



European Organization for Nuclear Research
Organisation européenne pour la recherche nucléaire

SPECIFIC SAFETY INSTRUCTION SSI-FS-2-1
FIRE SAFETY AND RADIATION RESISTANCE REQUIREMENTS FOR CABLES

1 INTRODUCTION

1.1 Legal basis

In accordance with its intergovernmental status, the Organization establishes and updates Safety Rules to implement its Safety Policy.

This Specific Safety Instruction forms part of the CERN Safety Rules and is issued pursuant to the Staff Rules and Regulations and the CERN Safety Policy.

1.2 Purpose and scope

The purpose of this Specific Safety Instruction is to define the minimum Safety requirements with respect to fire performance and resistance to ionising radiation of insulation and sheathing materials of Cables used in CERN Installations.

It applies to Cables purchased by or on behalf of CERN, or otherwise brought onto the CERN site as from the date of its entry into force.

Cables that are part of CE marked equipment that is used within the scope of the CE marking are not subject to this Specific Safety Instruction.

1.3 Definitions

- Cable(s): insulated electrical conductor(s), wire(s) or optical fibre(s), having a protective sheathing and used for transmitting electricity or communication signals.
- CERN Experiment: any approved Experiment other than a Large Experiment and any recognised Experiment carrying out activities with Safety implications at CERN.
- Collaborating Institution: a university or research institution participating in CERN activities and/or a CERN Experiment.
- Fire Reaction: response of a product when it is exposed to fire under specified conditions in a fire test.
- Fire Resistance: ability of a product to withstand fire or give protection from it for a defined period of time.
- Halogen Free: concentration of Halogens or sulphur in the Cable compatible with the performance requirements with respect to fire reaction (c.f. §2.2.1).
- Halogens: Group on the periodic table of elements consisting of chemical elements such as fluorine, chlorine, bromine, iodine and astatine.
- High Risk Installations: Installations underground accessible to workers, as well as any Installation where the relevant Laws in France or Switzerland or a risk assessment require a fire performance of $C_{ca-s2,d1,a2}$ or higher¹.
- HSE Unit: Organic unit competent in matters of occupational health and safety, radiation protection, fire and rescue preparedness and responses and environmental protection.
- Installations: buildings, premises, technical infrastructure and equipment necessary for the functioning of CERN, including the operation of its beam facilities and the conduct of CERN Experiments.
- Laws: laws, rules, regulations, ordinances, prescriptions or directives, issued by a national or international authority other than CERN, and prescriptions, directives or standards issued by a professional association or standardisation body if referred to in a CERN Safety Rule.

¹ Typical examples of High Risk Installations are given in guideline SG-FS-2-1-1

- Low Risk Installations: Installations that are not considered as High risk installations with respect to the fire performance requirements of Cables.²
- Organic unit: department or administratively assimilated unit and CERN Experiments.
- Radiation Area: area where a person is liable to receive an effective dose of more than 1 mSv under normal working conditions in any period of 12 consecutive months.

1.4 Supplementary provisions

This Specific Safety Instruction is supplemented by the documents listed below, where they exist:

- Safety Regulations (SR);
- General Safety Instructions (GSI);
- Specific Safety Instructions (SSI).

and by the relevant provisions of the following Laws:

- Regulation No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products (Europe).
- Directive protection incendie - Association des établissements cantonaux d'assurance incendie (AEAI)(Switzerland).
- Code de la construction et de l'habitation – Titre II : Sécurité et protection contre l'incendie (Switzerland).
- Arrêté du 25 juin 1980 portant approbation des disposition générales du règlement de sécurité contre les risques d'incendie et de panique dans les établissements recevant du public (ERP) (France).
- EN 13501-6 Fire classification of construction products and building elements - Part 6: Classification using data from reaction to fire tests on electric cables (Europe).
- IEC 60544-4 Electrical insulating materials - Determination of the effects of ionizing radiation - Part 4: Classification system for service in radiation environments.
- Relevant standards and publications of the IEC and other internationally recognised bodies.

In the event of any ambiguity or contradiction between the above-mentioned documents, they shall apply in decreasing order of priority, starting from the top.

2 MINIMUM SAFETY REQUIREMENTS FOR CABLE INSULATION AND SHEATHING

The Organic unit in charge of the procurement of Cables or of their arrival on the CERN site shall ensure the compliance with the requirements stated hereunder.

2.1 Halogen and sulphur compounds

Except as provided below, all constituent materials of Cable insulation and sheathing, including tapes and fillers, must be Halogen Free.

² Typical examples of Low Risk Installations are given in guideline SG-FS-2-1-1

Small amounts of Halogens or sulphur are accepted for *stand-alone* short distance equipment Cables³ (for example power supply cables of computers), except where these are part of permanent Installations in Radiation Areas⁴.

The use of Polytetrafluoroethylene (PTFE) and Fluorinated Ethylene Propylene (FEP) is permitted for the insulation of Cables used in low temperature cryogenic Installations, radiofrequency connectors, amplifiers or in similar equipment or Installations, provided no Halogen Free insulator is available on the market for that particular application.

2.2 Fire performance

2.2.1 Fire performance requirements with respect to Fire Reaction

Except as provided otherwise below, the fire performance of Cables purchased by or on behalf of CERN shall be established according to the European fire classification defined by EU Regulation 305/2011 (CPR).

For High Risk Installations the fire performance ⁵ according to the CPR shall be at least C_{ca}-s2,d1,a2.

For Low Risk Installations the fire performance ⁶ according to the CPR shall be at least D_{ca}-s2,d1,a2

Cables brought onto the CERN site as in-kind contributions by Collaborating Institutions from countries outside of the European Economic Area (EEA) shall have an equivalent fire performance as the ones specified above. The equivalence to the European fire performance classification will be established by fire tests specified by the HSE Unit.

The procurement, or importation onto the CERN site, of Cables with a lower fire performance than defined above, is subject to prior approval by the HSE Unit based on a detailed risk assessment and compliance with Laws.

The HSE Unit may request that Cables meet additional requirements with respect to the toxicity of the smoke they emit in case of fire.

2.2.2 Fire performance requirements with respect to Fire Resistance for Cables

Cables feeding systems that require fire resistant properties or used in such Installations shall have a fire resistance of at least 90 minutes, according to EN 50200 or IEC 60331. Some specific areas might require increased resistance⁷. The use of Cables with a lower fire resistance is subject to prior approval by the HSE Unit based on a detailed risk assessment and compliance with Laws.

³ Additional explanations are given in guideline SG-FS-2-1-1.

⁴ Please contact HSE Unit if in doubt concerning the applicability of this requirement for a contemplated procurement or importation of Cables

⁵ Typical examples of High Risk Installations are given in guideline SG-FS-2-1-1.

⁶ Typical examples of Low Risk Installations are given in guideline SG-FS-2-1-1.

⁷ Additional explanations are given in guideline SG-FS-2-1-1.

2.3 Radiation Resistance

Insulation and sheathing materials of Cables used in areas where the lifetime radiation dose is expected to exceed 100 Gy shall have a radiation index according to IEC 60544-4, equal or higher than 5.7⁸. For Cables installed in areas where the lifetime accumulated dose is expected to achieve values up to 2 MGy, the the insulation and sheathing materials shall achieve, at least, an RI of 7.0 (10 MGy)⁹.

The use of Cables in Radiation Areas with a lower radiation Index than defined above, is subject to prior approval by the HSE Unit based on a detailed risk assessment and compliance with Laws.

3 ACCEPTANCE OF CABLES

Prior to their acceptance for use on the CERN site, the Organic unit in charge of the procurement of Cables or their arrival on the CERN site shall ensure that the Cables are delivered with the required safety documentation including certificates attesting that any tests required by the HSE Unit or by Laws have been successfully carried out.

The HSE Unit may require Cables to be subjected to additional tests before their acceptance for use on the CERN site.

4 SAFETY DOCUMENTATION

The Organic unit in charge of the procurement of Cables or their arrival on the CERN site shall establish and maintain the corresponding safety documentation. The safety documentation shall include, at least, the following documents, where they exist:

- Declaration of Performance, according to the CPR;
- CE Marking tag of the Cable according to the CPR;
- Test reports;
- Material certificates.

5 FINAL PROVISIONS

5.1 Replacement of existing documents

This Specific Safety Instruction (version 1), including the supplementary provisions(cf. Section 1.4), cancels and replaces the Safety Instruction IS23 Rev. 3.

5.2 Entry into force

This Specific Safety Instruction (version 1) enters into force upon its publication on the CERN website dedicated to the CERN Safety Rules: <https://www.cern.ch/safety-rules>.

⁸ Additional explanations are given in guideline SG-FS-2-1-1.

⁹ Additional explanations are given in guideline SG-FS-2-1-1.