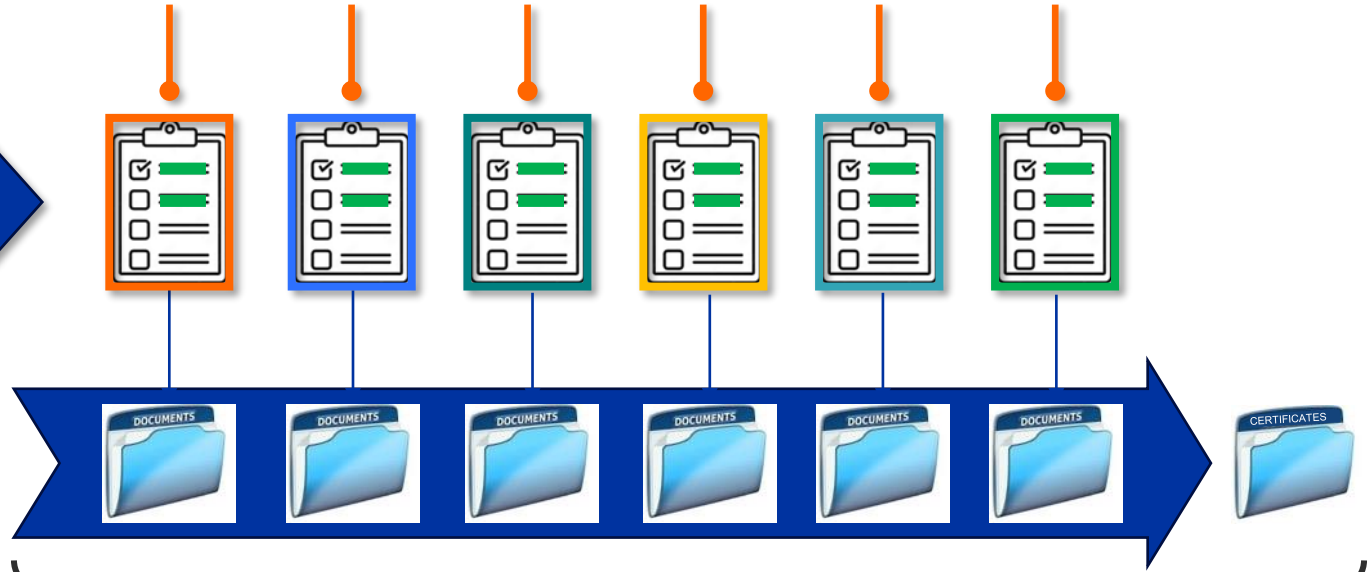
Provide requirements for a **system/tool** that allows to retrieve the “compliance” status.



WP3 - Deliverables

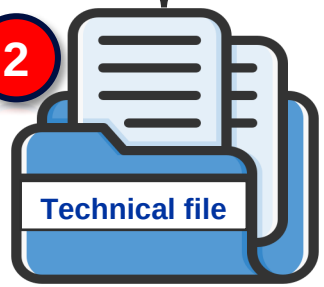


1



Provide the means to achieve **Electrical Safety Compliance** to all systems that will be installed in the **accelerator complex**.

2



3

An example of current practice- James Devine EP

Installation description

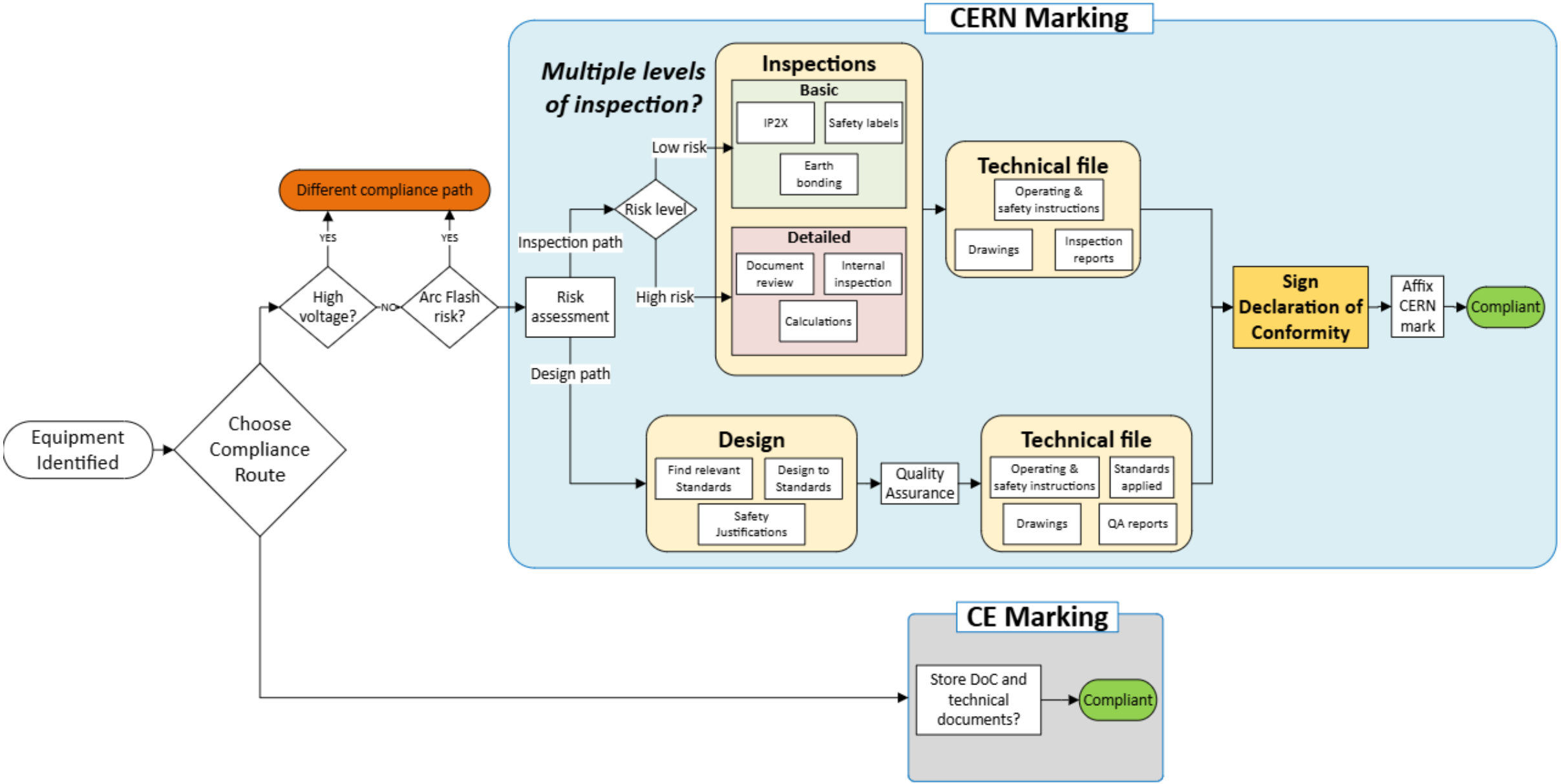
Electrical drawings

Technical datasheets, specifications, documentation, conformity certificates

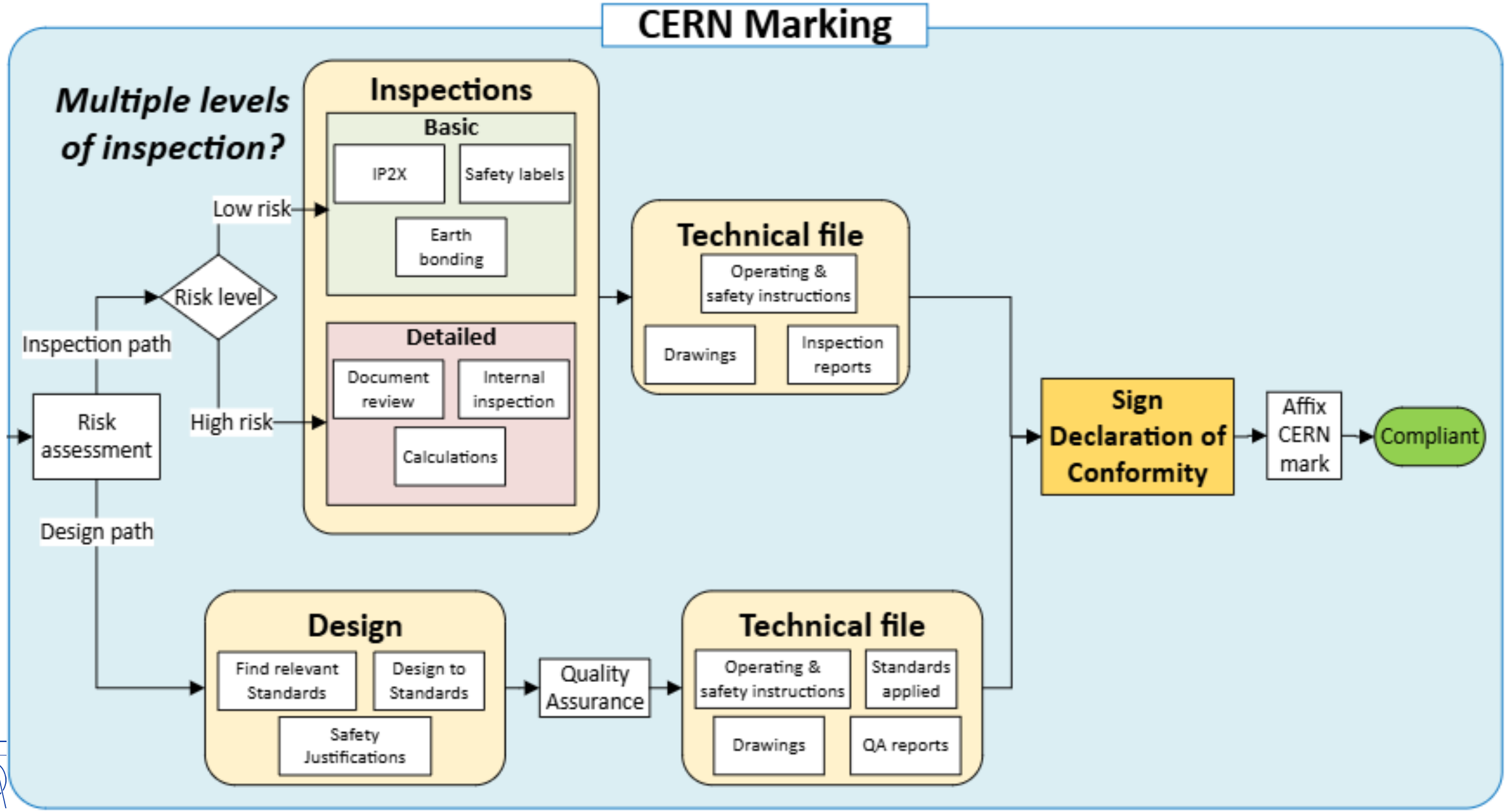
Inspection reports

Operational instructions

Equipment Compliance ‘Roadmap’



Equipment Compliance ‘Roadmap’



How deeply to analyse Equipment?

Red:	Electrical Fire Risk
Yellow:	Electric Shock Risk
Blue:	Arc Flash Risk

Increasing effort

External equipment inspection

- Labelling
- IP2X IEC
- Earth bonding
- Insulation resistance

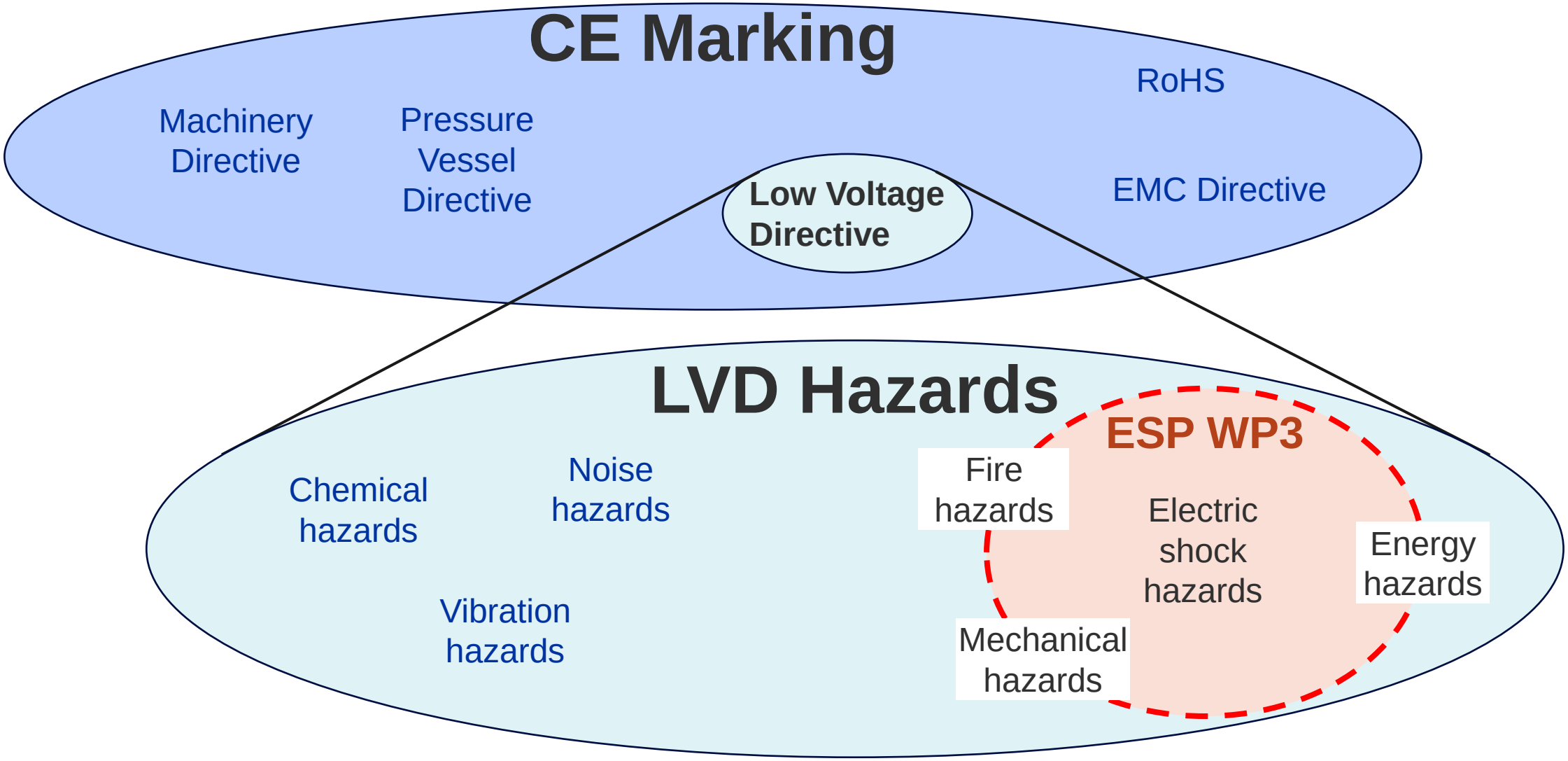
Documentation required

- Circuit diagrams
- Operational & safety instructions
- Fault current calculation

Internal inspection, measurement, calculation

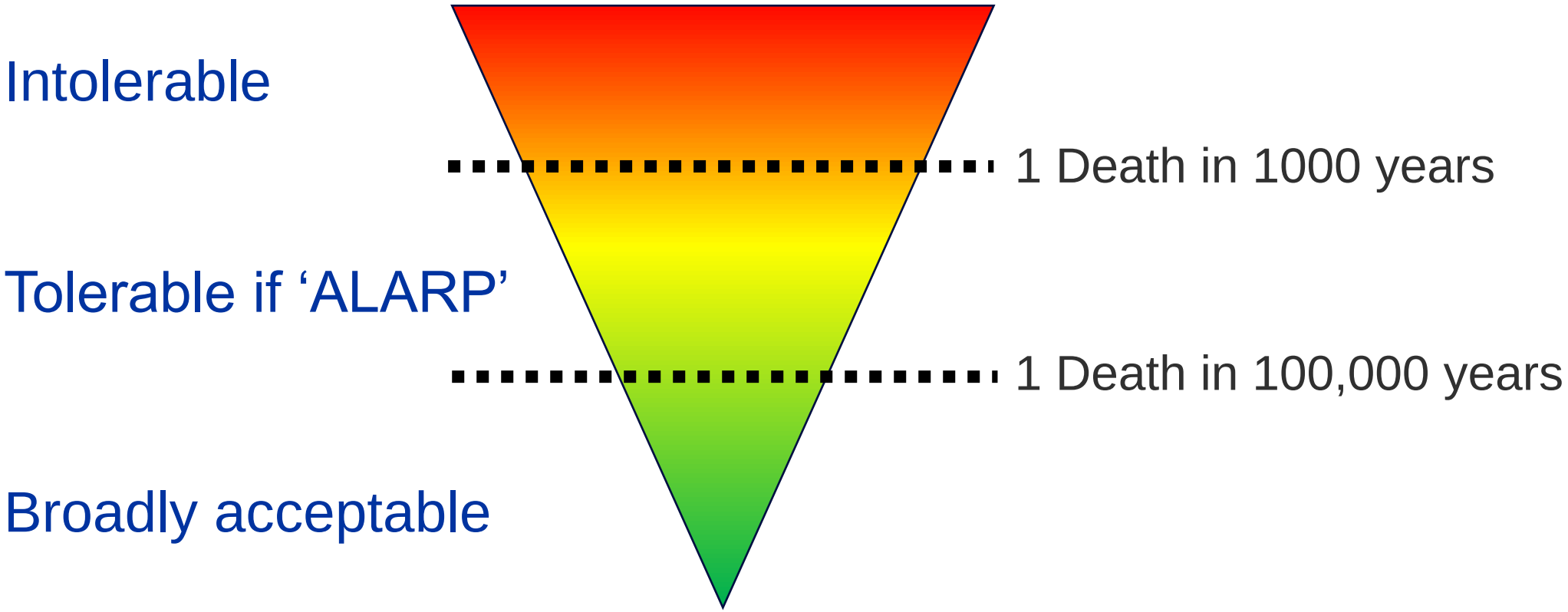
- Insulation classification
- Wiring colour conventions
- Overcurrent protection
- Creepage and clearances
- SELV layers of protection
- Flammable materials selection
- Internal cable sizing
- Component power dissipation
- Arc flash severity analysis
- Stored energy dissipation (capacitors)

The ESP project, LVD, and CE marking



Where to draw the line for WP3?

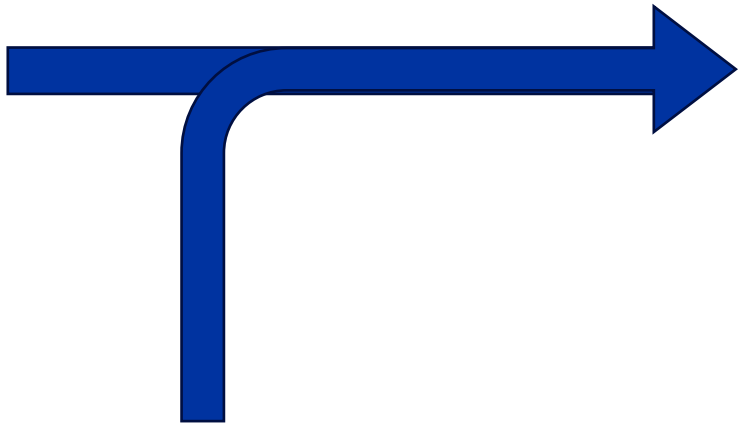
Risk assessment



Assessing tolerability of risk

FI	Frequency of functional failure leading to consequences (events per year)	Severity Index (SI)				
		1	2	3	4	5
		Negligible Minor first-aid injury to a single person in the workforce	Minor One or more first-aid injury.	Significant One or more injuries, not severe.	Severe Single fatality or multiple severe injuries	Catastrophic 10 fatalities and more
5	10^{-2}	6	7	8	9	10
4	10^{-3}	5	6	7	8	9
3	10^{-4}	4	5	6	7	8
2	10^{-5}	3	4	5	6	7
1	10^{-6}	2	3	4	5	6
High (H) =Intolerable Risk			Medium (M) =Tolerable Risk (ALARP)			Low (L) =Negligible Risk

Route from CERN marked to CE Marked



CE

- Other EU Directives (EMC, RoHS, etc)
- Mitigate non-electrical hazards

Machinery Directive versus Low Voltage Directive

"1.5.1. Electricity supply
Where machinery has an electricity supply, it must be designed, constructed and equipped in such a way that all hazards of an electrical nature are or can be prevented. The safety objectives set out in Directive 73/23/EEC[30] shall apply to machinery. However, the obligations concerning conformity assessment and the placing on the market and/or putting into service of machinery with regard to electrical hazards are governed solely by this Directive."

Thus, whilst machinery with an electrical supply must fulfil the safety objectives of the LVD, the manufacturer's EC Declaration of conformity should not refer to the LVD but to the Machinery Directive.

LVD on technical documentation

2. Technical documentation

The manufacturer shall establish the technical documentation. The documentation shall make it possible to assess the electrical equipment's conformity to the relevant requirements, and shall include an adequate analysis and assessment of the risk(s). The technical documentation shall specify the applicable requirements and cover, as far as relevant for the assessment, the design, manufacture and operation of the electrical equipment. The technical documentation shall, where applicable, contain at least the following elements:

(a) a general description of the electrical equipment;
(b) conceptual design and manufacturing drawings and schemes of components, sub-assemblies, circuits, etc.;
(c) descriptions and explanations necessary for the understanding of those drawings and schemes and the operation of the electrical equipment;
(d) a list of the harmonised standards applied in full or in part the references of which have been published in the Official Journal of the European Union or international or national standards referred to in Articles 13 and 14 and, where those harmonised standards or international or national standards have not been applied, descriptions of the solutions adopted to meet the safety objectives of this Directive, including a list of other relevant technical specifications applied. In the event of partly applied harmonised standards or international or national standards referred to in Articles 13 and 14, the technical documentation shall specify the parts which have been applied;
(e) results of design calculations made, examinations carried out, etc.; and
(f) test reports.

LVD Safety objectives

1. General conditions

(a) the essential characteristics, the recognition and observance of which will ensure that electrical equipment will be used safely and in applications for which it was made, shall be marked on the electrical equipment, or, if this is not possible, on an accompanying document;

(b) the electrical equipment, together with its component parts, shall be made in such a way as to ensure that it can be safely and properly assembled and connected;

(c) the electrical equipment shall be so designed and manufactured as to ensure that protection against the hazards set out in points 2 and 3 is assured, providing that the equipment is used in applications for which it was made and is adequately maintained.

2. Protection against hazards arising from the electrical equipment

Measures of a technical nature shall be laid down in accordance with point 1, in order to ensure that:

(a) persons and domestic animals are adequately protected against the danger of physical injury or other harm which might be caused by direct or indirect contact;

(b) temperatures, arcs or radiation which would cause a danger, are not produced;

(c) persons, domestic animals and property are adequately protected against non-electrical dangers caused by the electrical equipment which are revealed by experience;

(d) the insulation is suitable for foreseeable conditions.