



Safety requirements and Safety file contents

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Date: 11/30/2012

EDMS: [1255075](#)

Subject: **Safety requirements and Safety file contents of LIU project**

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2 INTRODUCTION

The purpose of this document is to define Safety requirements and the Safety file contents of LIU-project.

The Safety requirements and Safety file contents defined by the HSE Unit are based on the documents provided by the LIU project project leaders:

- Table of main activities for LIU-Booster;
- Table of main activities for LIU-PS
- Table of main activities for LIU-SPS;

The definition of the Safety requirements and contents of the Safety file is based on the CERN Safety rules which are available on the HSE Unit [web page](#).

The standards referred to in this document are available in the [CERN Document Server](#).

3 DESCRIPTION OF LIU PROJECT

The LHC Injectors Upgrade should plan for delivering reliably to the LHC the beams required for reaching the goals of the HL-LHC. This includes LINAC4, the PS booster, the PS, the SPS, as well as the heavy ion chain.

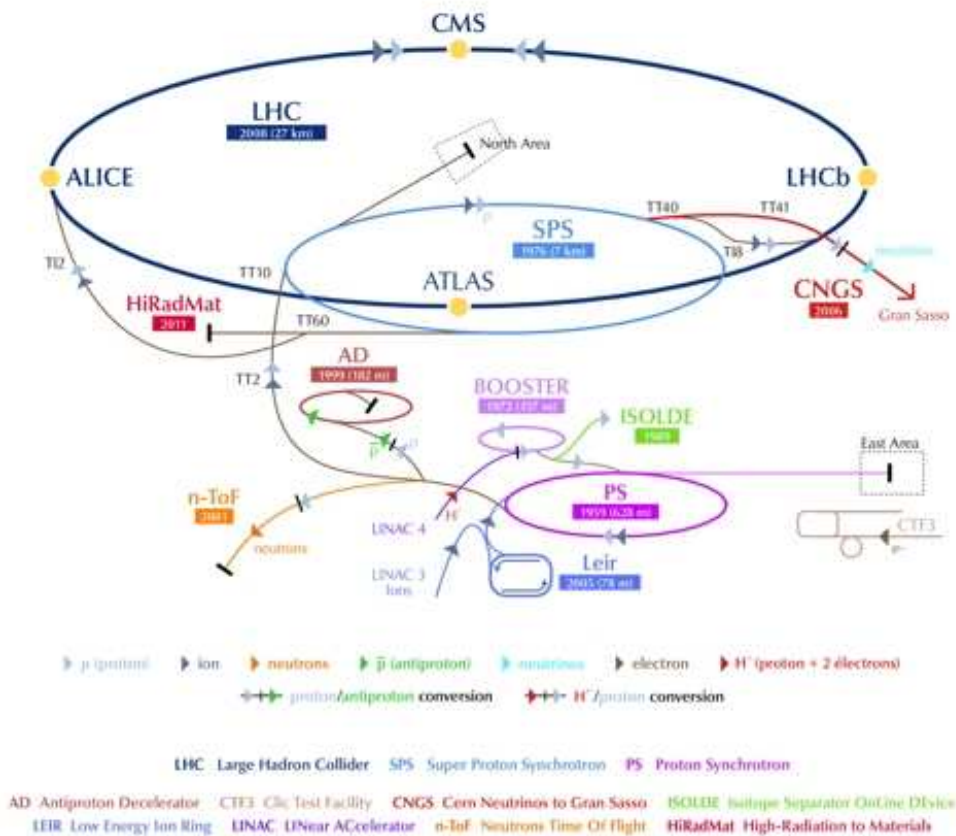


Figure 1: Overview of the LHC accelerator complex.



4 MAIN ACTIVITIES AND RELATED HAZARDS OF LHC INJECTORS UPGRADE (LIU)

Main activities	Booster	PS	SPS	Main hazards	Related safety domains	Applicable chapter(s)**
Magnets	X	X		Electric and electromagnetic Ionizing radiation* Non-ionizing radiation Thermodynamic and fluidic	Electrical safety Radiation protection Non-ionizing radiation safety Mechanical safety	§ 5.5 § 5.1 § 0 § 5.3.1 and § 5.3.4
RF system	X	X		Electric and electromagnetic Ionizing radiation* Non-ionizing radiation	Electrical safety Radiation protection Non-ionizing safety	§ 5.5 § 5.1 § 0
Power converters	X	X		Electric Fire Thermodynamic and fluidic Environment	Electric safety Fire safety Mechanical safety Environmental safety	§ 5.5 § 5.7 § 5.3.1 and § 5.3.4 § 5.11.36 and § 5.11.7
BI line	X			Electric and electromagnetic Ionizing radiation* Non-ionizing radiation Thermodynamic and fluidic	Electrical safety Radiation protection Non-ionizing radiation safety Mechanical safety	§ 5.5 § 5.1 § 0 § 5.3.1 and § 5.3.4
Beam injection systems	X	X	X	Electric and electromagnetic Ionizing radiation*	Electrical safety Radiation protection	§ 5.5 § 5.1

Main activities	Booster	PS	SPS	Main hazards	Related safety domains	Applicable chapter(s)**
				Non-ionizing radiation Thermodynamic and fluidic Chemical Environmental	Non-ionizing radiation safety Mechanical safety Chemical safety Environmental safety	§ 0 § 5.3.1 and § 5.3.4 § 5.8 § 5.11.3 and § 5.11.7
PSB extraction	X			Electric and electromagnetic Ionizing radiation* Non-ionizing radiation Thermodynamic and fluidic Chemical Environmental	Electrical safety Radiation protection Non-ionizing radiation safety Mechanical safety Chemical safety Environmental safety	§ 5.5 § 5.1 § 0 § 5.3.1 and § 5.3.4 § 5.8 § 5.11.3 and § 5.11.7
BT/BTP line	X			Electric and electromagnetic Ionizing radiation* Non-ionizing radiation Thermodynamic and fluidic	Electrical safety Radiation protection Non-ionizing radiation safety Mechanical safety	§ 5.5 § 5.1 § 0 § 5.3.1 and § 5.3.4
Beam interception devices	X	X		Electric and electromagnetic Ionizing radiation*	Electrical safety Radiation protection	§ 5.5 § 5.1
Beam dump			X	Ionizing radiation*	Radiation protection	§ 5.1
Damper systems	X	X	X	Electric and electromagnetic Ionizing radiation*	Electrical safety Radiation protection	§ 5.5 § 5.1

Main activities	Booster	PS	SPS	Main hazards	Related safety domains	Applicable chapter(s)**
				Non-ionizing radiation Thermodynamic and fluidic Chemical Environmental	Non-ionizing radiation safety Mechanical safety Chemical safety Environmental safety	§ 0 § 5.3.1 and § 5.3.4 § 5.8 § 5.11.3 and § 5.11.7
Passive protection devices			X	Ionizing radiation*	Radiation protection	§ 5.1
Vacuum	X	X	X	Thermodynamic and fluidic Chemical	Mechanical safety Chemical safety	§ 5.3.1 § 5.8
Beam instrumentation	X	X	X	Electrical and electromagnetic	Electrical safety	§ 5.5
Scraper system			X	Electric and electromagnetic Ionizing radiation*	Electrical safety Radiation protection	§ 5.5 § 5.1
Radioprotection instrumentation		X		Electric and electromagnetic Ionizing radiation*	Electrical safety Radiation protection	§ 5.5 § 5.1 § 0
Transport	X	X	X	Mechanical Ionizing radiation*	Mechanical safety Radiation protection Worksite safety	§ 5.3.2 § 5.1 § 5.9.6

Main activities	Booster	PS	SPS	Main hazards	Related safety domains	Applicable chapter(s)**
Electrical systems	X	X		Electric and electromagnetic Fire	Electrical safety Fire safety	§ 5.5 § 5.7
Cooling and ventilation	X			Thermodynamic and fluidic Ionizing radiation*	Mechanical safety Radiation protection	§ 5.3.1 and § 5.3.4 § 5.1
Controls		X		Electric and electromagnetic	Electrical safety	§ 5.5
Civil engineering Buildings		X			Structural safety Mechanical safety Electrical safety Fire safety Acoustics & ergonomics Worksite safety Environmental safety	§ 5.4 § 5.3.1, § 5.3.2 and § 5.3.4 § 5.5.1 § 5.7 § 5.10 § 5.9 § 5.11.2, § 5.11.6, § 5.11.7
Worksite	X	X	X		Worksite safety Environmental safety	§ 5.9 §5.11.2, §5.11.3, §5.11.6, §5.11.7, §5.11.8

* Only applicable to existing equipment and after operation of new equipment

** Equipment purchased in the market shall comply with § 5.2

Table 1 Activities, hazards and corresponding safety requirements identification



5 SAFETY REQUIREMENTS

5.1 Radiation protection

The Safety requirements on radiation protection are set by the following CERN Safety rules:

- [Safety Code F](#) – radiation protection (2006).

Additionally, the Safety requirements set by the Safety instructions contained in the [Radiation Safety Manual](#) (1996), which was replaced by code “Radiation Protection (2006)”, also apply.

5.1.1 Modification of existing systems and design of new equipment

Any modification of systems impacting the radiological hazards of the facility operation shall be reviewed and approved by the Radiation Protection Physicists in charge of the project. Such systems and equipment include (and are not limited to) shielding, cooling circuits used for devices inside the accelerator housing, ventilation systems as well as RF equipment with the potential for emission of X-ray.

The ALARA principle must be considered in the design of new equipment. In particular, special care should be given to the material choice and intervention planning in order to limit personnel exposure during operation of the facility, maintenance and repair and waste production at the end of the equipment lifetime.

For the choice of materials, recommendations can be found in the following References ([1](#) and [2](#)).

5.1.2 Work in Radiation Areas

Any activity involving working with radioactive equipment must be reviewed and approved by the Radiation Protection Officer responsible for the area (and by the line management as needed). In particular, a planning of the intervention initiated by the equipment responsible and a dose assessment associated to the activity must be performed in collaboration with DGS-RP. The dose assessment is used for the ALARA classification of the activity (References [1](#) and [2](#)) which will dictate the review and approval requirements.

5.1.3 Disposal of radioactive material

Any radioactive equipment for which no future use is identified must be considered as a radioactive waste and must be transferred to the radioactive waste treatment centre. In order to arrange for proper storage and facilitate the elimination of the waste, the equipment responsible for the project must inform the DGS-RP group as early as possible and provide to the best of his/her knowledge information on the waste generated. The required specifications are the type of item, the quantity, the type of material (chemical composition), geometrical information (dimension, mass, volume) the radiological information (history of irradiation, cooling time when applicable, etc.).

5.1.4 Transport of radioactive material

The transport of radioactive materials shall comply with:

- [NS 16](#) - Rules concerning the transport of radioactive material.

The [DGS-RP group](#) provides advice on radiation protection.

5.2 Products purchased on the market

Products purchased on the market must comply with CERN Safety rules and as such are legally required to bear the CE marking, whenever applicable.

It may be considered a substantial non-compliance, if a product is not CE marked when it should be according to the applicable directives and regulations, or a product is unduly CE marked.

Products bearing the CE marking comply with provisions of the applicable European Directives and Regulations. Compliance with legislation often requires simultaneous application of several Directives, Regulations and other legislation and relevant harmonized standards.

The list below is not exhaustive and provides general guidance for European Directives and Regulations which apply to the majority of products used at CERN.

New Approach directives and regulations (directives and regulations providing CE marking)			
Directive / Regulation	Reference (link to directive & harmonized standards)	Harmonized standards ¹	E.g. of products
Low voltage equipment (LVD) Electromagnetic compatibility (EMC)	2006/95/EC 2004/108/EC	EN 61010 (LVD standards) EN 61326 (EMC standards)	Electrical systems, power supply systems
Machinery (MD)	2006/42/EC	EN 13155 (Lifting accessories) Other MD standards	Lifting accessories, cranes, any machine
Pressure equipment (PED)	97/23/EC	EN 13445 (Pressure vessels) EN 13458 (Cryogenic vessels) EN 13480 (Metallic piping) Other PED standards	Pressure vessels, cryogenic vessels, metallic piping, pressure relief equipment...
Construction products (CPD)	305/2011/EU	Eurocodes (structures) Other CPD standards	Products integrated in a permanent manner in construction works e.g.: structures, HVAC...
Lifts	95/16/EC	Lifts standards	Appliance serving specific levels

¹ Harmonized standards are technical specifications of products meeting essential requirements set out by European Directives and Regulations. These standards are usually used as means to demonstrate compliance with European Directives and Regulations.

Table 2 - New approach directives and regulations

Products purchased on the market to be used at CERN shall comply with the applicable European Directives, Regulations and CERN Safety rules. Thus, procurement documents shall refer to the European Directives and Regulations applicable to the product as well as the relevant CERN requirements, e.g. material requirements with respect to fire safety and radiation resistance.

If the contractors access CERN the document, [working on the CERN site](#), which identifies the requirements applicable to contracting companies working at CERN shall be annexed to the technical specification.

5.2.1 Safety file of products purchased on the market

European Directives and Regulations oblige the manufacturer to draw up technical documentation (covering the design, manufacture and operation of the product) containing information to demonstrate the conformity of the product to the applicable requirements. Legally this technical documentation is not required to be delivered with the product unless required in the tendering specification.

Products purchased on the market are CE marked and, when applicable, delivered with the following documents:

- EC declaration of conformity;
- instruction manual.

The HSE Unit (Francois.Angerand@cern.ch) provides advice on tendering specifications.

5.3 Mechanical Safety

5.3.1 Pressure equipment

Pressure equipment shall comply with the following CERN Safety rules:

- Safety Regulation on mechanical equipment ([SR-M](#)),
- General Safety Instruction on standard pressure equipment ([GSI-M2](#));
- General Safety Instruction on special mechanical equipment ([GSI-M3](#)).

According to the CERN Safety rules, pressure equipment shall meet the essential requirements set by the following European Directives:

- Directive [97/23/EC](#) on pressure equipment - Pressure Equipment Directive (PED);
- Directive [2009/105/EC](#) on simple pressure vessels – Simple Pressure Vessels Directive (SPVD) ;
- Directive [2010/35/EU](#) on transportable pressure equipment – Transportable Pressure Equipment Directive (TPED).

Pressure equipment designed and manufactured according to harmonized standards (listed in the chapters below) benefit from presumption of conformity with the essential requirements laid down in the above cited European Directives.

5.3.1.1 Unfired pressure vessels

Pressure vessels with a maximum allowable pressure PS greater than 0.5 barg shall comply with the Directive 97/23/EC (PED).

According to Directive 97/23/EC unfired pressure vessels are classified in five hazard categories (“0”, I, II, III, and IV). This classification is based on the maximum allowable pressure gauge (PS), volume (V) and working fluid contained in the vessel. The hazard category of vessels containing fluids can be determined by using tables 1 to 4 provided in Annex II of Directive 97/23/EC (Figure 2).

Table 3 defines the conditions that define the limits of applicability of conformity assessment tables 1 to 4 (available in Table 3).

Equipment	Fluids	Group	Applicability	Conformity assessment table
Vessels (PS>0.5bar) Note: Where a vessel is composed of a number of chambers, it shall be classified in the highest category applicable to the individual chamber.	Gases	1 ^a	V > 1l and PS.V > 2.5bar.l, or; PS > 200bar	1
	Gases	2 ^b	V > 1l and PS.V > 2.5bar.l, or; PS > 200bar	2
	Liquids	1	V > 1l and PS.V > 200bar.l, or; PS > 500bar	3
	Liquids	2	PS > 10bar and PS.V > 10000bar.l, or; PS > 1000bar	4
Safety accessories (safety valves, burst disc)	All fluids	Category IV. By way of exception, safety accessories manufactured for specific equipment may be classified in the same category as the equipment they protect.		
^a Fluids group 1 is a substance or preparation as defined in Council Directive 67/548/EEC. It comprises fluids defined as: explosive, extremely flammable, highly flammable, flammable, very toxic, toxic and oxidizing.				
^b Fluids group 2 are all other fluids not included in group 1.				

Table 3 - Conformity assessment tables applicable to unfired pressure vessels

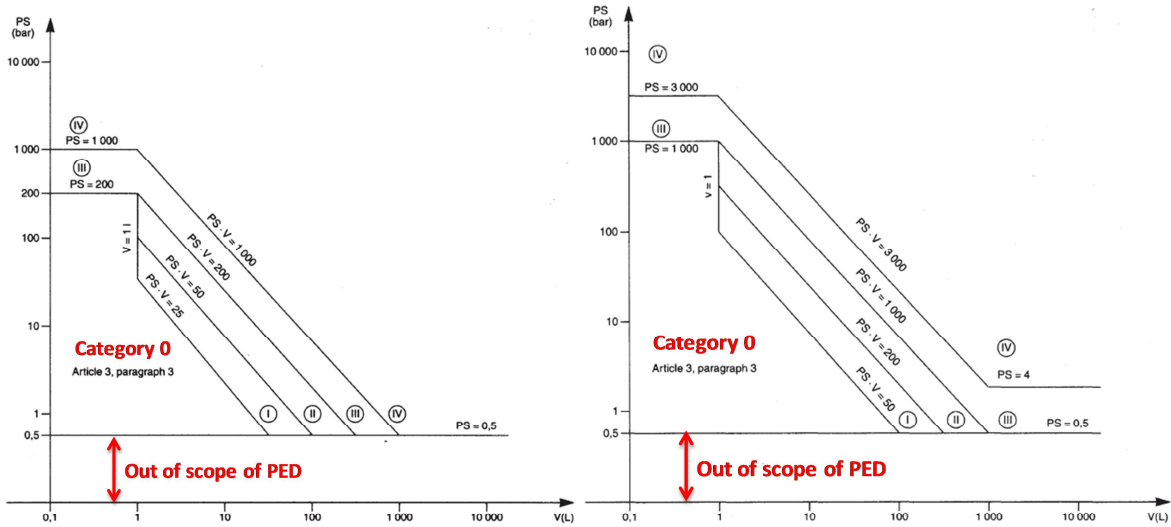


Table 1

Table 2

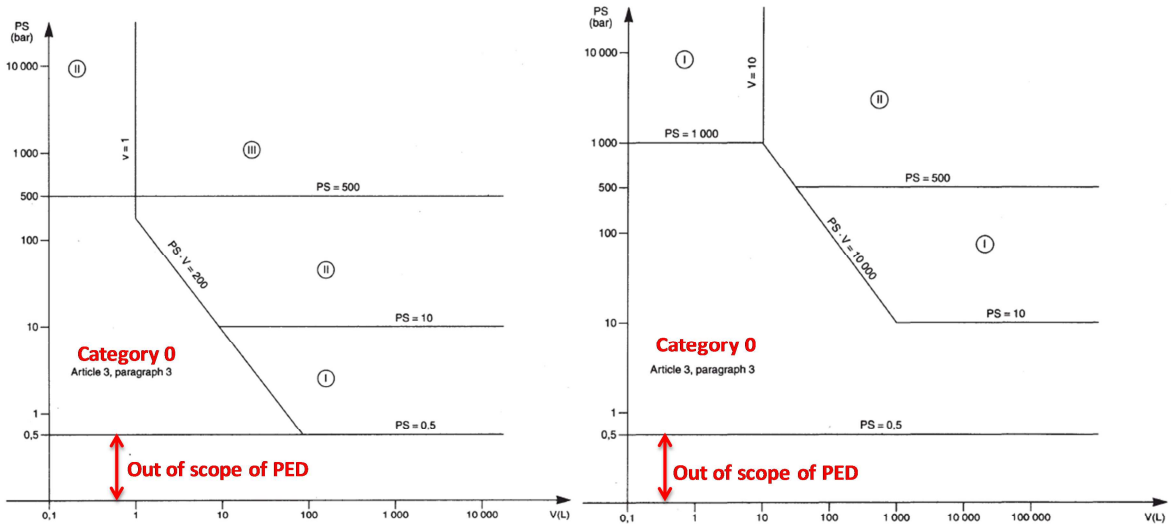


Table 3

Table 4

Figure 2 - Conformity assessment tables 1 to 4 for unfired pressure vessels [source: Annex II of Directive 97/23/EC]

Table 4 provides a summary of the applicability of the PED with respect to the pressure vessel category.

Pressure vessels operating at a maximum allowable pressure inferior to 0.5 barg are not obliged to meet the essential requirements set by the Directive 97/23/EC. Therefore such equipment cannot bear the CE marking. However, it shall have adequate instructions for use and bear the identification of the manufacturer and marking conform to GSI-M2. The HSE Unit recommends that such equipment is designed, manufactured and tested according to standards harmonized with the PED.

	Pressure vessel category		
	PS>0.5barg		PS≤0.5barg
	Categories I, II, III and IV	Category 0 (art.3, paragraph 3)	Out of scope of PED
Compliance with the essential safety requirements as defined in Annex I of Directive 97/23/EC	Compulsory	Optional	Not required
Conformity assessment as defined in Annex III of Directive 97/23/EC	Compulsory	Optional	Not required
Participation of notified body in the conformity assessment	Cat. I – Not required (manufacturer declares conformity with PED) Cat. II, III & IV – Compulsory (Notified body certifies conformity with PED)	Not required	Not required
CE marking	Compulsory	Not allowed	Not allowed
Identification of the manufacturer	Compulsory	Compulsory	Compulsory
Instructions manual	Compulsory	Compulsory	Compulsory
Design, manufacturing and testing standards	Standards harmonized with PED	HSE recommends standards harmonized with PED ^a	HSE recommends standards harmonized with PED
^a According to the PED the equipment shall be designed taking into account all relevant factors influencing its safety: Sound engineering practice (SEP).			

Table 4 - Applicability of the Directive 97/23/EC with respect to the pressure vessel category

5.3.1.1.1 Harmonized standards

Equipment, meeting the requirements of the standards listed below, are presumed to be compliant with the PED.

Scope	Harmonized Standards
Unfired pressure vessels	<ul style="list-style-type: none"> • EN 13445-1: Unfired pressure vessels - Part 1: General; • EN 13445-2: Unfired pressure vessels - Part 2: Materials; • EN 13445-3: Unfired pressure vessels - Part 3: Design; • EN 13445-4: Unfired pressure vessels - Part 4: Fabrication; • EN 13445-5: Unfired pressure vessels - Part 5: Inspection and testing; • EN 13445-6: Unfired pressure vessels - Part 6: Requirements for the design and fabrication of pressure vessels and pressure parts constructed from spheroidal graphite cast iron; • EN 13445-8: Unfired pressure vessels - Part 8: Additional requirements for pressure vessels of aluminium and aluminium alloys.
Metal bellows expansion joints	<ul style="list-style-type: none"> • EN 14917: Metal bellows expansion joints for pressure applications.

Table 5 – Harmonized standards

5.3.1.1.2 Control measures

Unfired pressure vessels, independently of the category, shall be equipped with **pressure relief devices** to ensure the safe operation of the working fluid in case of overpressure.

The pressure relief devices shall be:

- installed, commissioned, and periodically tested according to General Safety Instruction on standard pressure equipment ([GSI-M2](#)) ;
- CE marked and compliant with the harmonized standard [ISO 4126](#) on safety devices for protection against excessive pressure.

A guideline document ([EDMS 120990](#)) provides additional information for the purchase of pressure relief devices.

The **initial inspection of the pressure relief devices** shall be carried out by the HSE Unit inspection services (Didier.Gonnard@cern.ch).

According to the General Safety Instruction on standard pressure equipment ([GSI-M2](#)), unfired pressure vessels with a maximum allowable pressure (PS) greater than 0.5barg shall be subject to a **proof test**.

The **proof test** shall take the form of a hydrostatic pressure test. Where a hydrostatic pressure test is harmful or impractical other tests, with appropriate safety compensatory measures, may be carried out. Other tests of a recognized value or method may be carried out subject to the prior approval of the HSE Unit (Phillip.Santos.Silva@cern.ch).

The **proof test** must be no less than the greater of the following values:

- the maximum loading to which the pressure equipment may be subject in service taking into account its maximum allowable pressure and its maximum allowable temperature, multiplied by a coefficient of 1,25, or
- the maximum allowable pressure multiplied by a coefficient of 1,43.

The **proof test** shall be carried out under the supervision of the HSE Unit inspection service (Pierre-Yves.Buisson@cern.ch).

5.3.1.1.3 Safety file for unfired pressure vessels

The Safety file for unfired pressure vessels shall include the documents necessary to demonstrate its compliance with the above mentioned rules.

	Unfired pressure vessel category					
	PS≤0.5barg	PS>0.5barg				
		0	I	II	III	IV
<u>ENGINEERING DESIGN FILE</u>						
Risk assessment	x	x	x	x	x	x
Result of design calculations	x	x	x	x	x	x
Design drawings and diagrams of components, circuits...	x	x	x	x	x	x
Description and explanations necessary to understand the drawings and diagrams	x	x	x	x	x	x
<u>MANUFACTURING FILE</u>						
Manufacturing drawings	x	x	x	x	x	x
Material certificates for base materials and welding consumables	x	x	x	x	x	x
Manufacturer quality system certificate (whenever ISO 9000 certification is required by the conformity assessment procedure)				x ^a	x ^b	x ^c
EC design-examination certificate (if conformity assessment procedures B1+F & B1+D for category III and H1 for category IV are employed)					x	x
EC type-examination certificate (if conformity assessment procedures					x	x

	Unfired pressure vessel category				
B+C1 & B+E for category III and B+F & B+D for category IV are employed)					
Welders certificate	x	x	x	x	x
Welding procedure approval certificate		x	x	x	x
Non-destructive testing (NDT) personnel certificate		x	x	x	x
Records of welding inspections	x	x	x	x	x
Pressure report test	x	x	x	x	x
<u>FILE SUPPLIED WITH PRODUCT</u>					
EC declaration of conformity		x	x	x	x
EC certificate of conformity (if conformity assessment procedures B1+F for category III and B+F & G for category IV are employed)				x	x
EC certification of conformity of pressure relief devices		x	x	x	x
Instructions manual		x	x	x	x
<u>COMMISSIONING FILE</u>					
HSE pressure report test	x	x	x	x	x
<u>OPERATION & MAINTENANCE FILE</u>					
Records of inspections, maintenance and non-conformities	x	x	x	x	x
^a for conformity assessment procedures D1 & E1 as annex III of PED ^b for conformity assessment procedures B+E, H & B1+D as annex III of PED ^c for conformity assessment procedures B+D & H1 as annex III of PED					

Table 6 - Documents stipulated by applicable conformity assessment procedure

Remark: If the unfired pressure equipment is purchased on the market and delivered with the EC declaration of conformity signed by the European representative of the manufacturer; the engineering and manufacturing design file may not be included in the Safety file. According to the PED the manufacturer is not obliged to deliver the equipment with the complete engineering and manufacturing file.

The HSE Unit recommends that unfired pressure equipment which has: high potential hazard, or high complexity of design, or uses unconventional materials, or fabrication technologies, or operates in special conditions, or is intended to be used in a complex system is delivered with the engineering design and manufacturing file.

5.3.1.2 Piping made of metallic materials

Piping made of metallic materials with a maximum allowable pressure PS greater than 0.5bar shall comply with the Directive 97/23/EC (PED).

According to Directive 97/23/EC piping are classified in four hazard categories (“0”, I, II and III). This classification is based on the maximum allowable pressure (PS), geometry (DN) and working fluid. The hazard category of piping containing fluids can be determined by using tables 6 to 9 provided in Annex II of Directive 97/23/EC (Figure 2).

Table 7 defines the conditions that define the limits of applicability of conformity assessment tables 6 to 9 (available in Figure 3).

Equipment	Fluids	Group	Applicability	Conformity assessment table
Piping (PS>0.5bar)	Gases	1 ^a	DN> 25	6

Equipment	Fluids	Group	Applicability	Conformity assessment table
	Gases	2 ^b	DN>32 and PS.DN>1000bar	7
	Liquids	1	DN>25 and PS.DN>2000bar	8
	Liquids	2	PS> 10bar and DN>200 and PS.DN>5000bar	9
Safety accessories (safety valves, burst disc)	All fluids	Category IV. By way of exception, safety accessories manufactured for specific equipment may be classified in the same category as the equipment they protect.		

^a Fluids group 1 is a substance or preparation as defined in Council Directive 67/548/EEC. It comprises fluids defined as: explosive, extremely flammable, highly flammable, flammable, very toxic, toxic and oxidizing.

^b Fluids group 2 are all other fluids not included in group 1.

Table 7 - Conformity assessment tables applicable to piping

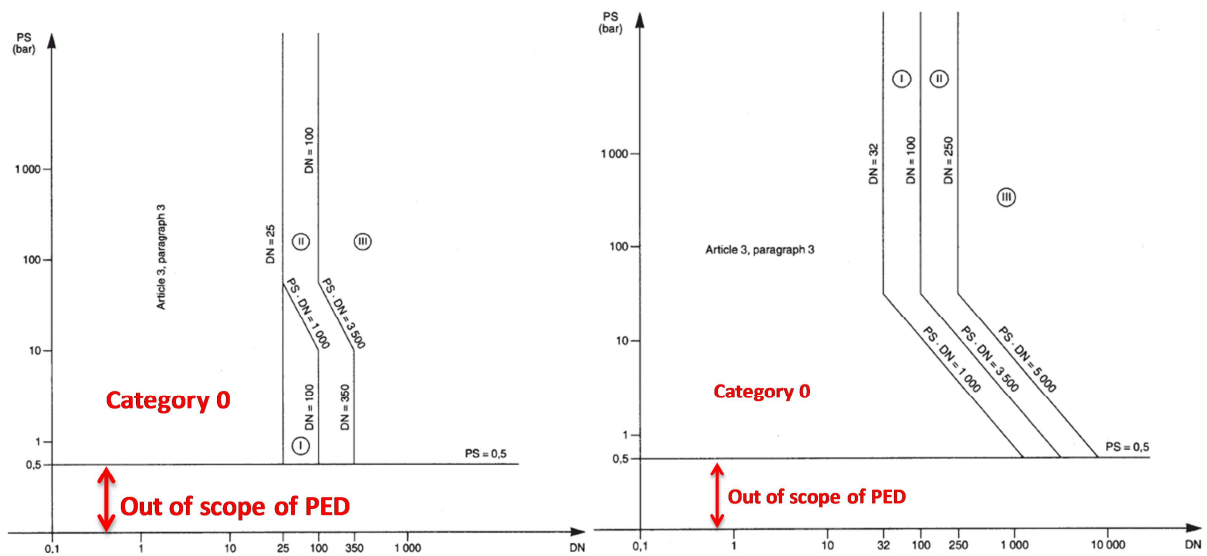


Table 6

Table 7

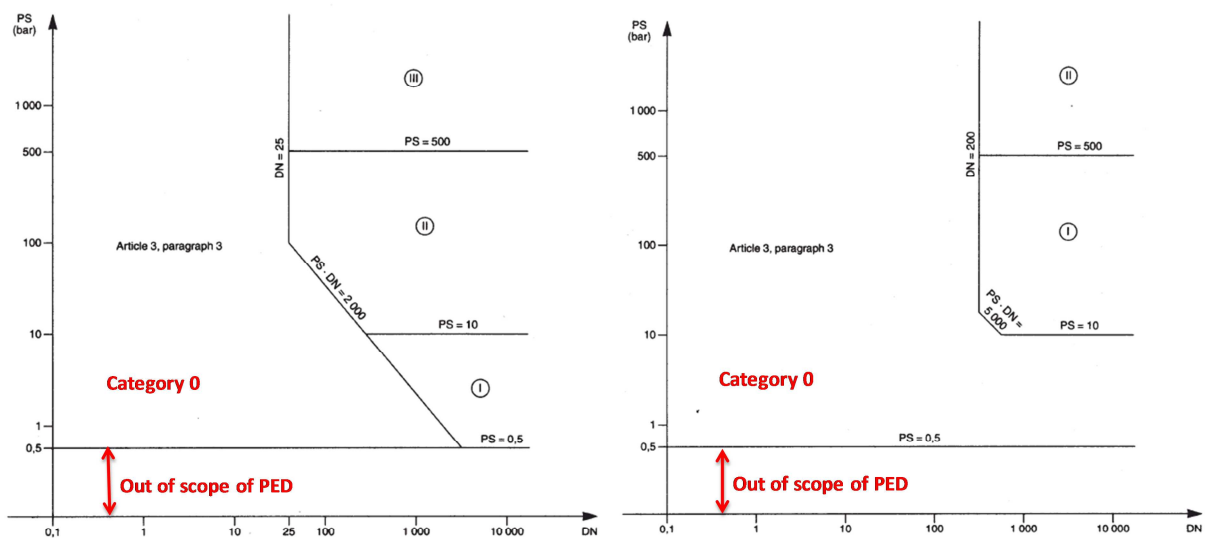


Table 8

Table 9

Figure 3 - Conformity assessment tables 6 to 9 for piping [source: Annex II of Directive 97/23/EC]

Table 8 provides a summary of the applicability of the PED with respect to the piping category.

Independent piping operating at a maximum allowable pressure up to 0.5barg are not obliged to meet the essential requirements set by the Directive 97/23/EC. Therefore such equipment cannot bear the CE marking. However, it shall have adequate instructions for use and bear the identification of the manufacturer. The HSE Unit recommends that such equipment is designed, manufactured and tested according to standards harmonized with the PED.

	Piping category		
	PS>0.5barg		PS≤0.5barg
	Categories I, II and III	Category 0 (art.3, paragraph 3)	Out of scope of PED
Compliance with the essential safety requirements as defined in Annex I of Directive 97/23/EC	Compulsory	Optional	Not required
Conformity assessment as defined in Annex III of Directive 97/23/EC	Compulsory	Optional	Not required
Participation of notified body in the conformity assessment	Cat. I – Not required (manufacturer declares conformity with PED) Cat. II, III & IV – Compulsory (Notified body certifies conformity with PED)	Not required	Not required
CE marking	Compulsory	Not allowed	Not allowed
Identification of the manufacturer	Compulsory	Compulsory	Compulsory
Design, manufacturing and testing standards	Standards harmonized with PED	HSE recommends standards harmonized with PED ^a	HSE recommends standards harmonized with PED
^a According to the PED the equipment shall be designed taking into account all relevant factors influencing its safety: Sound engineering practice (SEP).			

Table 8 - Applicability of the Directive 97/23/EC with respect to the pressure vessel category

5.3.1.2.1 Harmonized standards

Equipment, meeting the requirements of the standards listed below, are presumed to be compliant with the PED.

Scope	Harmonized Standards
Piping systems made of metallic materials	<ul style="list-style-type: none"> • EN 13480-1: Metallic industrial piping - Part 1 : general; • EN 13480-2: Metallic industrial piping - Part 2 : materials; • EN 13480-3: Metallic industrial piping - Part 3 : design and calculation; • EN 13480-4: Metallic industrial piping - Part 4 : fabrication and installation; • EN 13480-5: Metallic industrial piping - Part 5 : inspection and testing; • EN 13480-6: Metallic industrial piping - Part 6 : additional requirements for buried piping; • EN 13480-8: Metallic industrial piping - Part 8 : additional requirements for aluminium and aluminium alloy piping;

Table 9 – Harmonized standards

5.3.1.2.2 Control measures

Piping shall be equipped with **pressure relief devices** to ensure the safe release of the working fluid in case of overpressure.

The pressure relief devices shall be:

- installed, commissioned, and periodically tested according to General Safety Instruction on standard pressure equipment ([GSI-M2](#));
- CE marked and compliant with the harmonized standard [ISO 4126](#) on safety devices for protection against excessive pressure.

The **initial inspection of the pressure relief devices** shall be carried out by the HSE Unit inspection services (Didier.Gonnard@cern.ch).

According to the General Safety Instruction on standard pressure equipment ([GSI-M2](#)), new piping installation category I and above (see Figure 3) shall be subject to a **proof test**.

The proof test shall take the form of a hydrostatic pressure test. Where a hydrostatic pressure test is harmful or impractical other tests may be carried out. Other tests of a recognized value or method may be carried out subject to the prior approval of the HSE Unit (Phillip.Santos.Silva@cern.ch).

The **proof test** must be no less than the greater of the following values:

- the maximum loading to which the pressure equipment may be subject in service taking into account its maximum allowable pressure and its maximum allowable temperature, multiplied by a coefficient of 1,25, or
- the maximum allowable pressure multiplied by a coefficient of 1,43.

The **proof test** shall be carried out under the supervision of the HSE Unit inspection service (Didier.Gonnard@cern.ch).

5.3.1.2.3 Safety file for piping made of metallic materials

The Safety file for piping shall include the documents necessary to demonstrate its compliance with the above mentioned rules.

	Piping category				
	PS>0.5barg				PS≤0.5barg
	III	II	I	0	
<u>ENGINEERING DESIGN FILE</u>					
Piping and instrumentation diagram	x	x	x	x ^a	x ^a
Summary of design and operating conditions	x	x	x	x ^a	x ^a
Drawings of the layout of the piping and piping supports with dimensions (may include isometric drawings, as built drawings, views, ground layouts)	x	x	x	x ^a	x ^a
Parts lists for piping components with dimensions, standards, materials	x	x	x ^a	x ^a	-
<u>MANUFACTURING FILE</u>					
Material certificates for base materials and welding consumables, if required (material standards are listed in EN 13480-2)	x	x	x ^a	See EN 1348 0-2	-
Documentation for miscellaneous components, e.g. valves, safety equipment	x	x	x ^a	x ^a	x ^a
Welding documents (welding procedure specifications according to EN 288-2, approval testing of welders according to EN 287-1 or approval testing of welding operators according to EN 1418)	x	x	x ^a	x ^a	-

Non-destructive testing (NDT) ^b documents (reports of NDT testing in accordance to standard for testing method, qualification and certification of NDT personnel in accordance to EN 473)	x	x	x	-	-
Heat treatment documents	x	x	x	-	-
Pressure test or equivalent test documents	x	x	x	x ^a	-
Marking information	x	x	x	x	x ^a
Declaration of design compliance	x	x	x	-	-
Declaration of compliance for piping fabrication/installation	x	x	x	-	-
Pressure test certificate	x	x	x	-	-
<u>FILE SUPPLIED WITH PRODUCT</u>					
EC declaration of conformity	x	x	x	-	-
Operating instructions	x	x	x	x	x
<u>COMMISSIONING FILE</u>					
HSE pressure report test	x	x	x	x	
<u>OPERATION & MAINTENANCE FILE</u>					
Records of inspections, maintenance and non-conformities	x	x	x	x	x
^a recommended.					
^b NDT are defined in the EN 13480-5 and the CERN practise defined in Table 11					

Table 10 - Safety file for piping made of metallic materials

Fluid	Scope	NDT technique	Method	Acceptance criteria	Extent of testing
Non-flammable gas	any diameter everywhere	Radiographic testing	EN 1435:1997	Defined in EN 13480-5	10 %
Flammable gas	any diameter surface buildings	Radiographic testing	EN 1435:1997	Defined in EN 13480-5	10 %
Flammable gas	any diameter underground areas & shafts	Radiographic testing	EN 1435:1997	Defined in EN 13480-5	100 %

Table 11 - NDT techniques applicable at CERN

Remark: If the piping is purchased on the market and delivered with the EC declaration of conformity signed by the European representative of the manufacturer; the engineering and manufacturing design file may not be included in the Safety file. According to the PED the manufacturer is not obliged to deliver the equipment with the complete engineering and manufacturing file.

The HSE Unit recommends that pressure equipment which has: high potential hazard, or high complexity of design, or uses unconventional materials, or fabrication technologies, or operates in special conditions, is delivered with the engineering design and manufacturing file.

5.3.1.3 Nuclear pressure equipment

Nuclear pressure equipment (i.e.: pressure equipment operating with a maximum allowable pressure (PS) greater than 0.5barg, designed for a nuclear application, and which may emit radioactivity greater than 370 MBq in the event of failure) shall comply with the requirements provided in the:

- « [Arrêté du 12 Décembre 2005 relatif aux équipements sous pression nucléaires](#) ».

The HSE Unit shall grant safety clearance priori to design and operation. The conditions to grant Safety clearance and identification of the applicable Safety requirements are defined by the HSE Unit (Phillip.Santos.Silva@cern.ch) at the conceptual phase of the equipment.

5.3.1.4 Refrigerating systems and heat pumps

Refrigerating systems and heat pumps, meeting the requirements of the standards listed below, are presumed to be compliant with the Safety requirements laid down in the applicable CERN Safety rules.

Scope	Harmonized Standards
Refrigerating systems and heat pumps	<ul style="list-style-type: none"> • EN 378-1: Refrigerating systems and heat pumps: safety and environmental requirements : Part 1: basic requirements, definitions, classification and selection criteria; • EN 378-2: Refrigerating systems and heat pumps: safety and environmental requirements : Part 2: design, construction, testing, marking and documentation ; • EN 378-3: Refrigerating systems and heat pumps: safety and environmental requirements : Part 3: installation site and personal protection ; • EN 378-4: Refrigerating systems and heat pumps - safety and environmental requirements : part 4: operation, maintenance, repair and recovery.

Table 12 – Harmonized standards

5.3.1.4.1 Control measures

As defined in the chapter 5.3.1.1.2 and 5.3.1.2.2.

5.3.1.4.2 Safety file for refrigerating systems and heat pumps

As defined in the chapter 5.3.1.1.3 and 5.3.1.2.3.

5.3.2 Machinery

Machinery (including lifting equipment) shall comply with the following CERN Safety rules:

- Safety Regulation on mechanical equipment ([SR-M](#));
- General Safety Instruction on standard lifting equipment ([GSI-M1](#)).

In general, and according to the CERN Safety rules, machinery shall meet the essential requirements set by the following directives:

- Directive [2006/42/EC](#) on machinery;
- Directive [2009/104/EC](#) on the use of work equipment by workers at work.

Machinery designed according to the [harmonized standards](#) meeting the requirements set by the Directive 2006/42/EC benefit from presumption compliance with the Safety requirements on design and manufacturing laid down in the applicable rules.

Remark: The HSE Unit advises on harmonized standards that can be used for the design, manufacturing and testing of machinery.

5.3.2.1 Conformity of old machinery

Machinery manufactured from 1st January 1995 shall be CE-marked and comply with the requirements of the applicable Machinery Directive (Machinery Directive 2006/42/EC was published on 9th June 2006 and it is applicable from 29th December 2009, replacing the Machinery Directive [98/37/EC](#)).

Machinery which was first used before the implementation of the Machinery Directive 98/37/EC (i.e. 1st January 1995) is excluded to be CE-marked.

Any machinery that is refurbished or upgraded so that its original specification is changed or undergoes major repair shall be considered as “new” equipment and therefore shall comply with the requirements of the Machinery Directive 2006/42/EC.

Independently of the manufacturing date, a risk assessment shall be carried out on all machines that are in use and the users shall be informed and trained for all hazards pertinent to the machine.

5.3.2.2 Conformity of workshops and machine tools

For workshop and machine tools conformity refer to the detailed Safety requirements ([EDMS 1218317](#)).

5.3.2.3 Overhead and gantry cranes

Overhead and gantry cranes designed and manufactured according to the harmonized standards benefit from presumption of compliance with the machinery directive.

Scope	Harmonized Standards
Bridge and gantry cranes	<ul style="list-style-type: none"> • EN 15011 – Cranes – Bridge and gantry cranes.
Overhead and gantry cranes	<ul style="list-style-type: none"> • EN 12644 – Cranes – Information for use and testing; • EN 12100 – Safety for machinery – Basic concepts, general principles for design – Basic terminology, methodology; • EN 13001 – Cranes – General design – General principles and requirements; • EN 13586 – Cranes – Access; • EN 12077 – Cranes safety – Requirements for health and safety; • EN 13557 – Controls and control stations.
Dimensional tolerances for crane installations	<ul style="list-style-type: none"> • ISO 11660-2 – Cranes- Access, guards and restraints – Part 2: mobile cranes.

Table 13 – Harmonized standards

5.3.2.3.1 Control measures

Overhead and gantry cranes assembled at CERN shall be subject to an examination of adequacy, an examination of assembly, a functional test, a static test (test load of 1.5 times the load capacity if human strength, and 1.25 times for the others), and a dynamic test (test load of 1.1 times the load capacity).

These tests shall be carried out under the supervision of the HSE Unit inspection service ([L. Colly](#)).

Before using cranes, the handling personnel shall meet the requirements listed in the table below.

Requirements	CERN staff	Users	Contractor
Declared medically fit	CERN medical service		Contractor occupational physician
Training course on crane driving¹	CERN training course available (external training courses from recognized organizations are accepted)		For handling activities in Switzerland: Certificate ASFL. For handling activities in France: Sling-crane operator training (adapted to the crane category)
Workstation training	Workstation training under the responsibility of their CERN supervisor.		

Authorization of use²	Use of the equipment in compliance with the instructions of the owner Organic Unit.
¹ The crane driver shall provide the crane driver certificate ² The use of cranes shall be authorized by the Organic Unit crane owner	

Table 14 – Requirements for handling personnel

The HSE Unit recommends that a minimum of two qualified people are present at all lifting operations.

5.3.2.4 Non-fixed load lifting attachments, slings and chains

Lifting equipment, meeting the requirements of the standards listed below, are presumed to be compliant with the Safety requirements laid down in the applicable rules.

Scope	Harmonized Standards
Non-fixed load lifting attachments	<ul style="list-style-type: none"> • EN 13155: Cranes- Safety – Non-fixed load lifting attachments
Textile slings	<ul style="list-style-type: none"> • EN 1492 series (Part 1, 2 & 4) - Textile slings - Safety
Steel wire rope slings	<ul style="list-style-type: none"> • EN 13414 series (Part 1 to 3) - Steel wire rope slings - Safety
Short link chain	<ul style="list-style-type: none"> • EN 818 series (Part 1 to 7) - Short link chain for lifting purposes - safety

Table 15 – Harmonized standards

The **resistance of the lifting points**, e.g. lifting lugs, built in the equipment shall be verified as follows:

- the loads applied in the lifting points shall be determined for the most unfavourable handling situation;
- the elastic resistance of the lifting point shall be verified for a designed load equivalent to 2 times the applied load (safety factor of 2).

The resistance of the lifting points may be determined according to the applicable harmonized, e.g. EN 13155 for the verification of lift lugs of unfired pressure vessels, [EN 1993](#) for the verification of lifting points of steel structures.

The Safety file of the equipment shall contain details on the design and manufacturing of the lifting points.

5.3.2.4.1 Control measures

According to the General Safety Instruction on standard lifting equipment ([GSI-M1](#)), the lifting equipment shall be subject to an initial **load test**.

The load test shall be carried out under the supervision of the HSE Unit inspections service ([L. Colly](#)).

The load test consists of:

- a static load test in which a load of 1.5 times the load capacity of the lifting accessory (CMU) is applied for 15 minutes,
- a dynamic load test in which a load 1.1 times the load capacity of the lifting accessory is applied and the accessory is handled as for its conditions of use.

After successful testing, the HSE Unit inspection service authorizes the use of the lifting accessories at CERN.

Remark: It is forbidden to use lifting equipment not CE marked and not inspected by the HSE Unit inspection service.

5.3.2.5 Safety file for machinery

The Safety file for machinery shall include the documents necessary to demonstrate its compliance with the above mentioned rules.

	Machinery			
	Any machinery	Cranes	Lifting accessories	Slings, chains
<u>ENGINEERING DESIGN FILE</u>				To be purchased on the market
General description of the machinery	x	x	x	
Risk assessment	x	x	x	
Engineering design calculations including: description of equipment, conditions of use, actions considered in the design and design calculations	x	x	x	
Design drawings (overall and detailed drawings, and whenever existing electrical, control circuits, hydraulic and pneumatic drawings)	x	x	x	
Standards and technical specifications used (indicating safety requirements covered by these standards)	x	x	x	
<u>MANUFACTURING FILE</u>				
Manufacturing drawings	x	x	x	
Material certificates	x	x	x	
Welders' certificate	x	x	x	
Welding procedure approval certificate and/or welding procedure specification	x	x	x	
Records of welding inspection	x	x	x	
Results of test carried out	x	x	x	
<u>FILE SUPPLIED WITH PRODUCT</u>				
EC declaration of conformity	x	x	x	x
Instructions manual	x	x	x	x
<u>COMMISSIONING FILE</u>				
HSE reception test report		x	x	x
<u>OPERATION & MAINTENANCE FILE</u>				
Records of inspections, maintenance and non-conformities	x	x	x	x
HSE periodic inspection report		x	x	x

Table 16 - Safety file for machinery

Remark: If the machinery is purchased on the market and delivered with the EC declaration of conformity signed by the European representative of the manufacturer; the engineering and manufacturing design file may not be included in the Safety file.

The HSE Unit recommends that machinery which has: high potential hazard, or high complexity of design, or uses unconventional materials, or fabrication technologies, or operates in special conditions, or is intended to be used in a complex system is delivered with the engineering design and manufacturing file.

5.3.2.6 Activities involving the use of work equipment

Activities involving the use of work equipment shall comply with the requirements provided in the:

- [Directive 2009/104/EC](#) of the European Parliament and of the Council of 16 September 2009 concerning the use of work equipment by workers at work.

5.3.2.6.1 Control measures

Work equipment shall be subject to:

- Periodic inspections that ensure that the machinery is in conformity to the manufacturing specifications;
- Special inspections in the event of modification of work conditions, accidents or prolonged periods of inactivity.

Workers using work equipment shall receive adequate training, including training on any risks which such use may entail.

Work equipment shall be installed, used and dismantled under safe conditions, in particular observing any instructions provided by the manufacturer. Additionally, work equipment shall be CE marked.

5.3.2.7 Safety file for activities involving work equipment

The Safety file for activities shall include the Safety documents necessary to demonstrate compliance with the applicable rules:

- **Before starting the activity**
 - Risk assessment of the activity;
- **During the activity**
 - Records of incidents.

5.3.3 Welding activities

5.3.3.1 Welders

Welders shall be qualified and certified by competent bodies for the welding processes they perform (see Table 17).

External welders shall pass a test on CERN's premises in order to be authorized to carry out any welding activity at CERN. For any details, contact the EN/MME service (Gilles.Favre@cern.ch, Said.Atieh@cern.ch).

5.3.3.2 Specification and approval of welding procedures

Table below provides a list of the standards applicable to the relevant welding process.

Process	Arc welding	Gas welding	Electron beam welding	Laser beam welding	Resistance welding	Stud welding	Friction welding
General	EN ISO 15607: Specification and qualification of welding procedures for metallic materials. General rules						
Manual welder approval test	EN 287-1 : Qualification test of welders. Fusion welding. Steels EN ISO 9606-2 : Qualification test of welders. Fusion welding. Aluminium and aluminium alloys EN ISO 9606-3 : Approval testing of welders. Fusion welding. Copper and copper alloys						

	EN ISO 9606-4: Approval testing of welders. Fusion welding. Nickel and nickel alloys EN ISO 9606-5 : Approval Testing Of Welders. Fusion Welding. Titanium And Titanium Alloys, Zirconium And Zirconium Alloys						
Mechanised and automated welding – operator approval	EN 1418 : Welding personnel. Approval testing of welding operators for fusion welding and resistance weld setters for fully mechanized and automatic welding of metallic materials						
Guidelines for a grouping system	CR ISO/TR 15608			-	CR ISO/TR 15620		
Welding procedure specification (WPS)	EN ISO 15609-1	EN ISO 15609-2	EN ISO 15609-3	EN ISO 15609-4	EN ISO 15609-5	EN ISO 14555	EN ISO 15620
Consumables	EN ISO 15610		-				
Previous welding experience	EN ISO 15611					EN ISO 15611 EN ISO 14555	EN ISO 15611 EN ISO 15620
Standard procedure	EN ISO 15613			-			
Pre-production test	EN ISO 15613					EN ISO 15613 EN ISO 14555	EN ISO 15613 EN ISO 15620
Welding procedure test	EN ISO 15614 (Part 1 to 10)	EN ISO 15614 (Part 1, 3, 6 & 7)	EN ISO 15614 (Part 7 & 11)	EN ISO 15614 (Part 12 & 13)	EN ISO 14555	EN ISO 15620	

Table 17 - European standards for Specification and approval of welding procedures

5.3.3.3 Non-destructive examination of welds

The choice of non-destructive methods for testing welds and evaluation of results for quality shall be based on the standards listed in the Table 18.

Methods	X-ray	Eddy current	Magnetic	Penetration	Ultrasonic	Visual inspection
General requirements	EN 12062: Non-destructive examination of welds (General rules for metallic materials) EN 473: Qualification and certification of NDT personnel – General principles					
Methodology for testing levels	EN 1435	EN 1711	EN 1290	EN 571-1	EN 1714	EN 970
Acceptance level	EN 12517		EN 1291	EN 1289	EN 1712	EN 25817 EN 30042

Table 18 - European standards for non-destructive examination of welds

5.3.3.4 Safety file for welding activities

The Safety file for welding activities shall include the Safety documents necessary to demonstrate compliance with the applicable rules:

- **Before starting the activity**
 - Welder approval test certificate;
 - Non-destructive testing personnel certificate;
 - CERN attestation to carry out welding activities;
 - Welding procedure approval certificate;
- **During the activity**
 - Records of welding inspections.

The HSE Unit ([P. Santos Silva](#)) provides advice on mechanical Safety.

5.3.4 Heating, ventilation and air conditioning (HVAC) system

The purpose of HVAC systems in workplaces is to provide the workplace with adequate indoor air quality and thermal comfort.

Equipment purchased on the market (e.g.: Air Handling Units, chillers, boilers, fan coils) shall comply with the applicable European Directives and shall bear the CE marking. For products purchased on the market refer to 0.

Ductwork (supply or exhaust air) and piping systems incorporated in a permanent manner in a building, shall comply with the following European Regulation:

- [European Regulation 305/2011](#) - Construction Products Regulation.

Ductwork designed according to the harmonized standards:

- [EN 1505](#) - Ventilation for buildings. Sheet metal air ducts and fittings with rectangular cross-section. Dimensions;
- [EN 1506](#) - Ventilation for buildings. Sheet metal air ducts and fittings with circular cross-section. Dimensions;
- [EN 12097](#) - Ventilation for buildings. Requirements for ductwork components to facilitate maintenance of ductwork systems.

benefit from presumption of compliance with the Safety requirements regarding the design laid down in the applicable European Regulation.

Metallic piping shall be designed, manufactured and tested as defined in chapter 5.3.1.3.

5.3.4.1 HVAC requirements

The requirements applicable to HVAC systems are defined on the basis of the French and Swiss legislation. Chapters below provide a summary of those requirements.

For more information refer to the guidance document available in EDMS: [1157155](#).

5.3.4.1.1 Ventilation requirements

Workplaces shall be adequately ventilated. Windows or other openings may provide sufficient ventilation but, where necessary mechanical ventilation shall be provided. Clean air shall be drawn from a source outside the workplace, uncontaminated by discharges from flues or other process outlets.

Natural ventilation is accepted whenever the volume per occupant is superior to the values indicated in the table below.

Location	Workplace description	Volume/occupant
France ⁽¹⁾	Offices & workplaces dedicated to light physical activity	15 m ³
	Other workplaces	24 m ³
Switzerland ⁽²⁾	Offices & workplaces dedicated to seated work	12 m ³
	Offices & workplaces dedicated to work in standing position	15 m ³
	Offices & workplaces dedicated to work involving physical effort	18 m ³

⁽¹⁾ [Art.](#) R. 4222-1 of the French “Code du Travail”

⁽²⁾ [Commentaire de l’OLT 3](#) – Art. 12

Table 19 - Minimum volume per occupant requirements for natural ventilation

If the workplace does not have the required minimum volume per occupant, the workplace shall be provided with **mechanical ventilation** in order to supply the minimum quantity of fresh air per occupant as indicated in the table below.

Location	Workplace description	Fresh air/occupant
France ⁽¹⁾	Offices, workplaces without physical activity	25 m ³ /hour
	Meeting rooms	30 m ³ /hour
	Workshops and workplaces dedicated to physical work (e.g.: machining, drilling)	45 m ³ /hour
	Other workplaces – intense work activity	60 m ³ /hour
Switzerland ⁽²⁾	Offices	36 m ³ /hour
	Meeting rooms	36 m ³ /hour

⁽¹⁾ [Art.](#) R. 4222-5 of the French “Code du Travail”

⁽²⁾ Swiss standard [SIA 382/1](#)

Table 20 - Minimum quantity of fresh air per occupant to be supplied by mechanical ventilation

Independently of the volume, sanitary conveniences and washing facilities shall be mechanical ventilated as indicated in the table below.

Location	Sanitary conveniences and washing facilities	Fresh air to supply
France ⁽¹⁾	Toilet ⁽³⁾	30 m ³ /hour
	Bathroom or shower room ⁽³⁾	45 m ³ /hour
	Bathroom or shower room ⁽³⁾ with toilet	60 m ³ /hour
	Grouped bathrooms, showers and toilets	30 + 15 N ⁽⁴⁾ m ³ /hour
	Grouped washbasins	5 N ⁽⁴⁾ m ³ /hour

Switzerland⁽²⁾	Toilet	Individual adjustment
	Bathroom with toilet and showers	Individual adjustment
<p>⁽¹⁾ Art. R. 4212-6 of the French “Code du Travail”</p> <p>⁽²⁾ Swiss standard SIA SIA 382/1</p> <p>⁽³⁾ For a toilet, a bathroom or a shower with or without toilet not intended for collective use, the quantity of fresh air to be supplied can be limited to 15 m³/hour</p> <p>⁽⁴⁾ Quantity of equipment (e.g. toilets, bathrooms, showers, washbasins) per place</p>		

Table 21 - Ventilation requirements of sanitary conveniences and washing facilities

5.3.4.1.2 Temperatures in indoor workplaces

Workplace temperatures shall be adapted to the nature of the work and shall not cause harm to the health of the workers.

Location	Activity description	Temperature
France⁽¹⁾	Mental work	21°C
	Work involving low physical effort in seated or standing position	18 to 19°C
	Work involving moderate physical effort in standing position	17°C
	Work involving severe physical effort in standing position	15 to 16°C
Switzerland⁽²⁾	Seated work, intellectual activity	21 to 23°C
	Seated work, manual work	20 to 22°C
	Work involving low physical effort	18 to 21°C
	Work involving moderate physical effort	16 to 19°C
	Work involving severe physical effort	12 to 17°C
<p>⁽¹⁾ Recommendation by INRS (French Standard NF EN ISO 7730)</p> <p>⁽²⁾ Recommendation by Commentaire de l’OLT 3 – Art. 16</p>		

Table 22 - Recommended indoor temperatures during the winter

5.3.4.1.3 Humidity and air velocity

The recommended values of humidity level and air velocity in the workplace are as indicated in the table below.

Location	Parameter	Limits
France⁽¹⁾	Humidity	30% to 70%
	Air velocity in occupied area during winter (from floor level to 1.8m in height)	<0.15 m/s
	Air velocity in occupied area during the rest of year (from floor level to 1.8m in height)	<0.25 m/s
Switzerland⁽²⁾	Humidity	30% to 65%

	Air velocity in occupied area during summer (from floor level to 1.8m in height)	<0.2 m/s
	Air velocity in occupied area during the rest of year (from floor level to 1.8m in height)	<0.1 m/s
⁽¹⁾ Recommendation by INRS ED 950 ⁽²⁾ Recommendation by Commentaires de l'OLT 3 – Art. 16		

Table 23 - Recommended values of humidity level and air velocity

5.3.4.2 Safety file for HVAC systems

The Safety file for HVAC systems shall include the following documents:

- **Engineering design file**
 - Engineering drawings (P&I D(s));
 - Engineering design report including: description of the HVAC system, conditions of use, actions considered in the design (ventilation rates), design calculations;
 - Technical specifications;
- **Procurement file**
 - EC declaration(s) of conformity of equipment purchased on the marked (e.g.: Air Handling Units, chillers, boilers, fan coils);
 - Instruction(s) manual of the referred equipment;
 - Material certificates of ductwork and piping;
- **Commissioning file**
 - Records of tests and inspections made;
- **Operation and maintenance file**
 - Instruction manual for the operation and maintenance of the installation;
 - Records of inspections, maintenance and non-conformities.

The HSE Unit ([A. Henriques](#)) provides advice on HVAC systems.

5.4 Structural Safety

Structures shall comply with the requirements provided in the following CERN Safety rule:

- Safety Regulation on mechanical equipment ([SR-M](#)).

Structures designed and manufactured according to the **structural Eurocodes** benefit from presumption of compliance with the Safety requirements laid down in the applicable rules.

5.4.1 Basis of structural design

The basis and general principles for safety and serviceability of structures and structural reliability are set by the following Eurocodes and related national annexes:

- [NF EN 1990](#): Eurocode 0 - Basis of structural design.

5.4.2 Actions on structures

The actions on structures shall be defined according to the following Eurocodes:

- [NF EN 1991](#): Eurocode 1 - provides guidance on action for structural design (e.g. density of materials, imposed loads on structures, actions induced by cranes and machinery, accidental actions from impacts and explosions, etc);
- [NF EN 1998](#): Eurocode 8 - provides the rules for the representation of seismic actions.

Remark: For reasons of building construction permit, granted by the Swiss authorities, building structures constructed in the Swiss territory are required to comply with the SIA standards. In this case the actions on structures are defined according to the standard SIA 261 - Actions on structures.

5.4.2.1 Seismic action

The seismic action on structures built at CERN, **independently on the location**, is defined as stipulated by the French law.

According to the '[Décret n°2000-892 du 13 septembre 2000 relatif à la prévention du risque sismique](#)' new constructions or constructions submitted to important modifications in seismic regions shall comply with the applicable seismic design requirements.

According to the '[Décret n° 2010-1255 du 22 octobre 2010 portant délimitation des zones de sismicité du territoire français](#)' **CERN is classified as seismic zone 3**, 'sismicité modérée'.

In order to meet the provisions of the applicable French regulations, the design of structures for earthquake resistance shall comply with the following standards:

- [NF EN 1998-1](#) September 2005 - Eurocode 8: Design of structures for earthquake resistance - Part 1: General rules, seismic actions and rules for buildings;
- [NF EN 1998-1/NA](#) December 2007 (National annex).

taking into account:

- reference peak ground acceleration on type A ground, a_{gR} equal to 1.1 m/s²;

5.4.3 design ground acceleration a_g is equal to a_{gR} times the importance factor γ_I . Design of steel structures

The design of steel structures shall comply with the Eurocode 3:

- [NF EN 1993](#): Design of steel structures.

The Eurocode 3 shall be used in conjunction with the reference documents listed in the standard.

Remark: For reasons of building construction permit, granted by the Swiss authorities, the steel structures built in the Swiss territory may be required to comply with the SIA 263 –Design of steel structures.

5.4.3.1 Execution of steel structures

The execution of steel structures shall comply with the requirements of the:

- [EN 1090-2:2008](#) Execution of steel structures and aluminium structures. Technical requirements for the execution of steel structures.

Welding and frequency of inspection of welds shall be as specified in the [EN 1090-2](#).

The quality level of the welds shall be chosen according to the [EN 25817](#) (Arc-welded joints in steel. Guidance on quality levels for imperfections). The quality level C according to [EN 25817](#) is required.

5.4.3.2 Safety file for steel structures

The Safety file of the steel structure shall include the following documents:

- **Engineering design file**
 - Engineering drawings;
 - Engineering design report including: description of the structure, conditions of use, actions considered in the design, design calculations;
 - Technical specifications;
- **Manufacturing design file**
 - Manufacturing drawings;
 - Welding plan (§ 7.2 of EN 1090-2:2008);
 - Qualification of welding procedures (§ 7.4.1 of EN 1090-2:2008) and welding personnel (§ 7.4.2 of EN 1090-2:2008);
 - Records of inspection of welds;

5.4.4 Design of concrete structures

The design of concrete structures shall comply with the Eurocode 2:

- [NF EN 1992](#): Design of concrete structures.

The Eurocode 2 shall be used in conjunction with the reference documents listed in the standard.

Remark: For reasons of building construction permit, granted by the Swiss authorities, the concrete structures built in the Swiss territory are required to comply with the SIA 262 –Design of concrete structures.

5.4.4.1 Concrete requirements

Concrete for structures shall comply with the requirements set by the:

- NF EN 206-1 Concrete – Part 1: Specification, performance, production and conformity.

5.4.4.2 Safety file for concrete structures

The Safety file for concrete structures shall include the following documents:

- **Engineering design file**
 - Engineering drawings;

- Engineering design report including: description of the structure, conditions of use, actions considered in the design, design calculations;
- Technical specifications;
- **Construction/manufacturing design file**
 - Manufacturing drawings;
 - Material certificates: reinforcing steel and concrete;

5.4.5 Permanent means of access to machinery and buildings

Permanent means of access to machinery shall comply with the standards ISO 14122 concerning permanent means of access to machinery:

- [ISO 14122-1](#): Choice of fixed means of access between two level – this standard gives advice on the adequate access means to equipment which cannot be accessed from a floor level;
- [ISO 14122-2](#): Working platforms and walkways – this standard specifies the requirements applicable to platforms and walkways; e.g.: dimensions, distances to hazardous areas, design loads, etc;
- [ISO 14122-3](#): Stairs, stepladders and guard-rails – this standard specifies the requirements applicable to stairs, step ladders and guard rails; e.g.: dimensions, design loads, etc;
- [ISO 14122-4](#): Fixed ladders – this standard specifies requirements applicable to fixed ladders; e.g.: dimensions, design loads, testing, etc.

Permanent means of access to buildings shall comply with the French standards:

- [NF E 85 013](#) : Choix du moyen d'accès fixes entre deux niveaux ;
- NF E 85 014 : Plates-formes de travail et passerelles ;
- NF E 85 015 : Escaliers, échelles a marches et garde-corps ;
- [NF E 85 016](#) : Echelles fixes.

5.4.5.1 Control measures

According to the applicable standards, parts of the permanent means of access may need to be tested before use; e.g.: safety cage and anchor points.

The document "[Safety requirements and Safety file contents for permanent means of access to machinery](#)" provides a list of Safety checks required to verify the compliance of access means to machinery.

5.4.5.2 Safety file for permanent means of access

The Safety file for permanent means of access shall include Safety documents necessary to demonstrate conformity with the applicable standards:

- **Engineering design file**
 - Engineering drawings;
 - Design calculations;
- **Manufacturing file**
 - Manufacturing drawings;
 - Material certificates;
 - Welding documents: welders' certificate, and records of welding inspections;

The HSE Unit ([C. Colloca](#)) provides advice on structural Safety.

5.5 Electrical Safety

5.5.1 General requirements for electrical equipment and installations

Electrical installations and **equipment** shall comply with the Safety requirements provided in the following CERN Safety rules:

- [Safety Code C1](#) - Electrical safety code.

5.5.2 Electrical equipment

The **electrical equipment** to be installed at CERN shall be compliance with the latest applicable IEC standards related to the equipment.

5.5.2.1 Potentially explosive atmospheres

If there is any equipment to be installed or used in a potentially explosive atmosphere shall comply with the following European Directive:

- Council [Directive 94/9/EC](#) of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres.

5.5.3 Electrical installations

Low voltage and high voltage **electrical installations** shall comply with the standards which are referred to in the CERN [Safety Instruction IS 24](#) – Regulations applicable to electrical installations. As described in the IS24 the Low voltage installations (up to 1 KV AC or 1.5 kV DC) shall comply with the French standard NF C 15-100 – Installations électriques a basse tension. For the high voltage installations where the industrial frequency is used (50Hz), the installation shall comply with the French standard NF C 13-200 – Installations électriques a haute tension.

5.5.3.1 Initial electrical inspection

According to [Safety Instruction IS 4](#) on Safety inspections the electrical installations shall be submitted to a compulsory **initial electrical inspection** to be carried out by the HSE Unit inspection service ([O. Tison](#) or [J-P. Jullien](#)).

5.5.4 Electrical cables

Electrical cables shall comply with the Safety requirements provided in the following CERN Safety rules:

- [Safety Instruction IS 23](#) - Criteria and standard test methods for the selection of electric cables and wires with respect to fire safety and radiation resistance
- [Safety Instruction IS 41](#) - The use of plastic and other non-metallic materials at CERN with respect to fire safety and radiation resistance.

5.5.5 Electrical cabling

Electrical cabling shall comply with the fire safety requirements set by the following CERN Safety rules:

- [Safety Instruction IS 48](#) - Fire prevention for cables, cable trays and conduits.

5.5.6 Earthing

All accessible metallic/conductive parts shall be adequately earthed because they may become live (energized) due to an electrical fault. The fault current will flow through earthed conductive parts, which should allow a fuse or circuit breaker to detect it, and automatically disconnect the supply avoiding electrical hazards. The CERN earthing grid is interconnected everywhere in order to evacuate easily any fault current and to be cleared immediately. The accessible metallic/conductive parts of equipment shall be connected to the nearest earthing connection bar available in the area.

5.5.7 Emergency System Stops

Emergency System Stops shall be installed in power electrical equipment in order to stop the system in case of electrical hazards.

5.5.8 Safety file for electrical installations and equipment

The Safety file for electrical installations and equipment shall include the Safety documents necessary to demonstrate compliance with the applicable rules:

- **Engineering design file**
 - Results of design calculations made;
 - Drawing identifying areas which may pose any risks to the electrical equipment, e.g. areas where fire and explosion risks exist;
 - Drawing of the building/area with earthing systems and electrical underground network;
 - Diagrams, block diagrams, interconnection diagrams of electrical and safety installations.
 - List of cables data used in the installation;
 - List of safety installations and maximum occupancy of the building areas;
 - Technical specifications including power supplies;
 - Technical requirements for overcurrent/overvoltage protection for load and mains;
- **File supplied with products**
 - EC declaration of conformity for electrical equipment (e.g.: power supplies, protective devices);
 - Routine test and factory acceptance tests;
- **Installation and commissioning file :**
 - Acceptance test report of the general and local emergency stop systems;
 - Records of electrical inspections ;
- **Operation and maintenance file**
 - Records of inspections, maintenance and non-conformities;
 - Operation and maintenance procedures.

5.5.9 Activities in magnetic fields

Activities where workers are exposed to magnetic fields shall comply with the following CERN Safety rule:

- [Safety Instruction IS 36](#) – Safety rules for the use of static magnetic fields at CERN.

5.5.9.1 Control measures

According to IS 36, the following control measures shall be put in place:

- workers' exposure shall be limited to the occupational exposure limit , i.e. occupational exposure during a working day shall be limited to a magnetic flux density not greater than **200 mT**;
- areas with magnetic fields above **0.5 mT** shall be marked with warning;
- any person exposed to levels above **10 mT** shall follow appropriate health surveillance.

In addition, people accessing magnetic fields are informed about hazards and safety rules.

5.5.9.2 Safety file for activities in magnetic fields

The Safety file of activities involving magnetic fields shall include the Safety documents necessary to demonstrate compliance with the applicable rules:

- **Before starting the activity**
 - Magnetic field map;
 - Operating procedures;
- **During the activity**
 - Records of magnetic field measurements;
 - List of people exposed to magnetic fields exceeding 10 mT.

The HSE Unit ([J. Gascon](#) /[C. Bernard](#)) provides advice on electrical Safety.

5.6 Non-ionizing radiation Safety

5.6.1 Equipment emitting non-ionizing radiation

Equipment emitting non-ionizing radiation shall comply with the following standards:

- (1) [CISPR 11](#) - Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement;
- (2) [EN 55011](#) - Industrial, scientific and medical (ISM) radio-frequency Equipment. Electromagnetic disturbance characteristics. Limits and methods of measurement;
- (3) [EN 50082-1](#): Electromagnetic compatibility. Generic immunity standard. Residential, commercial and light industry;
- (4) [EN 50082-2](#): Electromagnetic compatibility. Generic immunity standard. Industrial environment;
- (5) [IEC 61000](#) series - Electromagnetic compatibility (EMC).

5.6.1.1 Control measures

According to the applicable rules the following shall be carried out:

- Measurement and/or calculation of the levels of electromagnetic fields to which people are exposed;
- Assessment of the risk of electromagnetic leakage during normal and degrading operating conditions.

5.6.1.2 Safety file for equipment emitting non-ionizing radiation

The non-ionizing radiation Safety file shall include the Safety documents necessary to demonstrate compliance with the applicable rules:

- **File supplied with equipment**
 - EC declaration of conformity of the equipment;
 - Documents, notices or instructions required by the applicable Directives;
- **Commissioning file**
 - Records of measurements of electromagnetic fields;
 - Records of the assessment of the risk of electromagnetic leakage.

For equipment designed, manufactured and test under the responsibility of CERN or a Collaboration; the Safety file shall integrate documentation necessary to demonstrate that these phase comply with the applicable standards. Upon request the HSE Unit defines the contents of the Safety file.

5.6.2 Activities in electromagnetic fields

Activities where workers may be exposed to electromagnetic fields shall comply with the following rules:

- [Directive 2004/40/EC](#) on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields)).

5.6.2.1 Control measures

In order to ensure that workers exposed to electromagnetic fields are protected against all known adverse health effects, exposure shall comply with the limits listed in the table below.

Frequency range	Current density for head and trunk J (mA/m ²) (rms)	Whole body average SAR (W/kg)	Localised SAR (head and trunk) (W/kg)	Localised SAR (limbs) (W/kg)	Power density S (W/m ²)
Up to 1 Hz	40	—	—	—	—
1 — 4 Hz	40/f	—	—	—	—
4 — 1 000 Hz	10	—	—	—	—
1 000 Hz — 100 kHz	f/100	—	—	—	—
100 kHz — 10 MHz	f/100	0,4	10	20	—
10 MHz — 10 GHz	—	0,4	10	20	—
10 — 300 GHz	—	—	—	—	50

Table 24 - Exposure limit values [source: directive 2004/40/EC]

If the exposure limit values are exceeded, immediate action shall be taken to reduce the exposure below the exposure limit values. The reasons why overexposure has occurred shall be identified, and the protection and prevention measure shall be amended in order to avoid any recurrence.

Where exposure above the limit values is detected, a medical examination shall be made available to the worker(s) concerned.

Frequency range	Electric field strength, E (V/m)	Magnetic field strength, H (A/m)	Magnetic flux density, B (μT)	Equivalent plane wave power density, S _{eq} (W/m ²)	Contact current, I _c (mA)	Limb induced current, I _l (mA)
0 — 1Hz	—	1,63x10 ⁵	2x10 ⁵	—	1,0	—
1 — 8 Hz	20 000	1,63x10 ⁵ /f ²	2x10 ⁵ /f ²	—	1,0	—
8 — 25 Hz	20 000	2x10 ⁴ /f	2,5x10 ⁴ /f	—	1,0	—
0,025 — 0,82kHz	500/f	20/f	25/f	—	1,0	—
0,82 — 2,5 kHz	610	24,4	30,7	—	1,0	—
2,5 — 65 kHz	610	24,4	30,7	—	0,4 f	—
65 — 100 kHz	610	1 600/f	2 000/f	—	0,4 f	—
0,1 — 1 MHz	610	1,6/f	2/f	—	40	—
1 — 10 MHz	610/f	1,6/f	2/f	—	40	—
10 — 110 MHz	61	0,16	0,2	10	40	100
110 — 400 MHz	61	0,16	0,2	10	—	—
400 — 2 000 MHz	3f ²	0,008f ²	0,01f ²	f/40	—	—
2 — 300 GHz	137	0,36	0,45	50	—	—

Table 25 - Action values [Source: Directive 2004/40/EC]

If the action values are exceeded, an action plan comprising technical and/or organizational measures shall be devised and implemented in order to prevent exposure exceeding the exposure limit values.

Workplaces where workers could be exposed to electromagnetic fields exceeding the action values shall be indicated by appropriate signs. The areas shall also be delimited and access to them restricted.

5.6.2.2 Safety file for activities in electromagnetic fields

The Safety file of activities in electromagnetic fields shall include the Safety documents necessary to demonstrate compliance with the applicable rules:

- **Before starting the activity**
 - Risk assessment of the activity;
- **During the activity**
 - Electromagnetic field measurements.

The HSE Unit ([F. Szoncsó](#)) provides advice on non-ionizing radiation Safety.

5.7 Fire Safety

Buildings, experimental facilities, equipment and experiments shall comply with the following CERN Safety rule:

- [Safety Code E](#) - Fire protection;
- [Safety Note NS3](#) – Fire prevention for enclosed spaces in large halls.

The Safety code E sets out the fire prevention and protection rules and procedures in order to:

- ensure the protection of the people on CERN’s premises;
- protect the property of CERN’s premises.

In view of the very special nature of the use of certain areas, especially those underground, which involve increased fire risk, the HSE Unit is the authority for approving and, where necessary, stipulating special provisions. It reserves the right to require the additional more stringent measures which it deems fit.

5.7.1 General requirements

According to the Safety Code E buildings shall comply with the fire Safety requirements defined by the Host State law where they are located. Typically the fire Safety requirements are based on the Host State regulations.

Location	Regulations
France	<ul style="list-style-type: none"> • French code du travail; • Arrêté du 25 juin 1980 portant approbation des dispositions générales du règlement de sécurité contre les risques d'incendie et de panique dans les établissements recevant du public (ERP);
Switzerland	<ul style="list-style-type: none"> • Ordonnances 3 et 4 relatives à la loi sur le travail (OLT 3 et OLT 4) and the accompanying guidance notes of SECO ; • Standards issued by the Association of Cantonal Fire Insurance Establishments (AEAI);

Table 26 - Host State regulations

The guidance document “[summary of fire Safety requirements applicable to office buildings](#)” provides a summary of the requirements set by the French and Swiss regulations respectively.

Chapter	Requirements provided in the guideline
3 – Escapes routes	<ul style="list-style-type: none"> • Maximum travel distances; • Dimensions of escape routes; • Emergency exits doors;
4- Stairways	<ul style="list-style-type: none"> • Dimensions;
5- Signs and emergency lighting	<ul style="list-style-type: none"> • Location and use of emergency lights; • Design standards for emergency lighting;
6- Evacuation plans and safety instructions	<ul style="list-style-type: none"> • Content of plans; • Design standards;
7- Fire extinguishing equipment	<ul style="list-style-type: none"> • Quantity and location;

	<ul style="list-style-type: none"> • Design, testing standards;
8 – Alarm systems	<ul style="list-style-type: none"> • Location and use;
9- Smoke extraction	<ul style="list-style-type: none"> • Natural and mechanical smoke extraction; • Design standards;
10 – Reaction to fire	<ul style="list-style-type: none"> • Classification of construction products; • Upholstered furniture and others.

Table 27 – Content of guidance document “[summary of fire Safety requirements applicable to office buildings](#)”

For experimental and accelerator facilities the fire Safety measures are verified by a fire risk assessment of the facility.

The fire risk assessment can be performed according to the following standards:

- [ISO/TS 16732](#): Fire safety engineering - Guidance on fire risk assessment;
- [ISO/TS 16733](#): Fire safety engineering - Selection of design fire scenarios and design fires.

The following standards give further guidance on the performance-based fire risk assessment.

- ISO/TR 13387-1:1999 “Fire safety engineering – Part 1: Application of fire performance concepts to design objectives”;
- ISO/TR 13387-2:1999 “Fire safety engineering – Part 2: Design fire scenarios and design fires”;
- ISO/TR 13387-3:1999 “Fire safety engineering – Part 3: Assessment and verification of mathematical fire models”;
- ISO/TR 13387-4:1999 “Fire safety engineering – Part 4: Initiation and development of fire and generation of fire effluents”;
- ISO/TR 13387-5:1999 “Movement of fire effluents”;
- ISO/TR 13387-6:1999 “Fire safety engineering – Part 6: Structural response and fire spread beyond the enclosure of origin”;
- ISO/TR 13387-7:1999 “Fire safety engineering – Part 7: Detection, activation and suppression”;
- ISO/TR 13387-8:1999 “Fire safety engineering – Part 8: Life safety – Occupant behaviour, location and condition”.

Figure 4 summarizes the roles and responsibilities of the HSE Unit and the project leader/GLIMOS during the life cycle of a project with regard to fire Safety protection.

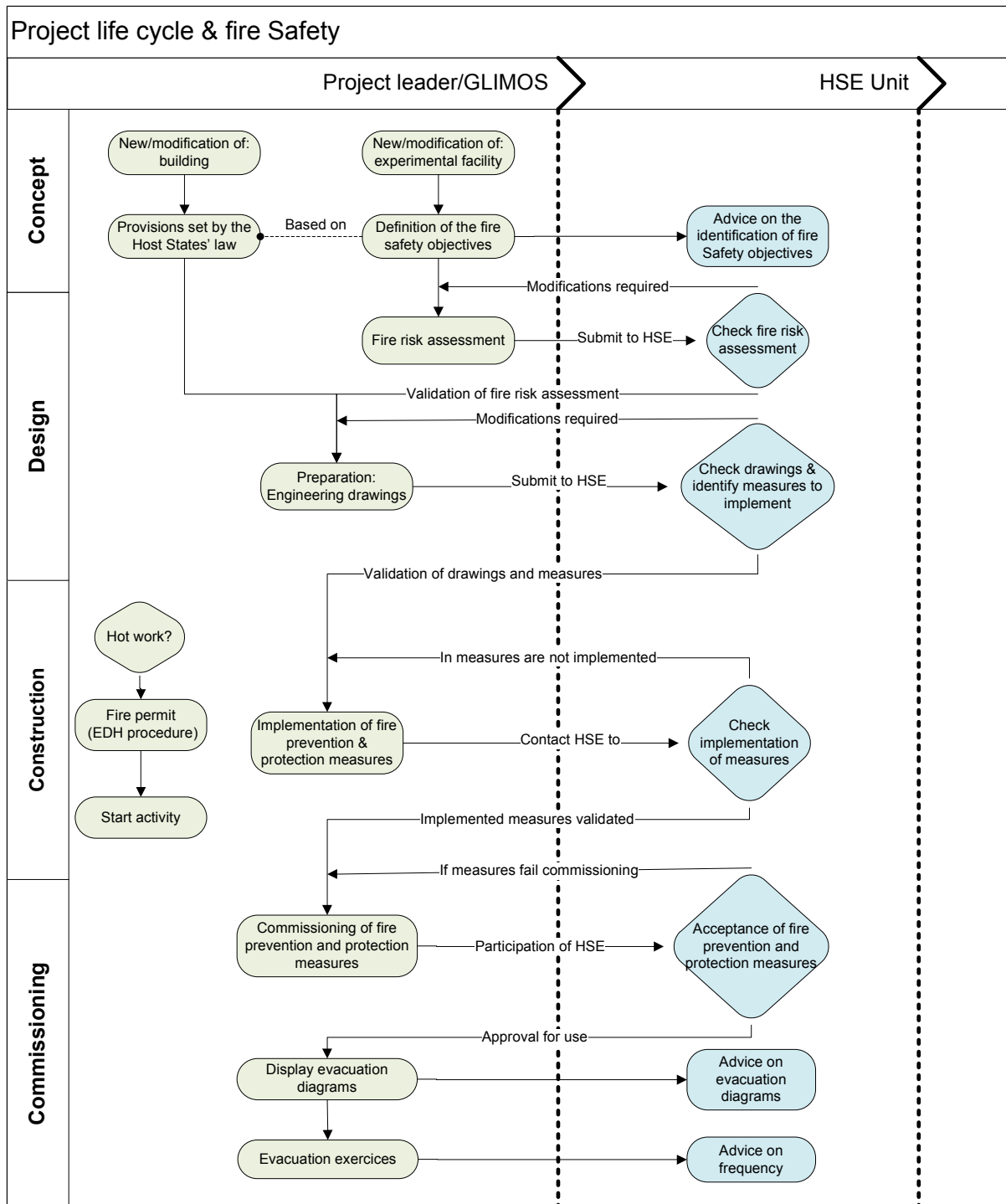


Figure 4 - Project life cycle and fire Safety

5.7.2 Fire prevention and protection measures

Fire prevention and protection measures shall be put in place in order to:

- firstly prevent the ignition of a fire;
- secondly:
 - ensure that the occupants can escape safely;
 - prevent the fire and smokes from spreading within the installation and or other installations (limiting material damage to a reasonable minimum);

- ensure that the safety rescue teams area taken into account.

The two main fire safety strategies are:

- prevention, aimed at minimizing the ignition probability of a fire, and
- protection, finalized at reducing the damage due to the outbreak of fire.

Fire protection includes passive and active measures. The first do not need an activation (i.e. reaction to fire of materials, load bearing capacity of a structure, etc.) while the latter require a manual or automatic activation (i.e. extinguishing system, smoke extraction system, etc.).

The fire prevention and protection measures shall be defined taking into account the characteristics:

- of the fire, such as
 - the sources of ignition;
 - the amount, spatial distribution and physical state of combustible materials;
 - the type of possible fires (flaming or smouldering);
- of the building / experiment, such as
 - structure and layout ;
 - technological systems such as ventilation, distribution of gas/liquids ;
 - managerial and operational aspects such as the intended use of all the facility halls / rooms;
- of the occupants such as
 - number and distribution ;
 - familiarity with the premises (staff, contractors, students, visitors, etc.);

In order to verify the adequacy of the fire prevention and protection measures the HSE shall be provided with a report containing detailed information on the fire risk assessment carried out by taking into account all the above-mentioned aspects.

5.7.2.1 Fire prevention measures

5.7.2.1.1 Fire permit

According to the [Safety code E](#), activities (e.g.: welding and plasma cutting) that can cause a fire and are performed outside authorized areas (workshops) shall start after being authorized. The authorization shall be requested by the filling in the fire permit form available in [EDH](#).

5.7.2.1.2 Fire Safety inspection

According to the [Safety code E](#) the HSE Unit shall be informed of the installation or modification of a building, facility and experimental apparatus.

The HSE Unit shall inspect the building, facility or experimental area before commissioning in order to check whether all the prevention and protection measures are put in place.

5.7.2.2 Passive fire protection measures

5.7.2.2.1 Reaction to fire of materials

Materials used at CERN shall be in accordance with the fire Safety requirements set by the Host State regulations and CERN Safety rules.

The Host State regulations set fire Safety requirements for materials in terms of material **reaction to fire**; i.e. means the way how the material reacts in case of fire (rate of heat release, rate of spread of flame, rate of smoke emission, toxic gas emission, flaming droplets/particles).

Location	Regulations
France	<ul style="list-style-type: none"> • Arrêté du 21 novembre 2002 relatif à la réaction au feu des produits de construction et d'aménagement;
Switzerland	<ul style="list-style-type: none"> • Directive de protection incendie – Matériaux et parties de construction.

Table 28 – Material reaction to fire

Additionally materials used at CERN shall comply with the following CERN Safety rules:

- [Safety Instruction IS 41](#) - The use of plastic and other non-metallic materials at CERN with respect to fire safety and radiation resistance;
- [Safety Instruction IS 23](#) - Criteria and Standard Test Methods for the Selection of Electric Cables and Wires with Respect to Fire Safety and Radiation Resistance;
- [Safety Note NS 29](#) - Fire Prevention for Insulating Core (Sandwich) Panel Structures for Inside Use Guidelines For Selection, Installation and Use.

According to the CERN Safety rules the use of halogenated or sulphur-containing plastics, fillers, and fire-retarding agents, etc shall be avoided.

5.7.2.2.2 Use of material non-compliant with IS41

Plastic materials, as for instance those used for scintillators and light guides, may not comply with the [Safety Instruction IS 41](#). Whenever possible these materials shall be replaced by a non hazardous material.

If the use of these materials is unavoidable, compensatory measures shall be put in place in order to ensure an acceptable risk level. The compensatory measures to be put in place shall be agreed by the HSE Unit ([F. Corsanego](#) or [S. Mendola](#) and [J. Gulley](#)).

The [derogation form](#) for the use of material non-compliant with IS41 shall be submitted to the HSE Unit ([F. Corsanego](#) or [S. Mendola](#) and [J. Gulley](#)).

The HSE Unit will assess the [derogation form](#) as well as the safety documentation related to the implemented compensatory measures. The operation of the equipment containing such material shall only commence after the HSE Unit has formally approved the derogation application.

5.7.2.2.3 Fire compartmentalization

The layout of buildings and facilities shall be designed in order to prevent the fire and smoke spread by applying the adequate measures such as:

- construction of fire compartments (area within the building or facility resistant to fire);
- plugging openings (e.g.: cable passageways, false floors) with fire resisting material;
- installation of fire doors (that shall be closed or fit with magnetic releases).

Fire compartmentalization shall be according to the applicable Host State regulations.

Location	Regulations
France	<ul style="list-style-type: none"> • Arrêté du 25 juin 1980 portant approbation des dispositions générales du règlement de sécurité contre les risques d'incendie et de panique dans les établissements recevant du public (ERP)

Switzerland	<ul style="list-style-type: none"> • Directive de protection incendie – Distances de sécurité – Compartiments coupe-feu
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Table 29 – Fire compartmentalization

5.7.2.2.4 Escape routes

The maximum distances to be covered during evacuation shall not exceed the values set by the Host State regulations.

Location	Description	Maximum distance
France	To reach a protected stairway	40 m
	To reach the final exit of a building from a protected stairway whose exit is located on the ground floor	20 m
	Evacuation routes shall not have dead-ends longer than	10 m
Switzerland [OLT 4 – Art.8]	If a premise contains only one exit, the distance from any point of the premise to this exit shall not exceed	20 m
	If there are 2 or more exits , the following distance is allowed	35 m
	Escape routes leading to a single stairway or an exit giving to the outside shall not exceed	35 m
	Escapes routes leading to at least 2 stairways or 2 exits, giving to the outside and far from each other, shall not exceed the total distance of	50 m

Table 30 - Maximum distances to be covered during evacuation

The quantity and width of the escape routes shall be determined on the basis of the occupancy.

Location	Occupancy	Total of escape routes	Escape route width [m]
France [Code du Travail – Art. R.4216-8]	Less than 20	1	0.9
	20 to 50	1 + 1 alternative exit (a)	0.90 + 0.60
		Or 1 (b)	1.40
	51 to 100	2	0.90 + 0.90
		Or 1 + 1 alternative exit (a)	1.40 + 0.60
	101 to 200	2	0.9+1.4
(a) Alternative exit (e.g. balcony, fixed ladder) shall have a minimum width of 0.6 m (b) Possible solution if the maximum escape distance is 25 m and the workplace is not in an underground area.			
Switzerland [OLT 4 – Art.8]	Up to 50	1	0.9
	51 to 100	2	0.9 + 0.9
	101 to 200	3 or 2	0.9+0.9+0.9 or 0.9+1.2

Table 31 – Quantity of escape routes

Escape routes shall be kept free at all times, of any obstacles. Escapes routes shall not be used for other purposes.

Doors which are used during evacuation shall comply with the Host State regulations.

Location	Requirements for evacuation doors
France	<p>Doors shall comply with the following characteristics :</p> <ul style="list-style-type: none"> • Doors which may be used for the evacuation of more than 50 people shall open in the direction of evacuation; • Doors located on escape routes shall be built in such a way that they can be unlocked and opened easily from inside without a key; <p>[Code du Travail – Art. R.4227-6]</p> <p>The following doors shall not be considered as emergency exit doors or escape routes:</p> <ul style="list-style-type: none"> • Sliding doors; • Revolving doors; • Doors which open upward; <p>Power-operated sliding doors can be used as escape routes if, in case of a failure of the control system or the power supply, the total width of the doors can be manually cleared.</p> <p>[Code du Travail – Art. R.4227-7]</p>
Switzerland	<p>Doors shall open in the direction of evacuation. Doors of small premises [surface area $\leq 30 \text{ m}^2$] designed for a small number of occupants [maximum 6 persons] and those of premises which do not constitute a fire hazard, are exempted.</p> <p>Doors located on escape routes shall be capable of being open quickly by people moving to safety, at all times and without the help of additional support. Emergency services shall be able to open the doors from the outside.</p> <p>Closing up-and-over doors, guillotine doors, revolving doors, roll-up and sliding doors shall only be permitted in premises which have additional doors which can be opened in the direction of evacuation.</p> <p>Automatic sliding and revolving doors, and roll-up doors which are a maximum of 1.2 m wide, are permitted on escape routes, provided that they allow evacuation at all times. In the case of power failure or if the doors are defective, they shall open automatically or be capable of being opened quickly and manually, and without the help of additional support.</p> <p>If there is a risk of smoke formation, doors giving access to staircases shall be provided with an automatic closing system.</p> <p>[Directive de protection incendie, voies d'évacuation et de sauvetage – Chap. 3.5.5]</p>

Table 32 – Requirements for evacuation doors

5.7.2.2.5 Stairways

Location	Dimension of stairways
France	<p>Stairs shall comply with the following requirements :</p> <ul style="list-style-type: none"> • They shall not be slippery ; • If the stairway does not consist of risers, successive steps shall overlap by 5 cm ; • It is forbidden to install 1 or 2 single steps on main walkways ; • The dimensions of the stairs shall comply with the state of the art; • Flights shall not have more than 25 stairs ; • Landings shall have the same width as the stairs and shall be at least 1 m long; • Spiral staircases shall be continued without any landing except those serving floors; • The distance between the steps and the central void shall be 0.60 m maximum and the dimensions of the steps shall comply with the state of the art; • The tread shall not overlap the step by more than 0.42 m. <p>[Code du Travail – Art. R.4216-12]</p>

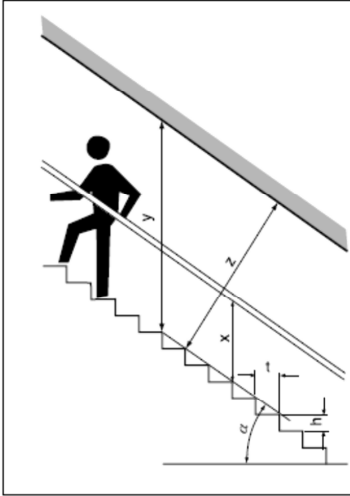
Switzerland	Stairways shall be designed according to the values given in the following table:			
				
			normal	raide
		Angle d'inclinaison α [°]	20 - 40	40 - 50
		Hauteur de la main courante x [cm]	90	90 - 85
		Espace libre y [cm]	215 - 230	- 240
		Espace libre z [cm]	200 - 180	180 - 155
		Hauteur des marches h [cm]	$h_{\min} = 15$ $h_{\max} = 20$	$h_{\min} = 20$ $h_{\max} = 24$
		Profondeur des marches t [cm]	$t_{\max} = 32$ $t_{\min} = 26$	$t_{\min} = 20$
		Angle d'inclinaison α décollant de $\text{tg}\alpha = h/t$		
Dimensionnement :				
1. Formule de commodité	$t - h = 12$			
2. Formule de la mesure du pas	$t + 2h = 63$			
3. Formule de sécurité	$t + h = 46$			
[Commentaire OLT 4 – Art. 9]				

Table 33 – Dimension of stairways

Host State regulations provide other requirements are applicable to stairs.

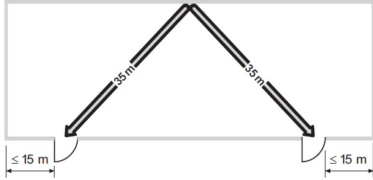
Location	General requirements for stairways
France	<p>Stairways shall be built in such a way that they are extended to the final exit.</p> <p>[Code du Travail – Art. R.4227-9]</p> <p>Stairways shall be provided with handrails.</p> <p>Stairways which are wider than 1.5 m shall be provided with handrails at both sides.</p> <p>[Code du Travail – Art. R.4227-10]</p> <p>Stairways serving upper levels shall be dissociated, in terms of evacuation to the outside, from those serving basement levels.</p> <p>[Code du Travail – Art. R.4227-11]</p>
Switzerland	<p>Stairways shall be provided with handrails at both sides. Stairways with a width not exceeding 1.5 m can be provided with one handrail.</p> <p>[OLT 3 – Art. 9]</p> <p>The following escape routes shall be provided:</p> <ul style="list-style-type: none"> • At least 1 staircase or 1 exit giving to the outside for floors with a maximum area surface of 600 m²; • At least 2 staircases for floors with a maximum surface area of 1800 m² and 1 additional staircase for every additional 900 m². <p>[OLT 4 – Art. 7]</p> <p>The requirements concerning the number and the layout of staircases and exits are also applicable to basement premises.</p> <p>[Directive de protection incendie, voies d'évacuation et de sauvetage – Chap. 3.4.6]</p> <p>If there are 2 exits or staircases, they shall not be more than 15 m from the extremities of the building.</p> <div style="text-align: center;">  </div>

Table 34 – Dimension of stairways

5.7.2.2.6 Emergency lighting

Escapes routes and exits shall be clearly identified with signs and emergency lighting.

Emergency lighting shall meet the requirements set by the French regulation: [Arrêté du 26 février 2003](#).

Location	Emergency lights	Panic light
Location	<ul style="list-style-type: none"> - Every 15 m on the walkway - At each emergency exit - At each change of direction - At each obstacle - At each change of level - At each room exit 	<ul style="list-style-type: none"> - Minimum luminous flux = 5 lumens / m² floor surface - The distance (d) between 2 luminaries shall be ≤ 4 times the height (h) between the luminaries and the ground. $d \leq 4h$ - Each room shall be lit with at least 2 luminaries
Walkways concerned	All (corridors, stairways, halls)	Escape routes > 50 m ² linked to one or more rooms with at least 100 persons
Rooms concerned	<ul style="list-style-type: none"> - Occupancy ≥ 20 - Distance from any point of the room to an escape route ≥ 30 m - Access from any point of the room to an escape route with a change of level 	Occupancy ≥ 100 with a density > 1 person / 10 m ²

Table 35 - Emergency lights and panic lighting [[Arrêté du 26 février 2003](#)]

5.7.2.3 Active fire protection measures

5.7.2.3.1 Class of fire and extinguishing agent

The fire extinguishing agent shall be adapted to the class of fire.

Class of fire ¹	Materials	E.g. of extinguishing agent
A	Solid materials, predominantly of an organic kind, forming glowing embers. E.g.: wood, paper, plastics	Water
B1	Liquids or liquefiable solids soluble in water. E.g.: methanol, acetone.	CO ₂ , dry powder, water spray, vaporizing liquids, foam
B2	Liquids or liquefiable solids not soluble in water. E.g.: resins, petrol.	CO ₂ , dry powder, water spray, vaporizing liquids, foam
C	Gases or liquefied gases resulting from leaks or spillage. E.g.: Hydrogen, methane.	Foam or dry powder with water to cool any leak
D	Metals. E.g.: aluminum, magnesium.	Special dry powder
F	Cooking oils and fat.	Wet chemical
Electrical fires	Electricity may trigger fire in any class. For such fires the use of vaporizing liquids, dry powder or CO ₂ are recommended.	

¹ Classification according to EN 2: Classification of fires

Table 36 - Class of fire and extinguishing agent

5.7.2.3.2 Fixed fire extinguishers

Equipment	When to use	Guidance documents
Hose reel	Outside experimental facilities and buildings.	<ul style="list-style-type: none"> • APSAD installation rules; • AEAI directives;
Sprinkler	High risk areas. In areas where access may be impossible in case of fire (controlled areas).	
Halogen gas	Used in racks with electronics, particle detectors, and computer installations.	
CO2 system	Racks with electronics.	

Table 37 – Fixed fire extinguishers

The HSE unit ([A. Russo](#)) should be contacted in order to define the type, number, capacity and placement of fire extinguishers.

5.7.2.3.3 Portable fire extinguishers

Location	Requirements for evacuation doors
France	<p>There shall be one fire extinguisher with a minimum capacity of 6 litres, for every 200 m² of floor area.</p> <p>There shall be at least one fire extinguisher per floor.</p> <p>If premises present particular fire risks, in particular from electrical risks, fire extinguishers shall be provided in a certain number and of a certain type according to the risks involved.</p> <p><i>[Code du Travail – Art. R.4227-29]</i></p> <p>Fire extinguishing equipment shall be subject to signage at suitable locations.</p> <p><i>[Code du Travail – Art. R.4227-33]</i></p>
Switzerland	<p>The layout of fire extinguishing equipment shall be adequate for fighting a fire wherever it occurs.</p> <p>Distance to the nearest fire extinguisher shall not exceed 40 m.</p> <p><i>[Aide de travail de protection incendie, bâtiments administratifs et artisanaux – Chap. 8.1.3]</i></p>

Table 38 - Host State requirements on portable fire extinguishers

The HSE unit ([A. Russo](#)) should be contacted in order to define the type, number, capacity and placement of fire extinguishers.

5.7.2.3.4 Smoke extraction

As a baseline, the following provisions may be applied, according on the location of the facility.

Location	Law
France	<ul style="list-style-type: none"> • According to the French "Code du travail", a smoke extraction system is necessary for premises larger than 300 m² located on the surface or upper floors, for rooms without openings of more than 100 m² and in the basement, as well as for stairwells. • Arrêté du 5 août 1992 pris pour l'application des articles R. 235-4-8 et R. 235-4-15 du code du travail et fixant des dispositions pour la prévention des incendies et le désenfumage de certains lieux de travail ; • The French "instruction technique 246" provides detailed guidance on how to realize the above-mentioned system.
Switzerland	<ul style="list-style-type: none"> • The « Directive de protection incendie – Installations d'extraction de fumée et de chaleur, 08.04.2003 / 22-03f » by AEAI defines the need for a smoke extraction system and provides details on its realization.

Table 39 - Smoke extraction requirements

In the event of a fire the smoke can be extracted by natural means or when this is not possible with a mechanical ventilation system.

Location	Law
France	<p>Natural smoke extraction</p> <ul style="list-style-type: none"> The total surface area shall be greater than 1% of the surface of the premise and shall be a minimum of 1 m². This also includes air supply. Opening systems for smoke extraction shall be capable of being activated from the ground floor. <p>[Code du Travail – Art. R.4216-14]</p> <p>Mechanical smoke extraction</p> <ul style="list-style-type: none"> Mechanical smoke extraction shall have an extraction flow of 1 m³ per second per 100 m². <p>[Code du Travail – Art. R.4216-15]</p> <ul style="list-style-type: none"> Ventilation systems can be used for smoke extraction. <p>[Arrêté du 5 août 1992 - Art. 13]</p>
Switzerland	<p>Natural smoke extraction</p> <ul style="list-style-type: none"> Openings allowing fresh air supply (e.g. openings in the facade, doorways, windows) shall be installed close to the floor. Their dimensions shall be at least equal to the dimensions of extraction openings. <p>[Directive de protection incendie, installations d'extraction de fumée et de chaleur – Chap. 3.3]</p> <ul style="list-style-type: none"> Opening systems for smoke extraction shall be located in a place protected from fire. From this point, it shall be able to determine if smoke extraction is active or not. <p>[Directive de protection incendie, installations d'extraction de fumée et de chaleur – Chap. 3.4]</p> <p>Mechanical smoke extraction</p> <ul style="list-style-type: none"> Mechanical smoke extraction shall allow a fresh air supply with a maximum speed of 5 m/s. <p>[Directive de protection incendie, installations d'extraction de fumée et de chaleur – Chap. 3.3]</p> <ul style="list-style-type: none"> Mechanical smoke extraction and ventilation systems shall be electrically supplied, independent from the general power supply. <p>[Directive de protection incendie, installations d'extraction de fumée et de chaleur – Chap. 3.7]</p> <ul style="list-style-type: none"> The use of HVAC systems for smoke and heat extraction is only permitted if parts of the installation comply with the requirements in terms of smoke and heat extraction. <p>[Directive de protection incendie, installations d'extraction de fumée et de chaleur – Chap. 3.8]</p>

Table 40 – Requirements for natural and mechanical smoke extraction

Smoke extraction should be designed and installed according to the following standards in order to comply with the above-mentioned requirements.

Location	Standards
France	<ul style="list-style-type: none"> NF S 61-937 – Systèmes de sécurité incendie (S.S.I.) – Dispositifs actionnés de sécurité (D.A.S) ; NF S 61-938 - Systèmes de sécurité incendie (S.S.I.) - Dispositifs de commande manuelle (D.C.M.) - Dispositifs de commandes manuelles regroupées (D.C.M.R.) - Dispositifs de commande avec signalisation (D.C.S.) - Dispositifs adaptateurs de commande (D.A.C.) ; NF S 61-939 - Systèmes de sécurité incendie (S.S.I.) - Alimentations pneumatiques de sécurité (A.P.S.) - Règles de conception ; NF S 61-932 – Systèmes de Sécurité Incendie (S.S.I.) – Règles d’installation du Système de Mise en Sécurité Incendie (S.M.S.I.). EN 12101 series on: Smoke and heat control systems.
Switzerland	<ul style="list-style-type: none"> EN 12101 series on: Smoke and heat control systems.

Table 41 – Design standards for smoke extraction systems

Where the referred requirements are deemed not sufficient or not appropriate, specific studies may be necessary based on other standards or on a performance-based approach (fire safety engineering).

5.7.2.3.5 Pressurized areas

Buildings and facilities may be fitted fire compartments that are pressurized in order to prevent the smoke penetration (e.g.: with pressurized areas in escape routes such as the shaft of underground facilities).

Typically at CERN pressurized areas meet the fire safety requirements set by:

- French “[instruction technique 246](#)” – overpressure in stairwells of buildings with public access of 20 Pa to 80 Pa;
- [ISO 17873](#): Nuclear facilities - Criteria for the design and operation of ventilation systems for nuclear installations other than nuclear reactors – minimum overpressure between critical radioprotection areas and other areas of 40 Pa.

5.7.2.3.6 Fire detection equipment

Fire detection & level-3 fire alarm systems shall comply with the following CERN Safety rule:

- [Safety Instruction IS 37](#) - Alarms and alarm systems.

The fire detection & level-3 alarm systems shall be installed whenever the HSE Unit requires it in order to protect people and in the situations described in the annex VI of the [Safety Code E](#).

According to the IS 37 any fire detection & level-3 fire alarm systems shall:

- be installed in premises containing flammable fluids and hazardous materials;
- generate a level-3 alarm whenever triggered;
- be fitted with evacuation alarm automatically triggered when the fire detection system goes off.

It is also recommended that the power of the electrical equipment installed in the vicinity of the fire detection & level-3 fire alarm system is shutdown once the system is triggered.

The CERN Service for installation, maintenance and calibration of fire detection & level-3 fire alarm system is GS/ASE.

The HSE Unit ([A. Russo](#)) shall participate in the commissioning of the fire detection & level-3 fire alarm systems.

5.7.3 Evacuation

According to the code E evacuation diagrams shall be displayed at suitable points and clearly identify the evacuation paths. They shall also show the emergency systems; i.e. fire extinguishers, emergency stops, etc.

The HSE Unit ([A. Russo](#)) provides advice on evacuation diagrams.

Fire drills are held regularly according to the procedures set out in Appendix VII of the [Safety Code E](#) - Fire protection.

5.7.4 Fire Safety file

The fire Safety file shall include the Safety documents necessary to demonstrate compliance with the applicable rules:

- **Engineering design file**

- Fire risk assessment (for accelerator and experimental facilities);
- Building/facility drawings;
- Derogation form;
- Approval of the derogation application;
- **File supplied with products**
 - Material certificates;
- **Construction phase file**
 - Fire permit;
- **Commissioning file**
 - Commissioning report of the fire detection & level-3 fire alarm systems;
 - Evacuation diagrams;
 - Fire Safety inspection report;
- **Operation and maintenance file**
 - Records of evacuation drills;
 - Emergency procedures;
 - Annual test report of fire detection system;

The HSE Unit ([A. Russo](#), [F. Corsanego](#), [S. Mendola](#)) provides Safety advice on fire protection.

5.8 Chemical Safety

5.8.1 Activities involving hazardous chemical agents

Activities involving hazardous chemical agents at CERN shall comply with the following CERN Safety rule:

- Safety Regulation on chemical agents ([SR-C](#));
- General Safety Instruction ([GSI-C1](#)) on prevention and protection measures;
- General Safety Instruction ([GSI-C3](#)) on monitoring of exposure to hazardous chemical agents in workplace atmospheres.

Prior to the use of the hazardous chemical agents, and in order to comply with the requirements of the applicable CERN Safety rule, a Chemical risk assessment shall be carried out (refer [Safety Form C-0-0-1, Chemical Risk Assessment](#)). In addition the following Safety forms shall be completed, when required, for the use of hazardous chemical agents:

- [Safety Form C-1-0-2](#) – Chemical Inventory ([example](#));
- [Safety Form C-1-0-3](#) – Tests of safety showers/eye washes;
- [Safety Form C-1-0-4](#) – Respirator use ([example](#));
- Safety Form C-3-0-2 – Exposure Form;

The following Guideline documents are available for consultation, when completing the Safety forms:

- [Safety Guideline C-1-0-1](#) – Storage of Hazardous Chemical Agents;
- [Safety Guideline C-1-0-2](#) – Chemical Protective Gloves;
- [Safety Guideline C-0-0-1](#) – Identification of Hazardous Chemical Agents;
- [Safety Guideline C-0-0-2](#) – Chemical Risk Assessment (Inhalation);
- [Safety Guideline C-0-0-3](#) – Lead;
- [Safety Guideline C-0-0-4](#) – REACH.

5.8.1.1 Control measures for hazardous chemical agents

The control measures for hazardous chemical agents are determined according to the results of the chemical risk assessment.

Activities involving hazardous chemical agents identified as activities having major Safety implications shall be authorized by the HSE Unit. The identification of such activities is done on the basis of the Chemical risk assessment.

5.8.1.2 Safety file for hazardous chemical agents

The Safety file for activities involving hazardous chemical agents shall include all the Safety documents necessary to demonstrate compliance with the applicable CERN rules (SR-C and GSI-C1).

It should be compiled using the following layout:

- **Record of the risk assessment (completed Safety Form C-0-0-1) including:**
 - description of the workplace and working areas (e.g. type of installation, building/room);
 - description of the activities concerned;
 - identification of the hazardous chemical agents concerned;

- details of the selected control measures;
 - who is responsible for carrying out particular actions and when the measures have to be taken;
 - the name of the person (the Assessor) who completes the assessment (Safety Form C-0-0-1) and the name of the person (HSE Unit) who authorizes the start of an activity (if required).
- **Records of control measures taken.**
 - Technical
 - Design reports, if applicable;
 - Programmes and records of performance checks for all prevention and protection measures;
 - Organizational.
 - executed maintenance and inspections;
 - training records (trained persons and content of the training).

The level of detail provided should depend on the type and size of operation and the degree of risk involved.

- **Exposure monitoring for hazardous chemicals (if required).**
 - report detailing the monitoring strategy and the results of exposure monitoring relating to the initial evaluation and periodic monitoring;
 - record of work stoppages due to an exposure limit being exceeded and corrective actions taken;
 - a completed exposure form for each person concerned.
- **Annex to the Safety File, may contain:**
 - Documents, certificates, technical specifications relating to the procurement and commissioning of equipment (e.g. EC-type examination certificates, EC certificates of conformity for work equipment);
 - safety data sheets and exposure scenarios for the hazardous chemical agents concerned;
 - storage plans and inventories for hazardous chemical agents;
 - applicable standard operating procedures for safe handling, transport and storage of hazardous chemical agents;
 - emergency procedures and programmes and reports of safety drills;
 - list of persons exposed or likely to be exposed to carcinogens, mutagens or toxic to reproduction substances;
 - records of authorizations, approvals and conditions associated therewith.

5.9 Worksite Safety

5.9.1 Installation and construction activities

Installation and construction activities shall comply with the following applicable CERN Safety Rules:

- [Safety Instruction IS 50](#) – Safety Coordination on CERN Worksites;
- [Safety Instruction IS 39](#) – Notice of Start of Works.

5.9.1.1 Control measures

According to the IS 50, a Safety Coordinator shall be appointed for 1st category work and a work supervisor or a designated person shall be appointed for 2nd category work, to coordinate the implementation of the general principles of prevention and safety.

Prior to the start-up of the installation activities, the Safety Coordinator (1st category) or the person in charge of the safety coordination (2nd category) shall be provided with Safety documents which shall include the following points:

- Description of the activities to be carried out;
- Workers involved in those activities;
- Assessment on risks inherent to the worksite and risks generated by the activity;
- Preventive and protection measures to be taken for each risk.

Before the start-up of the installation activities Safety Visits (“VIC - Visite d'Inspection Commune”) shall be carried out. The Safety Coordinator together with the parties and the Safety area officers (e.g. TSO, GLIMOS, etc...) involved in the installation, check in-situ the implementation of the Safety documents.

According to the IS 39 the start-up of the installation activities shall be announced by means of the “Notice of start of works” (AOC). The person responsible for the activity shall fill in the [AOC form](#).

The installation and installation activities shall only start once the AOC has been fully approved.

5.9.1.2 Safety file for installation and construction activities

The Safety file for installation and construction activities shall include the Safety documents necessary to demonstrate compliance with the applicable rules:

- **1st Category work:**
 - AOC form(s) and VIC report(s);
 - General Safety and Health Protection Plan and documents associated;
 - Dossier for later intervention;
 - Logbook;
 - Any other document written as part of the works carried out.
- **2nd Category work:**
 - AOC form(s) and VIC report(s);
 - Risk prevention plan or equivalent;
 - Any other document written as part of the works carried out.

CERN [Safety Coordinators](#) provide advice on the Safety documents to be provided.

5.9.2 Electricity

In case electrical power is needed on the site, personnel performing the activity shall bring their own electrical distribution panel, with appropriate over-current protection. Only CERN qualified persons are allowed to plug it in.

Temporary electrical installation required in the worksite, shall be verified by HSE unit prior to the use.

5.9.3 Fire protection

For all activities related to execution works, the respect of the following Swiss directive in matters of fire protection is recommended:

- Prévention incendie – Sécurité dans les exploitations et sur les chantiers, AEAI 11-03

5.9.4 Hot work and welding

Welding activities may be needed in installation phase. The description of this activity shall be included in a specific installation/dismantling safety procedure.

The hot work activity shall comply with the Safety requirements provided in the Safety Code E on fire protection.

Before starting the hot work activity the project leader shall ensure that:

- Fire permit form, which is available in EDH, is filled up and approved
- IS 37 form, which is available in EDH, is filled up and approved
- Any necessary compensatory measures are put in place.

5.9.5 Activities in confined spaces

Activities in confined spaces shall comply with the following CERN Safety Rule:

- [Safety code A4](#) - Confined spaces.

5.9.5.1 Control measures

Before accessing a confined space, it shall be ensured that:

- A supervisor, person responsible for any activity in the confined space, is assigned to the confined space;
- Any person who may enter the confined space as well as the supervisor shall follow a CERN training course on confined spaces;
- Any person who may enter the confined space shall follow appropriate health surveillance in order to check whether the person is suitable to work in such a working environment;
- There is at least one person maintaining a watch outside the confined space at all times.

CERN members of personnel and users are subject to specific health surveillance defined by the CERN Medical Service. Contractor's personnel shall be subject to the health surveillance defined by the law of the Host State in which the activity will be carried out.

Only CERN members of personnel and users are examined by the CERN Medical Service.

The training courses on confined spaces are held at CERN and registration for the course can be made via EDH.

5.9.5.2 Safety file for activities in confined spaces

The Safety file for activities in confined spaces shall include the Safety documents necessary to demonstrate compliance with the applicable rules:

- **Before starting the activity**
 - Entry permit;
 - Training records of the personnel;
 - Operating procedures.

5.9.6 Handling and lifting activities

The personnel performing the installation works is not allowed to use machines or handling equipment which are not CE marked and approved by the HSE Unit.

Handling personnel (excluding members of CERN personnel), shall be trained and in possession of the documents demonstrating their competence to use lifting equipment as the provisions of the Host State where the activity is carried out:

- CACES for activities in France;
- Machinist permit for activities in Switzerland.

The use by other personnel of handling and lifting equipment belonging to CERN is subject to:

- The attendance to the specific training designed for personnel using forklift, crane and for cherry-picker
- A special 'access request' to be formulated on EDH as it follows:
 - AC-CE, for fork-lift trucks up to 6 t capacity, except lateral forklift trucks
 - AC-CT, for tractors, in particular for the transport of equipment in the tunnel
 - AC-N3, for working platforms
 - AC-PE, for overhead travelling cranes to lift loads up to 10 t.
 - The obtained authorization is valid for 5 years.

Following the manufacturer recommendations, the staff working on personnel lifting equipments could be asked to be trained in 'working in heights'.

Handling and lifting equipment operating in the worksites shall be accompanied by the documentation concerning the periodical maintenance.

5.9.6.1 Safety file for handling and lifting activities

The Safety file for handling and lifting activities shall include the documents necessary to demonstrate compliance with the applicable rules:

- Training records;
- Certification on 'working in heights'.

5.9.7 Use of scaffolding

The use of scaffolding shall comply with the requirements provided in the applicable legislation.

Location	Regulations
France	<ul style="list-style-type: none">• French Décret n°2004-924 du 1er septembre 2004 relatif à l'utilisation des équipements de travail mis à disposition pour des travaux temporaires en hauteur ;• French Arrêté du 21 décembre 2004 relatif aux vérifications des échafaudages ;

	<ul style="list-style-type: none"> • French Circulaire du 27 juin 2005 relative à la mise en œuvre du décret du 1er septembre 2004 et de l'arrêté du 21 décembre 2004.
Switzerland	<ul style="list-style-type: none"> • Swiss Ordonnance sur la prévention des accidents et des maladies professionnelles (OPA); • Swiss Ordonnance sur la sécurité et la protection de la santé des travailleurs dans les travaux de construction (OTConst); • Swiss Règlement sur les chantiers (Rchant).

Table 42 - Regulations applicable for activities involving scaffoldings

5.9.7.1 Control measures

Collective protection shall be implemented as a priority for any works at height, regardless the height of work. As a result, scaffoldings shall be used in construction works when a risk assessment demonstrates it necessary.

Location	Control measures
France	<ul style="list-style-type: none"> • Scaffolding or parts of scaffolding which are not ready for use, for example during assembly, dismantling or modification shall be marked with general warning signs and be suitably delimited by physical means preventing access to the danger zone; • Scaffolding shall be inspected by a competent body. The following inspections shall be carried out: <ul style="list-style-type: none"> • Inspection before performing the activity; • Daily visual inspection on the state of preservation of the scaffolding; • Quarterly detailed inspection on the state of preservation of the scaffolding. • Scaffolding shall be assembled, dismantled and modified by trained workers only.
Switzerland	<ul style="list-style-type: none"> • Only scaffolding and parts of scaffolding which comply with the Swiss loi du 12 juin 2009 sur la sécurité des produits (LSPro) can be used for the activities; • Scaffolding shall be checked by users every day; • The maximum authorized load shall be indicated on a panel.

Table 43 – Control measures set by applicable Host State regulations

Scaffolding can only be accessed after being checked by a trained person. The person who performs the Safety check shall display and sign a form containing the following:

- Name of companies/members of personnel authorized to use the scaffolding;
- Maximum authorized load.

[Training courses](#) on assembling and conformity assessment of scaffoldings are held at CERN and the registration for the course can be made via [EDH](#).

5.9.7.2 Safety file of scaffolding

The Safety file of scaffolding shall include the Safety documents necessary to demonstrate compliance with the applicable rules:

- **Before starting the activity**
 - Record of the inspections carried out;
 - Training records of the personnel using scaffolding;
 - Operating procedures.

5.9.8 Asbestos

Activities in which workers are or may be exposed in the course of their work to dust arising from asbestos or materials containing asbestos, shall comply with the following CERN Safety rule:

- [Safety Instruction IS 43](#) – Asbestos, dangers and precautions.

5.9.8.1 Control measures

If an ACM (Asbestos Containing Material) or material suspected of containing asbestos is found during the work, work must be stopped and the HSE Unit must be immediately notified.

Before starting a new building project (renovation or extension), the building shall be subjected to a general asbestos survey in order to determine:

- The necessity (or not) of removing asbestos according to the work to be carried out. Following this, the HSE Unit ([O. Prouteau](#), [S. Evans](#)) shall approve the plan to remove asbestos.
- The precautions to take during minor works in the presence of asbestos.
- The precautions to take in order to ensure that works carried out as part of the project do not damage any ACM.

The control measures required by the IS 43 include the following points:

- At CERN, the clearance limit shall not exceed 0.0001 fibres per cm³.
- The Organization’s Medical Officer must be informed where there is a risk of exposure and of any CERN members of personnel that could be exposed to such a risk in the course of their work before the work starts.
- Where necessary the HSE Unit shall organize information or training sessions associated with particular work that is to be carried out or with particular functions (TSO, work supervisors, maintenance work on specific installations, etc.).

If there is any doubt over the presence or not of asbestos fibres in the air or in a material, the HSE Unit shall be contacted.

5.9.8.2 Asbestos Safety file

The Safety file of activities in which workers are or may be exposed to asbestos include the Safety documents necessary to demonstrate compliance with the applicable rules:

- **Before starting the activity**
 - Asbestos removal plan;
 - Training records of the personnel working on asbestos containing materials;
 - Operating procedures;
- **After ending the activity**
 - Record of the concentration of asbestos fibre measurements, in the case where premises are restored after the work to remove asbestos has been carried out.

5.9.9 Temporary work at height

Temporary work activities at height shall comply with the requirements provided in the applicable legislation.

Location	Regulations
France	<ul style="list-style-type: none">• Article R. 4323-58 of the French Code du Travail ;

Switzerland	<ul style="list-style-type: none"> Ordonnance sur la sécurité et la protection de la santé des travailleurs dans les travaux de construction (OTConst) ;
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Table 44 - Law applicable for activities involving scaffoldings

5.9.9.1 Control measures

Location	Control measures
France	<ul style="list-style-type: none"> workers shall not work alone when he is using personal protection, in order to be provided with appropriate assistance; collective protection measures (e.g. guard rails) must be given priority over personal protective measures (e.g. safety harnesses); temporary work at a height may be carried out only when the weather conditions do not endanger the safety and health of workers; areas where there is a risk of someone being struck by a falling object or person shall be clearly indicated - the access to these areas shall be restricted.
Switzerland	<ul style="list-style-type: none"> unprotected areas where there is a risk of a fall from a height of more than 2 m shall be equipped with roof edge protection (guard rails and toe board); if the installation of a roof edge protection is technically impossible, other protection measures shall be used (e.g. scaffoldings, safety net, rope access);

Table 45 – Control measures set by applicable Host State regulations

5.9.10 Use of ladders

The use of ladders shall comply with the requirements provided by the applicable legislation.

Location	Regulations
France	<ul style="list-style-type: none"> French Décret n°2004-924 du 1er septembre 2004 relatif à l'utilisation des équipements de travail mis à disposition pour des travaux temporaires en hauteur ; French Circulaire du 27 juin 2005 relative à la mise en œuvre du décret du 1er septembre 2004 et de l'arrêté du 21 décembre 2004.
Switzerland	<ul style="list-style-type: none"> Swiss Ordonnance sur la sécurité et la protection de la santé des travailleurs dans les travaux de construction (OTConst); Swiss Règlement sur les chantiers (Rchant).

Table 46 - Law applicable to the use ladders

5.9.10.1 Control measures

Location	Control measures
France	<ul style="list-style-type: none"> Ladders may be used as work stations for work at height only under circumstances in which the use of other, safer work equipment is not justified because of the low level of risk or the short duration of use; Ladders shall extend at least 1 m above an access level or landing platform; Every ladder shall be used in such a way that the user can maintain a safe handhold when carrying a load. But carrying loads on a ladder shall be avoided as much as possible.
Switzerland	<ul style="list-style-type: none"> Ladders shall be installed only in areas where there is no risk of falling objects; Ladders shall be frequently inspected and repaired immediately if necessary; Ladders shall extend at least 1 m above an access level or landing platform;

	<ul style="list-style-type: none"> The maximum height for works executed on a ladder shall be 5 m. However, mechanical ladders can be used for works above 5 m.
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Table 47 – Control measures set by applicable Host State regulations

5.9.11 Use of rope access

The use of rope access shall comply with the requirements provided in the applicable legislation.

Location	Regulations
France	<ul style="list-style-type: none"> French Décret n°2004-924 du 1er septembre 2004 relatif à l'utilisation des équipements de travail mis à disposition pour des travaux temporaires en hauteur;
Switzerland	<ul style="list-style-type: none"> Swiss Ordonnance sur la sécurité et la protection de la santé des travailleurs dans les travaux de construction (OTConst).

Table 48 - Law applicable to the use ropes

5.9.11.1 Control measures

Location	Control measures
France	<ul style="list-style-type: none"> Rope access shall not be used as work stations. It may be used only under circumstances where the risk assessment indicates that the work can be performed safely and for a short duration of use; The work must be properly planned and supervised, so that a worker can be rescued immediately in an emergency; The workers concerned must receive adequate training specific to the operations envisaged, in particular rescue procedures.
Switzerland	<ul style="list-style-type: none"> Only trained workers can use rope access; In order to carry out such work, lone working is forbidden.

Table 49 – Control measures set by applicable Host State regulations

5.9.11.2 Safety file of rope access

The Safety file of rope access shall include the Safety documents necessary to demonstrate compliance with the applicable rules:

- Before starting the activity**
 - Training records of the personnel using rope access;
 - Operating procedures.

The HSE Unit ([O. Prouteau](#), [S. Evans](#)) provides advice on worksite Safety.

5.10 Acoustic and ergonomics

5.10.1 Noise

In order to ensure the protection of people from risks arising to their health and safety or likely to arise from exposure to noise, the technical project leader shall ensure that the strictest requirements of the following rules are applied:

- Directive 2003/10/EC of the European Parliament and of the Council of 6 February 2003 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (noise)

- Commentaires de l'ordonnance 3 relative à la loi sur le travail (Switzerland), Chapitre 2, Section 2, article 22.

Emissions of environmental noise related to neighbourhoods shall respect the thresholds indicated in:

- Arrêté du 23/01/97 relatif à la limitation des bruits émis dans l'environnement par les installations classées pour la protection de l'environnement (France)
- Ordonnance sur la protection contre le bruit (OPB) du 15 décembre 1986, article 6 (Switzerland).

Immission of environmental noise shall respect the thresholds indicated in:

- Décret n° 2006-1099 du 31 août 2006 relatif à la lutte contre les bruits de voisinage (France)
- Ordonnance sur la protection contre le bruit (OPB) du 15 décembre 1986, article 6 (Switzerland).

The Plan d'attribution du degrés de sensibilité OPB, shall also be taken in account:

<http://daelmap.etat-ge.ch/dael/ImagesDSOPB/29330.pdf>

5.10.1.1 Noise Safety file

The noise Safety file shall include:

- Acoustic study with recommendations on materials and layout
- Technical sheets of installed elements and materials
- Expected levels of emission and impact on immission levels.

5.10.2 Ergonomics

Working places, equipments and auxiliary means shall be designed in conformity with the principles of ergonomics, including ventilation and lighting, indicated in the following rules:

- Commentaire de l'ordonnance 3 relative à la loi sur le travail (Switzerland), Chapitre 2, Section 3, articles 15, 16, 17, 23 and 24
- European standard NF EN 12464-1 « Eclairage des lieux de travail ».

The HSE unit (Flora.Gavand@cern.ch) provides advice on acoustic and ergonomics.

5.11 Protection of the environment

With regard to protection of the environment CERN Safety Policy states that Organization is committed to ensure the best possible protection of the environment. This can be achieved by ensuring that the Environmental requirements and guidelines set by the Host State regulations, European Directives, international standards and best practices are implemented in all CERN's activities susceptible to harm the environment.

5.11.1 Conventional protection of the environment

In order to meet the CERN Safety Policy, CERN activities shall comply with the technical provisions set by the following European Directives:

- Directive [2008/1/EC](#) on Integrated Pollution Prevention and Control – IPPC Directive.
- Directive [2004/35/CE](#) on environmental liability with regard to the prevention and remedying of environmental damage;
- Directive [2008/98/EC](#) of the European Parliament and of the Council of 19 November 2008 on waste.

According to the IPPC Directive, all activities susceptible to harm the environment shall use adequate pollution-prevention measures (notably best available techniques), use energy efficiently, ensure accident prevention and damage limitation in order to achieve a high level of protection of the environment.

5.11.2 Water protection

CERN activities discharging effluent water into the CERN clean and sewage water networks shall be designed and set-up in conformity with the Host State regulations where the effluent water is discharged.

Location	Regulations
France	<ul style="list-style-type: none"> • Loi sur l'eau et les milieux aquatiques • Arrêté du 02/02/98 relatif aux prélèvements et à la consommation d'eau ainsi qu'aux émissions de toute nature des installations classées pour la protection de l'environnement soumises à autorisation, if applicable
Switzerland	<ul style="list-style-type: none"> • Loi fédérale sur la protection des eaux • OEaux: Ordonnance sur la protection des eaux

Table 50 - Host State regulations on water protection

The direct or indirect introduction of potentially polluting substances into water, including their infiltration into ground is prohibited.

5.11.2.1 Control measures

CERN activities discharging pollutants into the surface water shall be controlled by implementing as a general rule, and in order of priority, the following measures:

- To reduce at the minimum the discharge of pollutants in the water;
- To comply with emission limit values for effluent water. The discharge of effluent water into the CERN clean and sewage water networks shall be done in conformity with the Host State regulations in force according to the location of the receiving watercourses;

Location	Regulations	Regulations specific to discharge of water from worksites
France	Art. 31, 32 & 34 of Arrêté du 02/02/98 relatif aux prélèvements et à la consommation d'eau ainsi qu'aux émissions de toute nature des installations classées pour la protection de l'environnement soumises à autorisation	
Switzerland	Annex 3.2 of Ordonnance sur la protection des eaux, Oeaux	SIA 431 Standard «Evacuation et traitement des eaux de chantier» and Ordonnance sur la protection des eaux (as indicated in Oeaux, Annexe 3.2)

Table 51 - Host State requirements on emission limit values for effluent water

- In the event of exceeding the emission limit values for effluent water, to study the possibility of a different elimination pathway, either incorporating water treatment equipment or treating the effluents as dangerous waste.
- To control the amount of water released and quantify whenever possible;
- To keep storage facilities in good shape, ensure retention means complying with: [SR-C](#); Safety Guideline [C-1-0-1](#) - Storage of hazardous chemical agents and other relevant prescriptions;

The HSE Unit ([S. Kleiner](#)) provides advice on measurements of effluent water, water monitoring and risk control measures.

5.11.3 Prevention of atmospheric polluting emissions

Atmospheric potentially polluting emissions shall be limited at the source and shall respect the requirements and related technical prescriptions of the following rules:

Location	Regulations
France	<ul style="list-style-type: none"> • Code de l'environnement – Partie réglementaire – Livre II – Titre II. • Arrêté du 02/02/98 relatif aux prélèvements et à la consommation d'eau ainsi qu'aux émissions de toute nature des installations classées pour la protection de l'environnement soumises à autorisation.
Switzerland	<ul style="list-style-type: none"> • Loi fédérale sur la protection de l'environnement (Loi sur la protection de l'environnement, LPE). • Ordonnance sur la protection de l'air.

Table 52 - Host State regulations on atmospheric pollution

5.11.3.1 Control measures

CERN activities discharging pollutants into the air shall be controlled by implementing as a general rule, and in order of priority, the following measures:

- To reduce at the minimum the discharge of pollutants in the air;
- To collect the air at the source;
- To ensure that the emission of air effluents comply with emission limit values set by the Host State regulations.

Location	Regulations	Regulations specific to discharge of air from worksites
France	Articles 26, 27, 28, 29, 30 of the Arrêté du 02/02/98 relatif aux prélèvements et à la consommation d'eau ainsi qu'aux émissions de toute nature des installations classées pour la protection de l'environnement soumises à autorisation	HSE recommends : Directive Air Chantiers (OFEV)

Switzerland	Annexes 1 to 4 of Ordonnance sur la protection de l'air	Directive Air Chantiers (OFEV)
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Table 53 - Host State requirements on emission limit values for air emissions

- To implement air monitoring programme for:
 - greenhouse gases (Decision No [280/2004/EC](#))
 - and substances that deplete the ozone layer ([Regulation \(EC\) No 1005/2009](#))
- To assess annually emission levels of greenhouse gases and ozone depletion gases according to their annual consumption within equipments;
- To ensure effectiveness of remedial measures.

5.11.4 Energetic efficiency

Buildings shall be designed and constructed in order to meet the energy efficiency requirements set by the Host State regulations.

Location	Regulations
France	<ul style="list-style-type: none"> • La Réglementation Thermique 2012 (RT2012)
Switzerland	<ul style="list-style-type: none"> • SIA 380/1 – L'énergie thermique dans le bâtiment • SIA 380/3 – Isolation thermiques des conduites, canalisations et reservoirs du batiments • SIA 380/4 – L'énergie électrique dans le bâtiment

Table 54 - Host State regulations on energetic efficiency

5.11.5 Prevention of noise pollution

Emissions and immissions of environmental noise related to neighbourhoods shall respect the thresholds indicated in:

Location	Regulations
France	<ul style="list-style-type: none"> • Arrêté du 23/01/97 relatif à la limitation des bruits émis dans l'environnement par les installations classées pour la protection de l'environnement
Switzerland	<ul style="list-style-type: none"> • Ordonnance sur la protection contre le bruit (OPB) du 15 décembre 1986, article 6

Table 55 - Host State regulations on emissions and immissions of environmental noise

The [Plan d'attribution du degrés de sensibilité OPB](#), shall also be taken in account when designing new installations on the Suisse territory.

5.11.5.1 Control measures

The HSE Unit ([F. Gavand](#)) performs environmental noise measurements in order to check the compliance of with the applicable regulations.

5.11.6 Soil protection

CERN activities that may damage the soil shall meet the requirements set by the Host State regulations mentioned in the section 5.11.2.

Whenever excavation works are required, the HSE Unit ([S. Kleiner](#)) shall be contacted in order to check whether the site is polluted or contaminated and, if needed, to define remedial measures.

The identification of polluted and contaminated sites is done accordingly to the limit values defined in [Osites](#), [directive OFEV](#) and [Circulaire du 08/02/07](#).

5.11.6.1 Control measures

In order to prevent the soil pollution and contamination the following measures shall be implemented as a general rule, and in order of priority:

- To keep storage facilities in good shape, ensure retention means complying with the CERN Safety rules and Host State practices:
 - SR-C; Safety Guideline C-1-0-1 - Storage of hazardous chemical agents;
 - French practices “[Stockage et transfert des produits chimiques dangereux, INRS 2009](#)” ;
 - Swiss practices “[Guide Pratique: Entreposage des matières dangereuses, Institut de sécurité 2008](#)” and Directives CCE: [Mesures de protection pour installations d'entreposage et places de transvasement Remplissage des réservoirs](#).
- The infiltration of polluted water into the ground is prohibited.

5.11.7 Dangerous substances for the environment

The introduction of such substances at CERN shall comply with the CERN Safety regulation on chemical agents (SR-C) and the following Host State regulations.

Location	Regulations
France	<ul style="list-style-type: none"> • Code de l'environnement Livre V : Titre II – Article RS21-3 to R.S21-54 and Titre IV • Arrêté du 30 juin 2009 relatif à la procédure d'enregistrement et de déclaration au registre national pour les équipements électriques et électroniques prévu à l'article R. 543-202 du code de l'environnement, JO du 9 juillet 2009 • Directive 2011/65/EC of the European parliament and of the council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)
Switzerland	<ul style="list-style-type: none"> • ORRChim: Ordonnance sur la réduction des risques liés aux produits chimiques.

Table 56 - Host State regulation on dangerous substances for the environment

Activities involving the use of greenhouse gases and ozone depleting gases shall comply with specific Host State regulations

Location	Regulations
France	<ul style="list-style-type: none"> • Code de l'environnement Livre V: Titre IV, Chapitre III, Fluides frigorigènes – Article RS21-3 to R.S21-54
Switzerland	<ul style="list-style-type: none"> • ORRChim: Ordonnance sur la réduction des risques liés aux produits chimiques

Table 57 - Host State regulations for activities involving the use of greenhouse gases

5.11.7.1 Control measures

The storage of chemicals shall be made according to the regulations list in the table below.

Location	Regulations
France	<ul style="list-style-type: none"> • Stockage et transfert des produits chimiques dangereux, INRS 2009
Switzerland	<ul style="list-style-type: none"> • Guide Pratique: Entreposage des matières dangereuses, Institut de sécurité 2008

Table 58 - Host State regulations on the storage of chemical agents

Activities involving the use of greenhouse gases and ozone depleting gases shall comply with specific regulation indicated in the table below.

Location	Regulations
France	<ul style="list-style-type: none"> Code de l'environnement Livre V: Titre IV, Chapitre III, Fluides frigorigènes – Article RS21-3 to R.S21-54
Switzerland	<ul style="list-style-type: none"> ORRChim: Ordonnance sur la réduction des risques liés aux produits chimiques; Annexes 1.5 et 2.10

Table 59 - Host State regulations on the storage of chemical agents

Working procedures shall be established and implemented for activities involving the use of greenhouse gases including the storage, handling, transport, recovery and disposal. Additionally such activities shall be performed by trained personnel.

5.11.8 Waste

The generation of waste shall be limited at the source. Furthermore, during the design phase, the technical project leader shall ensure that the waste will be handled from its collection to its elimination or recycling according to the following European directives:

- Directive on waste 2008/98/EC;
- Commission Decision on the European List of Waste (COM 2000/532/EC) ;
- Directive 2002/95/EC of the European Parliament on waste electrical and electronic equipment (WEEE).

Additionally, waste management shall comply with the applicable Host State regulations.

Location	Regulations and guidance documents
France	<ul style="list-style-type: none"> Code de l'Environnement Livre V: Titre IV -Déchets (France). Gestion de déchets : Guide pour les établissements publics d'enseignements supérieur ou recherche.
Switzerland	<ul style="list-style-type: none"> Loi fédérale sur la protection de l'environnement (LPE): Titre II, Chapitre IV Directive SIA 430 Gestion des déchets de chantier lors de travaux de construction, de transformation et de démolition Ordonnance sur le traitement des déchets (OTD) Ordonnance sur les mouvements de déchets (OMoD) Ordonnance sur la restitution, la reprise et l'élimination des appareils électriques et électroniques (OREA)

Table 60 - Host State regulations on waste management

Waste shall be handled in accordance with the Host State regulations, including the traceability of waste at any time. In the event of generation of waste, which is under the responsibility of CERN, the contractor shall respect the internal waste sorting procedures in force within the Organization and maintained by the GS Department (except the radioactive waste, which is managed by the HSE unit) to ensure the adequate elimination of waste.


The following CERN services can be contacted for waste management:

- [Conventional Waste Collection and Classification;](#)
- [Dangerous Waste Collection and Classification;](#)
- [Radioactive Waste.](#)

5.11.8.1 Control measures

Waste production is avoided and limited at the source in accordance with [Directive 2008/98/EC](#); where waste is produced, it is recovered or, where that is technically and economically impossible, it is disposed of while avoiding or reducing any impact on the environment.

The following measures can be put in place in order to meet this requirement:

- Sort waste properly. If needed ask for waste bins. Contact the relevant CERN service: [Conventional Waste Collection and Classification](#)
- Even If your waste doesn't follow the standard CERN collection procedure, characterize waste and sort it accordingly (e.g.: electrical waste, hazardous waste).
- Ensure appropriate waste collection, recovering and/or disposal.
- For elimination of conventional waste, contact relevant CERN service: [Conventional Waste Collection and Classification](#);
- For elimination of the hazardous waste, contact relevant CERN service: [Dangerous Waste Collection and Classification](#);
- For management of the radioactive waste, contact relevant CERN service: [Radioactive Waste](#).
- Transport the waste as dangerous good according to the directive ADR (Directive 94/55/EC on the approximation of the laws of the Member States with regard to the transport of dangerous goods by road. [EDH Internal Transport request \(option Internal\) for common chemical waste](#) )
- Ensure traceability: Inventory of waste categories, amounts and collection points.
- Store hazardous waste properly as indicated in the [Safety Guideline C-1-0-1](#) – Storage of Hazardous Chemical Agents

5.11.9 Environment Safety file

The environment Safety file shall include the Safety documents necessary to demonstrate compliance with the applicable rules:

- Procedures for any activities involving the use of greenhouse gases including the storage, handling, transport, recovery and disposal;
- Records of training of personnel;
- Records of greenhouse gas consumption;
- Record of the environmental impact assessment of relevant activities and installations, if applicable;
- Records of preventive measures and working methods;
- Programmes and records of environmental monitoring;
- Procedures established to deal with environmental emergencies;
- Programmes and reports or debriefing exercises following any safety drills;
- Records of remedial measures;

The HSE Unit ([S. Kleiner](#)) provides advice on conventional protection of the environment.

5.12 Accidents and near misses

In the event of an accident or a near miss during activities related to the installation, maintenance, operation or dismantling the procedure described in Code A2 shall be followed:

- Immediately inform the CERN Fire Brigade;
- Draw up the [accident report](#) available in EDH.

To contact the CERN Fire Brigade use a red phone or dial 74444 from a CERN phone or dial +41 22 767 4444 from other phones.

6 SAFETY FILE

The Safety file shall include the Safety documents necessary to demonstrate compliance with the applicable rules:

- Safety file of products purchased on the market (5.2.1);
- Mechanical Safety file:
 - Safety file for unfired pressure vessels (5.3.1.1.3);
 - Safety file for piping made of metallic materials (5.3.1.2.3);
 - Safety file for refrigerating systems and heat pumps (5.3.1.4.2);
 -
 - Safety file for machinery (5.3.2.5);
 - Safety file for activities involving work equipment (5.3.2.7);
 - Safety file for welding activities (5.3.3.4);
 - Safety file for HVAC systems (5.3.4.2);
- Structural Safety file:
 - Safety file for steel structures (5.4.3.2);
 - Safety file for concrete structures (5.4.4.2);
 - Safety file for permanent means of access (5.4.5.2);
- Electrical Safety file:
 - Safety file for electrical installations and equipment (5.5.8);
 - Safety file for activities in magnetic fields (5.5.9.2);
- Non-ionizing radiation Safety file:
 - Safety file for equipment emitting non-ionizing radiation (5.6.1.2);
 - Safety file for activities in electromagnetic fields (5.6.2.2);
- Fire Safety file:
 - Fire Safety file (5.7.4);
- Chemical Safety File:
 - Safety file for hazardous chemical agents (5.8.1.2);
- Worksite Safety file:
 - Safety file for installation and construction activities (5.9.1.2);
 - Safety file for handling and lifting activities (5.9.6.1);
 - Safety file of scaffolding (5.9.7.2);
 - Asbestos Safety file (5.9.8.2);
 - Safety file of rope access (5.9.11.2);
- Protection of the environment (5.11.9);
- Accident report (5.12).