



**SLOVENSKI STANDARD**  
**SIST-TP CLC/TR 50503:2010**  
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**Smernice za obvladovanje zalog, upravljanje, dekontaminacijo oziroma odstranjevanje električne opreme in izolacijskih tekočin, ki vsebujejo PCB**

Guidelines for the inventory control, management, decontamination and or disposal of electrical equipment and insulating liquids containing PCBs

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Ta slovenski standard je istoveten z: **CLC/TR 50503:2010**  
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TECHNICAL REPORT  
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**CLC/TR 50503**

February 2010

ICS 29.040.10

English version

**Guidelines for the inventory control, management,  
decontamination and/or disposal of electrical equipment  
and insulating liquids containing PCBs**

**iTeh STANDARD PREVIEW**

This Technical Report was approved by CENELEC on 2009-12-25.

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**CENELEC**

European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**Central Secretariat: Avenue Marnix 17, B - 1000 Brussels**

## Foreword

This Technical Report has been prepared by CENELEC BTTF 116-1 "Fluids for electrotechnical applications".

It was circulated for voting in accordance with the Internal Regulations, Part 2, Subclause 11.4.3.3 (simple majority).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

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## Introduction

Insulating liquids with PCBs bases (Askarels) or contaminated by PCBs that may still be present in electrical equipment in the generation, transmission, distribution and use of electric energy.

Polychlorinated biphenyls (PCBs) are a mixture of 209 possible congeners (as defined by EN 61619). Such compounds of a synthetic origin, have been produced and used in various commercial mixtures at an international level since 1930 (see Annex A). The chemical stability and relative non-flammable nature of PCBs was the main reason for their use by the electrotechnical industry.

The same functional features of these substances created environmental problems: PCBs are, in fact, classified as hazardous and persistent organic pollutants (POPs) in the environment, bio-accumulable along the food chain.

It is recognised that oil-filled electrical equipment may have been contaminated by PCBs either during manufacture or maintenance operations using oils which have been contaminated with PCBs.

Insulating liquids and equipment containing insulating liquids are classified, respectively, "PCBs" and "Equipment containing PCBs" when the total concentration of polychlorinated biphenyls (209 possible congeners) and correlated compounds PCTs (polychlorinated terphenyls- 8 557 possible congeners) and PCBTs (polychlorinated benzyltoluenes-thousands of possible congeners) present in the insulating liquids exceeds the limits prescribed by current legislation for the single environmental matrices and/or applications (equipment and insulating liquids in operation, waste, used oils, fuel oils, etc.).

During their operational life cycle, such equipment and insulating liquids degrade, and may degrade faster if not properly managed and maintained, inducing failures that could cause incidents having a significant environmental impact, that can be correlated to the specific site conditions. In accordance with Directive 96/59/EC, during their service life, equipment containing PCBs should, under certain conditions, be subject to measures capable of preventing and/or mitigating degradation processes and the spillage of PCBs, to ensure the protection of workers, public health and the environment, as well as complying with the prescriptions of the Stockholm Convention on Persistent Organic Pollutants (POPs) entered into force on 17 May 2004.

Since the 1980's, PCBs have been subject to prohibitions and limitations for the marketing and use: the recent Council Directives and Commission Decisions introduced new obligations for the inventory, control, management, decontamination and/or disposal of electrical equipment and insulating liquid containing PCBs.

## 1 Scope

The scope of this Technical report is to provide guidance for the activities of inventory, control, management, decontamination and/or disposal of equipment and containers with insulating liquid containing PCBs, in compliance with the Council Directives (96/59/EC), using Best Available Techniques - BAT - (96/61/EC), Commission Decision (2001/68/EC), Stockholm Convention on Persistent Organic Pollutants (POPs) and/or with appropriate national or local legislation.

This Technical report is addressed, in particular, toward the Life Cycle Management (LCM) of insulating liquids and it has been developed in accordance with the following objectives:

- a) reduction of risks for workers, public health and the environment, arising from human error, malfunction, or failures of the equipment that could cause fires or spillage of hazardous and Persistent Organic Pollutants (POPs);
- b) implementation of the "Best Available Techniques" (BAT), "Best Environmental Practices" (BEP) and methodologies available for safety, whilst taking into account the surroundings and the criteria of self-sufficiency and functional recovery;
- c) technical feasibility of the activities within the prescribed time schedules, taking into account current legislation and economic feasibility.

NOTE 1 For those CENELEC countries in which the European Directives do not apply, this Technical report has an informative purpose only. Different limits from those given in the present Technical report are required in some countries.

NOTE 2 For those countries outside of European Community the Stockholm Convention on Persistent Organic Pollutants (POPs) should be applied.

NOTE 3 When reading this Technical report, reference should also be made to Annex C of EN 50195 and Annex B of EN 50225, because in some EU countries (i.e. France, Italy, Poland, Spain, etc.) there are other mandatory requirements.

## 2 Normative references

The following referenced documents may be used for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12766-1	Petroleum products and used oils - Determination of PCBs and related products - Part 1: Separation and determination of selected PCB congeners by gas chromatography (GC) using an electron capture detector (ECD)
EN 12766-2:2001	Petroleum products and used oils - Determination of PCBs and related products - Part 2: Calculation of polychlorinated biphenyl (PCB) content
EN 12766-3	Petroleum products and used oils - Determination of PCBs and related products - Part 3: Determination and quantification of polychlorinated terphenyls (PCT) and polychlorinated benzyl toluenes (PCBT) content by gas chromatography (GC) using an electron capture detector (ECD)
EN 50195	Code of practice for the safe use of fully enclosed askarel-filled electrical equipment
EN 50225	Code of practice for the safe use of fully enclosed oil-filled electrical equipment which may be contaminated with PCBs
EN 60567	Oil-filled electrical equipment - Sampling of gases and of oil for analysis of free and dissolved gases - Guidance (IEC 60567)
EN 60599	Mineral oil-impregnated electrical equipment in service - Guide to the interpretation of dissolved and free gases analysis (IEC 60599)
EN 61198	Mineral insulating oils - Methods for the determination of 2-furfural and related compounds (IEC 61198)



EN 61619	Insulating liquids - Contamination by polychlorinated biphenyls (PCBs) - Method of determination by capillary column gas chromatography (IEC 61619)
EN 62535	Insulating liquids - Test method for detection of potentially corrosive sulphur in used and unused insulating oil (IEC 62535)
EN 60296	Fluids for electrotechnical applications - Unused mineral insulating oils for transformers and switchgear (IEC 60296)
EN 60422:2006	Mineral insulating oils in electrical equipment - Supervision and maintenance guidance (IEC 60422:2005)
EN 60836	Specifications for unused silicone insulating liquids for electrotechnical purposes (IEC 60836)
EN 61099	Specification for unused synthetic organic esters for electrical purposes (IEC 61099)
EN 61203	Synthetic organic esters for electrical purposes - Guide for maintenance of transformer esters in equipment
EN ISO 9001	Quality management systems - Requirements (ISO 9001)
IEC 60475	Methods of sampling liquid dielectrics
IEC 60588 series	Askarels for transformers and capacitors
IEC 60944	Guide for the maintenance of silicone transformer liquids
ASTM D 971	Standard test method for interfacial tension of oil against water by the ring method
ASTM D 7151	Standard test method for determination of elements in insulating oils by inductively coupled plasma and atom emission spectrometry (ICP-AES)

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### 3 Terms and Definitions

For the purposes of this document, the following terms and definitions apply.

#### 3.1 askarel

synthetic, fireproof insulating liquid which, when decomposed by electrical arc, will evolve predominantly non combustible gaseous mixtures

NOTE Askarels usually consist of polychlorinated biphenyls with or without the addition of polychlorinated benzenes.

[IEV 212-07-08]

#### 3.2 Best Available Techniques (BAT) and Best Environmental Practices (BEP)

*Best Available Techniques (BAT)* means the most effective and advanced stage in the development of activities and their operation methods which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole:

- “*techniques*” shall include both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned;
- “*available techniques*” shall mean those techniques developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the member state in question, as long as they are reasonably accessible to the operator;

- “best” shall mean most effective in achieving a high general level of protection of the environment as a whole

[Council Directive 96/61/EC]

*Best Environmental Practices (BEP)* means the application of the most appropriate combination of environmental control measures and strategies (Stockholm Convention Art. 5)

### 3.3

#### **congener**

all the chlorine derivatives of biphenyl, irrespective of the number of chlorine atoms, are termed congeners

[EN 61619]

### 3.4

#### **contaminant**

foreign substance or material in an insulating liquid, gas or solid, which usually has deleterious effect on one or more properties

[IEV 212-07-26]

### 3.5

#### **technical decontamination**

procedure of reducing, eliminating and/or decomposing compounds and/or undesired elements as contaminants on a specific matrix, to the prescribed concentration limit

### 3.6

#### **decontamination from PCBs**

all operations which enable equipment, objects, materials or fluids contaminated by PCBs to be reused, recycled or disposed of under safe conditions, and which may include replacement, meaning all operations in which PCBs are replaced by suitable fluids not containing PCBs

[Council Directive 96/59/EC Art. 2, e]

NOTE PCBs decontamination techniques may be applied during the service life of the electrical equipments or at the end of their life. In the latter case these techniques may be considered as waste treatment. When these techniques are applied during the service life then they should be considered as maintenance activities.

### 3.7

#### **dehalogenation of PCBs**

method of chemical decontamination and dehalogenating of PCBs down to the prescribed concentration limit

NOTE Halogenated compounds include PCTs, PCBTs, PCDFs, PCDDs, etc.

### 3.8

#### **depolarisation**

method of decontamination from specific polar compounds or oxidation by products of unused and used insulating liquid, capable of reinstating the functional features required.

This process includes selective physical and/or chemical reactions applying the best available techniques

### **3.9 disposal**

operations D8, D9, D10, D12 (only in safe, deep, underground storage in dry rock formations and only for equipment containing PCBs and used PCBs which cannot be decontaminated) and D15 provided for in Annex II A of Directive 75/442/EEC

[Council Directive 96/59/EC Art. 2, f]

### **3.10 equipment containing PCBs**

any equipment containing PCBs or having contained PCBs (e.g. transformers, capacitors, receptacles containing residual stocks) which has not been decontaminated. Equipment of a type which may contain PCBs shall be treated as if it contains PCBs unless it is reasonable to assume the contrary

[Council Directive 96/59/EC Art. 2, b]

### **3.11 failure**

end of the capability of a component or system to fulfil the function required

### **3.12 holder**

natural or legal person who is in possession of PCBs, used PCBs and/or equipment containing PCBs

[Council Directive 96/59/EC Art. 2, d]

### **3.13 incineration**

controlled combustion to degrade materials

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### **3.14 insulating liquid**

liquid with negligibly low electrical conductivity, used to separate conducting parts at different electrical potentials

### **3.15 maintenance**

combination of all technical and administrative actions, including supervision actions, intended to retain an item in, or restore it to, a state in which it can perform a required function

### **3.16 reclaiming**

elimination of soluble and insoluble contaminants from an insulating liquid by chemical absorption means, in order to restore properties as close as possible to the original value

NOTE The process may include the use of antioxidants.

### **3.17 risk**

probability value of damage to occur. It is a function of time, failure rate, asset value and potential damage

### 3.18 PCBs

- polychlorinated biphenyls;
- polychlorinated terphenyls;
- monomethyl-tetrachlorodiphenyl methane, monomethyl-dichloro-diphenyl methane, monomethyl-dibromo-diphenyl methane;
- any mixture containing any of the above mentioned substances in a total of more than 0,005 % by weight

[Council Directive 96/59/EC Art. 2, a]

### 3.19 polychlorinated biphenyls

biphenyl substituted by one to 10 chlorine atoms

### 3.20 treatment

procedure using physical or chemical means with the purpose of reinstating the features of the fluid and/or environmental matrix near the values desired

### 3.21 used PCBs

any PCBs which are considered as a waste within the meaning of Directive 75/442/EEC

### 3.22 waste

any substance or object which the holder discards or intends or is required to discard

NOTE During their service life, electrical equipment and insulating liquids shall not be considered as waste.

## 4 Inventory and communication

Electrical equipments containing PCB contaminated insulating liquids are not considered waste whilst in service even if they are subject to the inventory.

The holders of equipment containing PCBs in volume exceeding 5 dm<sup>3</sup> (5 l) are required to provide inventory and report to the authorities in charge, providing the information specified in 4.5.

NOTE 1 The limit of 5 dm<sup>3</sup> is intended as referred to the volume of the insulating liquid (PCBs) contained by the equipment; if this is not known or can be presumed from the data of the plate or other documents of the manufacturer, it should be referred to the total volume of the equipment.

NOTE 2 Each capacitor in a bank battery should be considered as a single equipment to which the total volume of 5 dm<sup>3</sup> applies.

### 4.1 PCBs for inventory purposes

With the term of PCBs is intended a family of substances including polychlorinated biphenyls and the products correlated to them listed in Table 1.

**Table 1 - PCBs family**

	Family of substances	Symbols synonyms and commercial mixtures
1	Polychlorinated biphenyls	Askarels, Aroclor (1242 – 1254 – 1260), Apirolio, Clophen, Pyralene, etc.
2	Polychlorinated terphenyls	PCT Aroclor (5442 – 5460 – 5060)
3	Monomethyl-tetrachlorodiphenyl methane, Monomethyl-dichloro-diphenyl methane, Monomethyl-dibromo-diphenyl methane	Polychlorinated benziltoluenes PCBT Ugilec 141, T4
4	Any mixture containing any of the above mentioned substances in a total of more than 0,005 % by weight	Mineral insulating oils Synthetic insulating liquids such as silicones, alkylbenzenes, etc.
<p>NOTE Directive 96/59/EC expresses the limit concentration as a percentage by weight, whereas technical standards and common use utilise units of measure such as mg/kg or parts per million (ppm). To clarify, the conversion ratios are listed here below:</p> <ul style="list-style-type: none"> <li>• 0,005 % by weight corresponds to 50 mg/kg, or 50 parts per million (ppm);</li> <li>• 0,05 % by weight corresponds to 500 mg/kg, or 500 parts per million (ppm).</li> </ul> <p>In this Technical Report, concentrations are always expressed in mg/kg.</p>		

Consequently, the designation PCBs includes, besides polychlorinated biphenyls, other families of substances having a similar level of hazard and thus subject to the same restrictions. The summation of the concentrations of all the substances mentioned herein constitutes the total PCBs content to which the limits are referred.

Among all the families of substances belonging by definition to the category of PCBs, the polychlorinated biphenyls, properly designated, had a capillary dissemination, whereas PCTs and PCBTs have been marketed and used on a more limited scale.

The analytical methods that can be applied in measuring the PCBs content in insulating liquids and in the relevant containers are described in 4.4.

#### 4.2 Equipment containing PCBs for inventory

For “equipment containing PCBs”, (Directive 96/59/EC), means any equipment containing PCBs or having contained PCBs (e.g. transformers, resistors, inductors, reactors, switches, capacitors receptacles containing residual stock, etc.) which has not been decontaminated. Equipment of a type which may contain PCBs shall be treated as if it contains PCBs unless it is reasonable to assume the contrary (Article 2, b).

It is also reasonable to assume that equipment containing insulating liquid can be considered “PCBs free” when one or more of the following conditions occur:

- the equipment has been acquired with a certificate by the manufacturer guaranteeing that it was PCBs free and that it has not subsequently been subject to handling of the dielectric or topping-up with oils containing PCBs. In the event of doubt, it is required that at least a screening test of the total chlorine content in the insulating liquid is performed (see 7.4);
- laboratory analytical determinations, performed with methodologies approved by current regulations are available, certifying a concentration of PCBs not exceeding 50 mg/kg.
- statistical analysis of appropriate equipment populations shows this to be the case.

If conditions of the above point a) do not occur and it is not possible to perform the measurements indicated in point b) (because the equipment is sealed, cannot be accessed or it is difficult to take samples due to operational requirements or any other reason) the equipment should be considered as “containing PCBs” unless it is reasonable to assume the contrary.

Also, the determination of the concentration of PCBs in insulating liquids is recommended: