

GUIDE

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Guide for defining halogen content terminology in IEC standards

Guide pour la définition de la terminologie relative à la teneur en halogènes dans les normes IEC

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 13.020.01

ISBN 978-2-8322-8674-6

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

GUIDE FOR DEFINING HALOGEN CONTENT TERMINOLOGY IN IEC STANDARDS

FOREWORD

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IEC Guide 122 has been prepared in accordance with the ISO/IEC Directives, Part 1, Annex A, by the IEC Advisory Committee on Environmental Aspects (ACEA).

The text of this IEC Guide is based on the following documents:

Draft	Report on voting
SMBNC/56/DV	SMBNC/60/RV

Full information on the voting for the approval of this Guide can be found in the report on voting indicated in the above table.

The language used for the development of this Guide is English.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC

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INTRODUCTION

IEC and other standards development organizations (SDOs), as well as numerous environmental performance programmes worldwide (such as Blue Angel in Europe and EPEAT in the US), are developing standards for the determination, quantification, and possible limitation of halogen content in materials and products.

There are multiple reasons for such interest in the use and amounts of elemental halogens and certain halogenated compounds in materials and products, including:

- the health and safety of workers and end users;
- the safety of people, animals and goods in the event of fire;
- the minimization of adverse environmental impacts;
- the demonstration of compliance with product legislation;
- business and commercial interests.

NOTE 1 The list above is not prioritized by level of importance.

NOTE 2 More information about fire retardancy in relation to halogens is provided in Clause B.2.

An analysis of standards developed by different IEC committees reveals differences in terminology, and differences in the halogens concerned and their associated threshold (see Annex A). Similar differences are also observed with respect to other standards such as regional (CEN, CENELEC, UL), national (IPC, JEDEC) and sectorial publications (e.g. in the railways domain).

The definitions related to halogen content in standards developed by IEC and other SDOs exhibit differences such as the following (see more details in Annex A).

- Different terms like halogen-free, non-halogenated, zero-halogen, and low-halogen are often used to express the same or similar halogen content.
- Different limits for the halogens (either as individual limits or as a total halogen content) are used, while often they are referred to using the same term.
- Different standards use similar terms (e.g. non-halogenated) when referring to different sets of halogens, e.g. chlorine and bromine only, or all four halogens – fluorine, chlorine, bromine, and iodine.
- Different standards cover different forms of halogen (elemental halogens, brominated or chlorinated compounds, etc.) and yet use the same terminology to refer to them.
- Different standards covering different product scopes, like electrical and electronic equipment (EEE) or certain product parts such as cables and cable management systems and printed circuit boards (PCBs), use inconsistent terminology or requirements.

There are many reasons for the observed differences in the various standards, such as the following.

- The scope of SDOs is focused on developing vertical standards on specific categories of product.
- Stakeholders did not include a complete representation of the scope of the SDO in question.
- Standards were created at different moments in time, with more recent publications using newer data and terminology.
- Stakeholders during different standardization activities can have a different knowledge base or perspective of halogenated substances and materials, their perceived risks, or links to specific legislation.

Differences in the various definitions bring confusion among the users of IEC standards and of other standards related to halogen content. Especially for manufacturers, traders and users of finished goods, the claims that can be associated with these different standards can appear as "greenwashing". While the specification of test methods and requirements is the responsibility of individual IEC product or systems committees, harmonization of the terminology associated with halogen content across committees would be beneficial.

This Guide, therefore, provides recommendations on how IEC committees can best employ harmonized terminology that is suitable to the halogen-content-related requirements in a scientifically sound, uniform, verifiable, and environmentally relevant way.

It also complements IEC Guide 109 [1]¹, which describes the general principles of specifying environmental aspects in IEC standards.

Standards that include halogen content provisions cover not only environmental matters, but often have a broad scope also covering health, safety and fire-related matters, thus going beyond ACEA's scope. In recognition of this, and in order to collect input from other domains, this Guide was circulated for comment to the following IEC, ISO and CLC committees:

- IEC: TC 8, TC 15, TC 18, SC 18A, TC 20, TC 21, TC 23, TC 34, TC 46, SC 46A, SC 46C, TC 47, TC 59, TC 65, SC 65C, TC 86, SC 86A, TC 89, TC 91, TC 100, TC 110, TC 111, TC 112, TC 120, TC 121, TC 147 and ACOS.
- ISO: TC 34/SC 11, TC 61/SC 5, TC 61/SC 9, TC 92/SC 3, TC 147/SC 2 and TC 207.
- CLC: TC 213.

The following IEC committees (including relevant subcommittees) made active contributions to the development of this Guide: TC 20, TC 23, TC 46, TC 47, SC 86A, TC 91 and TC 111.

In this Guide:

- the term "committees" includes technical committees (TCs), project committees (PCs), subcommittees (SCs), systems committees (SyCs), and advisory committees (ACs).
- the term "standard" includes International Standard (IS), Technical Report (TR), Technical Specification (TS), and Publicly Available Specification (PAS), where the document types are those defined in the ISO/IEC Directives, Part 2.

¹ Numbers in square brackets refer to the Bibliography.

GUIDE FOR DEFINING HALOGEN CONTENT TERMINOLOGY IN IEC STANDARDS

1 Scope

This Guide raises awareness and provides recommendation on the use of consistent terminology related to halogen content for use in horizontal and product-specific IEC standards.

The terminology related to halogen content provided in this Guide does not take into consideration astatine (At) and the artificially created tennessine (Ts), since they are not used in electrical and electronic equipment (EEE). Diatomic halogen molecules (F₂, Cl₂, Br₂, I₂), normally not found in EEE, are also excluded from the terminology recommended in this Guide.

NOTE The IEC Standardization Management Board (SMB) has decided that Guides such as this one can have mandatory requirements which shall be followed by all IEC committees developing technical work that falls within the scope of the Guide, as well as guidance which may or may not be followed. The mandatory requirements in this Guide are identified by the use of "shall". Statements that are only for guidance are identified by using the verb "should". (See ISO/IEC Directives, IEC Supplement:2021, A.1.1.).

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

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- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1.1

halogen

fluorine (F), chlorine (Cl), bromine (Br) or iodine (I)

Note 1 to entry: Together the four halogens plus astatine (At) constitute the group of the periodic table that in the past was known as "group VIIA". In the current IUPAC nomenclature, it is known as "group 17".

Note 2 to entry: For the purposes of this document, astatine (At) is not included in this definition because it is not known to be used in EEE. Similarly, the artificially created element tennessine (Ts) can also be considered a halogen but it is not known to be used in products in general.

3.1.2

halogen content

quantity of all halogens in a material, product or product part

Note 1 to entry: Halogen content is typically defined in mass or mass fraction (e.g. mg or mg/kg). Any expression of halogen content mass fraction is best accompanied by a clear unit basis. Parts per million (ppm) alone is not sufficient.

**3.1.3
environment**

surroundings in which a product or system exists, including air, water, land, natural resources, flora, fauna, humans and their interrelation

[SOURCE: IEC 60050-904:2014, 904-01-01]

**3.1.4
environmental impact**

change to the environment, whether adverse or beneficial, wholly or partly resulting from environmental aspects

[SOURCE: IEC 60050-904:2014, 904-01-03]

**3.1.5
greenwashing**

description of one or more properties of a good or service that overstates the environmental performance or environmental benefit provided by that good or service

**3.1.6
material**

substance or mixture of substances within a product or product part

[SOURCE: IEC 62474:2018, 3.15]

**3.1.7
formulation**

list of ingredients and their proportions, used in the preparation of a material

[SOURCE: ISO 1382:2020, 3.217, modified – In the definition, "compounding ingredients" has been replaced by "ingredients" and "compound" has been replaced by "material".]

**3.1.8
trace contaminant**

substance that is present in a minimal concentration, below which the substance cannot be meaningfully used, and above the detection limit of existing detection methods to enable control and enforcement

[SOURCE: REGULATION (EU) 2019/1021 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 20 June 2019 on persistent organic pollutants (recast), Definition (12), modified – "unintentional" has been deleted from the term. In the definition, "level of a" and "incidentally" have been deleted, and "amount" has been replaced by "concentration" for conformity with ISO 80000-9:2019, 9-12.1.]

**3.1.9
background level**

concentration of a substance in an environmental medium (air, water, or soil) that occurs naturally or is not the result of human activities

[SOURCE: EEA (European Environmental Agency) Glossary]

3.2 Abbreviated terms

BFR	brominated flame retardant
CFR	chlorinated flame retardant
CPSC	Consumer Product Safety Commission
EEE	electrical and electronic equipment
ETFE	ethylene tetrafluoroethylene
FEP	fluorinated ethylene propylene
GABA	gamma-aminobutyric acid
KPFBS	potassium perfluorobutane sulfonic acid and its salts
MCCP	medium chain chlorinated paraffins
PBB	polybrominated biphenyls
PBDE	polybrominated diphenyl ethers
PCB	printed circuit board
PFA	perfluoroalkoxy alkanes
PFOA	perfluorooctanoic acid and its salts
PFOS	perfluorooctanesulfonic acid and its salts
ppm	parts per million
PTFE	polytetrafluoroethylene
PVC	polyvinylchloride
PVF	polyvinyl fluoride
PVF2	polyvinylidene difluoride
SCCP	short chain chlorinated paraffins
SDO	standards development organization

4 The use of halogens in EEE and associated terminology

4.1 Halogens in electrical and electronic equipment

Halogens can be included in electrical and electronic equipment (EEE), whether additively, reactively or through polymerization, to provide or improve specific characteristics of materials such as, but not limited to:

- performance properties (e.g. thermal, mechanical, electrical);
- fire behaviour;
- manufacturability or ease of installation.

A detailed summary of the use of halogenated substances in EEE is provided in Annex B.

The presence of halogens can also originate from natural occurrence, residues left from synthesis, or contamination.

4.2 Currently used terminology

In order to provide guidance for future reference when using terminology related to halogen content, one must first understand how and where these terms are currently used, as well as the context in which they are used. With this in mind, this Guide attempts to collect the currently used terminology and to outline why there is a need going forward to align to specific terms to reduce confusion within the broader industry and within the supply chain in general.

Table 1 and 4.3.1 to 4.3.9 present a non-exhaustive overview and discussion of how various halogen content terminology is used, including specific applications and the requirements associated with them. Annex A provides more detailed information, including the sources of the terms.

Table 1 – Examples of halogen content terminology used in standards and legislation

Term	Standard reference	Application	F	Cl	Br	I	Total	Threshold (mass fraction in %)
Non-halogenated	IEC 61249-2 series IEC 61249-4 series	Printed circuit boards base materials		X	X		X	0,09 Cl and Br 0,15 total Cl + Br
	UL 746E:2016	Safety for polymeric materials as industrial laminates, filament wound tubing, vulcanized fibre, etc.		X	X		X	0,09 Cl and Br 0,15 total Cl + Br
	UL 746H:2014 (Part I)	Combustible materials	X	X	X		X	0,09 F, Cl, and Br 0,15 total F + Cl + Br
Non-halogen	DIN/VDE 0472-815:1989	Cables wires and flexible cords	X	X	X	X		0,1 F, 0,2 Br, Cl and I
Non-bromine Non-chlorine	UL 746H:2014 (Part II)	Combustible materials		X	X		X	0,09 Cl and Br 0,15 total Cl + Br
Halogen-free	IEC 62821 series IEC 60502-1:2021	Power cables	X	X	X			0,1 F, 0,5 Br and Cl
	IEC 62893 series	Charging cables	X	X	X			0,1 F, 0,5 Br and Cl
	IEC 60092-360:2021	Ships and offshore installation cables	X	X	X			0,1 F, 0,5 Br and Cl
	IEC 60754-3:2018	Cable materials	X	X	X	X		≤ 0,1 F, Cl, Br and I
	UL 2885:2018	Non-metallic cable materials incl. insulating and jacketing materials and other cable components (e.g. tapes, fillers, threads, pigments)	X	X	X	X		≤ 0,1 F, Cl, Br and I
	IEC 63355:2022 EN 50642:2018/A1:2022	Cable management systems	X	X	X	X	X	≤ 0,15 Cl and Br, ≤ 0,3 F and I, ≤ 0,4 total Br + Cl + F + I
	JPCA-ES01-2003	Test methods for halogen-free materials		X	X		X	0,09 Cl and Br 0,15 total Cl + Br
	IEC 61156-11:2023	Transmission cables						Not specified

Term	Standard reference	Application	F	Cl	Br	I	Total	Threshold (mass fraction in %)
Low smoke halogen-free	IEC 62821 series	Sheathed cables	X	X	X			0,1 F, 0,5 Br and Cl
	IEC 62821-3:2015	Flexible cables	X	X	X			0,1 F, 0,5 Br and Cl
	US MIL-DTL-24643 C(I1)	Navy shipboard cables	X	X	X	X		0,2 halogen content
Zero-halogen	ANSI/NEMA HP 8	Internal wiring of high-reliability electrical and electronic equipment						0,2 halogen content
	CSA C22.2 NO. 96.2-18	Wind turbine cables						components have < 0,2 halogen content
Low smoke zero-halogen	IEC 61196-6-3:2020	Communication CATV cables						Not specified
	IEC 61196-8:2023							
	ISO 11197:2019	Medical electrical equipment						Not specified
	ISO/PAS 21195:2018	Ships and marine technology						Not specified
Low-halogen	JEDEC/ECA JS709C:2018	Nonmetallic and nonceramic materials within electronic products		X	X			0,1 Cl and Br from flame retardant and PVC for other materials
Low levels of Chlorine, Bromine, Iodine and/or Fluorine	IEC 60684-2:2011	Insulating sleeving	X	X	X	X		Detection limits 0,014 Cl and/or Br and/or I and > 0,02 F
Halogenated	IEC 62321-3-2:2020	Analytical test methods for materials used in EEE	X	X	X			Not specified
	ISO 10301:1997	Water quality	X	X	X	X		Defines highly volatile halogenated hydrocarbons
	ISO 16035:2003	Fats and oils						Defines halogenated hydrocarbons content. Detection limitation of all edible fats and oils in the range 0,000 01 to 0,000 2
	Commission Regulation (EU) 2019/2021	Electronic display enclosures and stands	X	X	X	X		No use of halogenated flame retardants

Term	Standard reference	Application	F	Cl	Br	I	Total	Threshold (mass fraction in %)
Fluorinated	IEC 60684 series SAE AS22759D	Insulation and sleeving for wires and cables in applications such as aerospace	X					No thresholds specified. Indication for use of types of fluorinated materials
	ISO 20568-1 and ISO 20568-2	Test methods to define characteristics of thermoplastic fluoropolymer resins	X					No thresholds specified. Indication for use of types of fluorinated materials
	MIL-DTL-17J	Specification for radio frequency cables	X					No thresholds specified. Indication for use of types of fluorinated materials
	NEMA HP3	Specification for PTFE insulated high temperature hook-up wire	X					No thresholds specified. Indication for use of types of fluorinated materials
Chlorinated	NEN-HD 622:1996/A2:2005 DS/HD 627 S1/A2:2006	Cable materials used in power stations		X				No thresholds specified. Indication for use of types of chlorinated materials
	NEN 3607:1998	Cable materials for installation above and below ground		X				No thresholds specified. Indication for use of types of chlorinated materials
Chlorinated, Brominated	JEDEC/ECA JS709C:2018	Electronic products		X	X		X	Indication for use of brominated and chlorinated flame retardants 0,09 Cl and Br and 0,15 Total Cl + Br
Brominated	IEC 61249-2-21	Printed circuit boards base materials			X			No thresholds for brominated specified
Fluorinated, Chlorinated, Brominated, Iodinated	ISO 10301:1997	Water quality	X	X	X	X		No thresholds specified. In reference to highly volatile halogenated hydrocarbons (from 1 to 6 carbon atoms)
Halogen containing	IEC TR 62392:2006	Recycling materials	X	X	X			Not specified
Halogen content	IEC 61189-2:2006 [TEST 2C12]	PCBs and interconnection structures		X	X			Not specified
NOTE "X" in the table indicates that the elements or their summation are included in the requirements of the referenced standard.								