

<b>Technical Requirements for Electrical Equipment</b>  <small>Title</small> <b>Technical Requirements for Cable</b>	Document TBE 111
	Issue 6
	Date 2022-11-17
	Supersedes 5

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# 1 Introduction

These Technical Requirements state the requirements for electrical cable intended for use in nuclear power stations. Included in the definition cable are insulated conductors for internal connection within enclosures and also for connection of certain process components.

General technical and quality requirements for electrical equipment (including cable) and directions for the Manufacturer/Supplier are expressed in other Technical Requirements according to the Technical Specification (TS).

## 2 Definitions

In general the definitions as stated in TBE 100 and KBE 100 shall apply.

## 3 General product requirements

### 3.1 General requirements

The requirements in this chapter apply to all types of cables.

Cable must conform to Swedish legislation and to Swedish safety regulations for electrical cables.

The cable must be designed and manufactured in a manner that does not jeopardise its functions as a result of manufacturing tolerances and input materials, or due to strain during installation or normal variations in operational and environmental conditions after installation.

Cable manufactured and delivered according to these Technical Requirements must, for traceability reasons, be marked in such a way that a specific cable can be identified from other cables of the same type even after being cut in appropriate installation lengths.

Cable must have a circular cross section unless otherwise stated in TS.

No splicing of conductors in delivered cable lengths is allowed.

### 3.2 Standardization

All cables must conform to the design and testing rules as stated by Swedish Standard, EN or IEC.

Cable for installation in process location outside the reactor containment must conform to the standards stated in the TS. Depending of the cable type, TS applicable standards are stated in KBE IP 111.1, KBE IP 111.2, or KBE IP 111.3.

Cable for installation in the reactor containment, must conform to the standards stated in the TS. Depending of the cable type, TS applicable standards are stated in KBE IP 111.1, KBE IP 111.2, or KBE IP 111.3, as well as the standards that are specific for the environment of the reactor containment stated in KBE IP 111.4.

### 3.3 Flame spread

The material of the cable must be non-flammable and self-extinguishing.

Fire performance requirements shall be stated in the TS and shall be verified according to one of the following alternative methods:

- Class Cca according to EN 13501-6
- Class Dca according to EN 13501-6 and additional flame spread requirements in class Cca according to EN 13501-6
- Class Dca according to EN 13501-6 and additional flame spread requirements according to IEC 60332-3 (F4A, F4B, F4C or F4D)

### **3.4 Environmental capability requirements**

In addition to the general requirements for environmental conditions according to TBE 101 the cable shall be designed for installation in wet areas, and shall withstand sprinkling and high-pressure washing with water without affecting its function.

### **3.5 Materials**

The cable shall not emit corrosive gases when in normal or extreme operation. The amount of corrosive gases emitted in case of fire shall be reported by the Manufacturer in the Tender.

Documentation on fire-load shall also be included in the Tender.

### **3.6 Marking**

The entire length of the cable shall be labelled with the type, manufacturer and time of manufacturing with a minimum of marking every meter, in form of a readable and permanent marking on the cable jacket.

Cable parts shall be individual identified in the whole length of the cable with marking or by color. If they are marked, the marking shall be readable every 30 centimeters in normal indoor lighting.

### **3.7 Other requirements**

When cable is delivered on cable-drums, both ends of the cable shall be sealed water-tight. Cable-drums with protruding sealed ends shall be supplied with a sturdy protection for the cable ends. The cable shall also be protected from sunlight.

It shall be feasible to strip cable jacket and conductor insulation using generally available stripping tools approved/recommended by the Manufacturer.

The Manufacturer shall in the Tender specify any limitations during cable pulling.

## **4 Nuclear Specific Requirements**

### **4.1 Life and long term performance**

The Manufacturer shall in the Tender present an analysis of the cable life based on the long-term characteristics of the polymeric materials that are essential for its functions and environmental protection. The analysis shall include material specifications.

### **4.2 Requirements on cable for installation in process locations, outside the reactor containment**

The cable shall be manufactured for the environment in the process locations outside the reactor containment (TBE 101, Severity B). Specific requirements (e.g. high temperature, steam or ionizing radiation) shall be specified in the TS and verified in the Inspection Plan.

### **4.3 Requirements on cable for installation inside the reactor containment**

The cable shall be manufactured for the environment in the reactor containment (TBE 101, Severity C). Specific requirements (e.g. high temperature, steam or ionizing radiation) shall be specified in the TS and verified in the control plan. Further, the cable shall also conform to the requirements for 1E-qualification according to nuclear regulations (Regulatory Guide 1.89, IEEE 383 or IEC/IEEE 60780-323).

Cable for installation in the reactor containment shall be halogen free.

## **5 Documentation**

In the Tender the Manufacturer shall present the following documentation in addition to what is required in TBE 100 and KBE 100:

- specifications of materials of conductor insulation and cable jacket
- data on materials, materials testing and life analysis according to section 3.4
- instructions for cable pulling and installation
- amount of corrosive products at combustion according to IEC 60754 “Test on gases evolved during combustion of materials from cables”
- fire-load data (amount of combustible material per unit length)

Documentation that cannot be submitted until the delivery is to be specified in the Tender.

