TÜVRheinland®	**List of Criteria** Product Group **"Printing Modules with Toner"** **Keywords:** • **Emission Tested** • **Tested for Harmful Substances** • **Regular Product Surveillance**	TÜVRheinland ZERTIFIZIERT Emissionsgeprüft Schadstoffgeprüft Regelmäßige Produkt-überwachung www.tuv.com ID 0000000888
2 PfG S 0136/01.09.2021		Creation date: 21.03.2013 Revision date: 01.09.2021 Version: 3.0
TÜV Rheinland LGA Products GmbH Technical Competence Center „VOC Emission & Chamber Testing“		Creator: Dr. Jelena Galinkina

1. Purpose

The present criteria catalogue for the product group “Printing Modules with Toner” for electrographic printing and copying systems includes the requirements for products regarding potential and relevant emission/contaminant loads. After successful testing and evaluation by TÜV Rheinland LGA Products GmbH, the products may be awarded with a test mark / certificate.

Based on the positive test and considering the Testing and Certification Regulations of TÜV Rheinland LGA Products GmbH (TRLP), the certification mark “TÜV Rheinland Certified” mark with keywords: “Emission tested”, “Tested for harmful substances” and “Regular Product Surveillance” can be awarded for the printing modules (including the toner powder contained in it).

Within the scope of awarding the TÜV Rheinland certification according to the keyword “Tested for harmful substances” – if applicable – both the defined requirements of the emission parameters of the complete copying/printing system [toner cartridges in combination with a designated printer for the printing module] and the demands of the material parameters of the toner powder must be met. At the client’s request and when a complete examination is carried out, the keyword “Emission tested” can be additionally awarded next to the keyword “Tested for harmful substances”.

The definition of the test parameters was made considering the decisive state-of-the-art technology, existing legal requirements as well as the relevance of a contaminant load with reference to a potential exposure effect.

The testing of a product refers exclusively to the designated test parameters, a comprehensive statement about the marketability as well as other relevant aspects on the safety of the product cannot be made.

2. Scope of application

The following requirements apply to printing modules based on black and coloured toner powder for use in office equipment with electrophotographic printing functions.

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1. Basics

The requirements of this list of criteria and the implementing rules were set and defined in consideration of the literature accessible documents listed below:

Act on making products available on the market (**Product Safety Act**) of 27. July 2021 (Federal Law Gazette I p. 3146, 3147) as amended by Article 2 of the ordination of 27. July 2021 (Federal Law Gazette I p. 3146).
Ordinance on prohibitions and restrictions on the placing on the market and on the supply of certain substances, mixtures and articles under the Chemicals Act (Chemical Prohibition Ordinance - ChemVerbotsV) of 20. January 2017 (Federal Law Gazette. I p. 94; 2018 I p. 1389) as amended by Art. 300 V from 19. June 2020 (Federal Law Gazette. I p. 1328).
Regulation (EC) No. 1907/2006 (REACH) OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18. December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing an European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No. 793/93 and Commission Regulation (EC) No. 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC (including the corrigendum).
REGULATION (EC) No. 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16. December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No. 1907/2006.
Directive 2004/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21. April 2004 on the limitation of emissions of volatile organic solvents in certain paints and varnishes and vehicle refinishing products and amending Directive 1999/13/EC.
REGULATION (EU) No 528/2012 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 22 May 2012 concerning the making available on the market and use of biocidal products.
DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 June 2011 on the restriction of use of certain hazardous substances in electronic equipment.
TVOC concept of the ad hoc working group of members of the Indoor Air Hygiene Commission (IRK) of the Federal Environment Agency and the highest health authorities of the countries (ad hoc working group IRK/AOLG).
Guide values for indoor air of the ad hoc working group IRK/AOLG (RW I / RW II) taking into account the current release status.
BGA-Pressedienst 19/77 vom 12.10.1977. / Bundesgesundheitsbl. – Gesundheitsforsch. – Gesundheitsschutz Bewertung für Formaldehyd in der Raumluft 7:2007.
ISO / IEC 28360: 2018 –Information technology – Office equipment – Determination of chemical emission rates from electronic equipment
DIN ISO 16000-3:2013-01 – Indoor air – Part 3: Determination of formaldehyde and other carbonyl compounds in indoor air and test chamber air - Active sampling method (ISO 16000-3:2011)
DIN ISO 16000-6:2012-11 – Indoor air – Part 6: Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA® sorbent, thermal desorption and gas chromatography using MS or MS-FID (ISO 16000-6:2011)

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DIN ISO 16000-9:2008-04 – Indoor air – Part 9: Determination of the emission of volatile organic compounds from building products and furnishing – Emission test chamber method (ISO 16000-9:2006); German version EN ISO 16000-9:2006.
DE-UZ 219 – Basic Award Criteria for German Ecolabel „Blue Angel“ for Office Equipment with Printing Function (Printers and Multifunction Devices), Edition January 2021
DE-UZ 177 – Basic Award Criteria for German Ecolabel „Blue Angel“ for Remanufactured Toner Modules, Edition July 2021
BAM test method for determining the emissions of hardcopy devices as part of the award of the “Blue angel” ecolabel for office equipment with printing function DE-UZ 219, January 2021

2. Required Documents and Declarations

In the scope of the certification process, the applicant / manufacturer has to provide complete information regarding all installed or used materials and components, including information of all sources of materials (supplier companies) of the used materials / components. A material list must be completed by the applicant / manufacturer in terms of materials / components used. Detailed information of the toner powder used must be provided.

Furthermore, the applicant / manufacturer confirms in a manufacturer's declaration that compounds listed under Point 6.5 have not been used as structural components in the toner powders.

As part of the safety assessment of the article to be certified, the holder must provide a declaration of conformity that the legal and/or normative product guidelines / standards are taken into account or are maintained.

For awarding products distributed to a non-European market, the country-specific legal requirements for safety and chemical safety defined for a product to be certified must be additionally considered.

In the scope of the certification process of the printing module, the following documents have to be provided by the client / manufacturer corresponding to the "Appendix" referring to the List of Criteria:

- Safety data sheet [toner powder]
- Sampling protocol (to be completed in the scope of test sample configuration)
- Manufacturer's Declaration / Declaration of conformity (Appendix to the List of Criteria)
- Tabulation of the printing modules / cartridge types which are expected to be filled with the toner to be certified and the appropriate printer specifying the page output.
- Photographs of the printing modules / cartridges to be certified
- Product marking in accordance with the requirements of Product Safety Act
- Proof of the functionality of the toner cartridges as part of the internal quality control (tests according to DIN 33870-1 or -2)

In the case of materials and components used that are not covered by specified test requirements, TRLP reserves the right to carry out further corresponding material-relevant tests.

5. Test Requirements and Guideline Limits

5.1 Section A – Material Testing

5.1.1 Black and Coloured Toner Powder

5.1.1.1 Volatile Organic Compounds using Thermal Extraction

Testing method	The toner sample is heated in the tube furnace (Gerstel Thermal Extractor TE-2) and the compounds emitting from the sample into the vapour phase are transported using a nitrogen feed gas flow to and trapped on a thermal desorption pipe that is filled with adsorption material (Tenax TA). Determination and quantification of the adsorbed compounds is done by using the thermal desorption GC/MS method. For colour toner sets, a test of the black toner by itself and a test of a mixed sample of three colours (cyan, magenta and yellow) must be carried out.
Analytical method	Based on DIN ISO 16000-6

TEST PARAMETERS	REQUIREMENTS
Total of volatile organic compounds in the retention range C_6 – C_{16} (TVOC) [1]	≤ 300 mg/kg [2]
Styrene	≤ 40 mg/kg [2]
Benzene	≤ 0.35 mg/kg
Volatile CMR compounds [3] of categories 1A and 1B	≤ 1 mg/kg (each individual substance)
Volatile CMR compounds of category 2 [4]	≤ 20 mg/kg (sum) [6]
Substances classified as acutely toxic according to Category 1, 2 and 3 (Acute Tox. 1, 2, 3), or specific target organ toxic according to Category 1 (STOT single exposure 1, STOT repeated exposure 1) [5]	≤ 40 mg/kg (sum) [6]
Substances classified in Appendix VI of EU Regulation No. 1272/2008 (GHS) as inhalant allergens (Category 1) and skin allergens (Category 1) [7, 8]	≤ 40 mg/kg (sum) [6]
Not identified substances [9]	≤ 30 mg/kg (sum) [6]

5.1.1.2	Heavy Metals [9]

Analytical method	Microwave digestion, determination by means of ICP-OES

TEST PARAMETERS	REQUIREMENTS
Cobalt	≤ 25 mg/kg
Nickel	≤ 70 mg/kg
Cadmium	≤ 5 mg/kg
Lead	≤ 25 mg/kg
Mercury	≤ 2 mg/kg
Chromium (total) Chromium (VI) [11]	≤ 1 mg/kg ≤ 3 mg/kg

5.1.1.3	Tin Organic Compounds[9]

Analytical method (Method A)	Derivatization with sodium tetraethyl borate, extraction with methanol, determination by means of GC/MS

Analytical method (Method B)	Derivatization with sodium tetraethyl borate, extraction with artificial sweat solution (DIN EN ISO 105-E04), determination by means of GC/MS

TEST PARAMETERS	REQUIREMENTS	
	Method A [12]	Method B [12]
Total of tributyltin (TBT) and dibutyltin (DBT)	≤ 0,5 mg/kg	≤ 0.05 mg/kg
Total of other tin-organic compounds [13]	≤ 5 mg/kg	≤ 0.5 mg/kg

5.1.1.4. Azo Dyes (only for colour toner) [9]

Analytical method	The material samples are analysed based on the official method according to § 64 LFGB (DIN EN 14362).

TEST PARAMETERS	REQUIREMENTS
Aromatic amines that are specified in the Regulation (EC) No 1907/2006 (REACH), Annex XVII, entry 43	< 15 mg/kg

5.1.1.5. Flame retardants

Analytical method	Proof or confirmation of non-use by a manufacturer’s declaration or alternatively by an active test. Extraction, determination by means of GC-MS.

TEST PARAMETERS	REQUIREMENTS
Polybrominated biphenyls	Not used / not detectable (determination limit < 10 mg/kg)
Tetrabromodiphenyl ether	
Pentabromodiphenyl ether	
Hexabromodiphenyl ether	
Heptabromodiphenyl ether	
Octabromodiphenyl ether	
Hexabromocyclododecane	
Decabromodiphenyl ether	
2,5,6,9,10-Hexabromcyclododecane	

5.1.1.6 Polycyclic aromatic hydrocarbons (PAH)

Analytical method	Based on AfPS GS: PAK:2019

TEST PARAMETERS	REQUIREMENTS
Total 15 PAH naphthalene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benzo[a]pyrene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, dibenzo[a,h]anthracene, indeno[1,2,3-c,d]pyrene, benzo[g,h,i]perylene, benzo[e]pyrene, benzo[j]fluoranthene.	< 50 mg/kg (sum)
PAHs classified as carcinogenic benzo[a]pyrene, benzo[e]pyrene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[j]fluoranthene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, benzo[ghi]perylene, indeno[1,2,3-cd]pyrene	< 1 mg/kg (each individual substance)
Phenanthrene, pyrene, anthracene, fluoranthene	< 50 mg/kg (sum)
Naphthaline	< 10 mg/kg

5.2. Section B – Emission Requirements on the Complete Printing/Copying System

5.2.1. Volatile Organic Compounds (Test Chamber Examination)

Testing method	The test chamber examination is carried out in accordance with DIN EN ISO 16000-9: Indoor air - Part 9: Determination of the emission of volatile organic compounds from building products and furnishing – Emission test chamber method (ISO 16000-9:2006); German version EN ISO 16000-9:2008.

Test chamber conditions	Air flow rate	1.0 h^{-1} ± 0.05 h^{-1} (blank test) (1.5 – 5.0) h^{-1} ± 5 % (print and follow-up phase, depending on the chamber size)
	Relative air humidity	50 % ± 5 %
	Temperature	23 °C ± 2 °C
	Test chamber volume	1 - 3 m³, 25 m³

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Analytical method	Based on DIN ISO 16000-6 as well as based on the test specification according to Annex S-M to award criteria DE-UZ 219 with individual determination of benzene, styrene and other volatile CMR substances.

REST PARAMETERS	**PERMISSIBLE EMISSION RATE**	
	Monochrome (black) printing	Colour printing
Total of volatile organic compounds in the retention range C_6 – C_{16} (TVOC) [1]	≤ 10 mg/h	≤ 18 mg/h
Styrene	≤ 1 mg/h	≤ 1.8 mg/h
Benzene	≤ 0.05 mg/h	≤ 0.05 mg/h
Volatile CMR compounds [3] of categories 1A and 1B	≤ 0.1 mg/h (sum) [14]	≤ 0.1 mg/h (sum) [14]
Volatile CMR compounds of category 2 [4]	≤ 1 mg/h (sum) [14]	≤ 1 mg/h (sum) [14]
Substances classified as acutely toxic acc. to Cat. 1, 2 and 3 (Acute Tox. 1, 2, 3), and specific target organ toxic acc. to Cat. 1 (STOT single exposure 1, STOT repeated exposure 1) [5]	≤ 1 mg/h (sum) [14]	≤ 1 mg/h (sum) [14]
Substances classified in Appendix VI of EU Regulation No. 1272/2008 (GHS) as inhalant allergens (Category 1) and skin allergens (Category 1) [7,8]	≤ 1 mg/h (sum) [14]	≤ 1 mg/h (sum) [14]
Nit identified substances [9]	≤ 1 mg/h (sum) [14]	≤ 2 mg/h (sum) [14]

5.2.2 Fine and ultrafine particle emissions

Testing method	The chamber test and evaluation of the particle emissions is carried out in accordance with Appendix S-M "Test procedure for the determination of emissions from hardcopy devices" to RAL-UZ 219 "Office devices with printing function (printer, copier, multifunctional devices), January 2021 edition	
Test chamber conditions	Air flow rate	1.0 h^{-1} ± 0.05 h^{-1} (blank test) (1.5 – 5.0) h^{-1} ± 5 % (print and follow-up phase, depending on the chamber size)
	Relative air humidity	50 % ± 5 %
	Temperature	23 °C ± 2 °C
	Test chamber volume	1 - 3 m³, 25 m³

Analytical method	Determination of particle emissions using an aerosol measuring device

TEST PARAMETERS	PERMISSIBLE EMISSION RATE	
	Monochrome (black) printing	Colour printing
Particle emission rate in the fine and ultrafine size range (PER $_{10\ PW}$) [13]	3.5 * 10^{11} [particle / 10 minutes]	3.5 * 10^{11} [particle / 10 minutes]

6. Further Requirements

6.1. Factory Inspection

An (initial) inspection of the production plant(s) is (are) required as part of the certification process.

6.2. Monitoring Tests / Product Control Tests

Monitoring checks are to be carried out once a year on selected certified toner powders to manage or extend the certificate or alternatively a new inspection of the production facility is required. A monitoring check can take the form of a full or partial test using selected test parameters. A complete check is required at an interval of 2 years.

6.3. Packaging and Shipping

Required test sample for the material test:

- One printing module (cartridge) filled with the toner powder to be tested (toner will be taken from this cartridge), or
- Approximately 150 g of toner powder in a **glass container**, filled to the brim and closed with a tight lid (preferable with a Teflon seal or an aluminium foil liner).

Required test samples for the emission test:

- Two printing modules (cartridges) filled with the toner system to be tested (or, according to the agreement).
- A laser printer as good as new for the emission testing with the highest page printing performance for the toner systems to be certified (or, according to the agreement). The printing modules may not be cleaned with solvents.

The following has to be recorded in the appendix of the certificate: Toner designation/identification, Batch No., filling date of the cartridge, day of packaging.

Certified toner modules can be taken directly from retail stores for monitoring tests.

The packaging of the test object (printing modules) to be tested has to follow the standardized and common merchandising and marketing procedure in its original box. This also applies to the usual time interval between the manufacturing point and packaging. (The filling date may not be older than six months.)

6.4. Manufacturer’s Declaration

In form of a declaration of conformity, the applicant / manufacturer confirms that the product to be certified complies with the basic safety requirements of all relevant directives as well as the relevant legal requirements.

The applicant / manufacturer confirms in manufacturer’s declaration that compounds listed under Point 6.5 are not used as constituents/structural components.

6.5. Exclusion of Chemicals as Constituents in Toner Powder

The following substances and substance classes are not used as constitutional/structural components[16] in the production of individual materials, formulations, components etc.:

- **Halogenated compounds and their polymers**
  - Halogenated foaming agents (e.g. CFCs)
  - Halogenated flame retardants (fluorine, chlorine, bromine, iodine derivatives)
  - The use of halogenated plastics (e.g. PVC)
- **Acute or chronic toxic and toxicologically relevant compounds**
  - CMR compounds: CMR = carcinogenic (C), mutagenic (M), reprotoxic (R) under EC classification as per Annex VI of Regulation (EC) No. 1272/2008 (CLP).
  - Substances classified in Annex VI of EC Regulation No. 1272/2008 (CLP) as acutely toxic of Categories 1, 2 and 3, as specific target organ toxic (STOT) for single (SE) or repeated (RE) exposure of Category 1 and 2.
  - Substances classified in Annex VI of EC Regulation No. 1272/2008 (CLP) as inhalant allergens (Category 1) and skin allergens (Category 1).
  - Substances of Very High Concern (SVHC) included in the Candidate List according to Article 59 of the REACH Regulation (http://echa.europa.eu/de/candidate-list-table).
  - Substances classified as persistent organic pollutants according to Regulation (EC) No 2019/1021 (POPs)
  - Phthalates, which are limited under EC Regulation No. 1907/2006/EC or were identified as SVHC.
  - Compounds that have been identified according to the present knowledge as endocrine disruptors [compare this: Annex II of the document “State of the Science of Endocrine Disrupting Chemicals, WHO, 2012”], https://apps.who.int/iris/handle/10665/78102]
  - Azo dyes [Aromatic amines that are specified in the Regulation (EC) No 1907/2006 (REACH), Annex XVII, entry 43]
  - Powdered titanium dioxide (TiO2) with a content of > 1%

☝ **Preservatives and biocides**

❖ Biocides, which are not listed in Annex I of EC Regulation No. 528 / 2012 or are not permitted according to the requirements of the regulation.

All materials used must be in compliance with the legal requirements applicable under EU or national laws:

❖ Requirements of German Chemical Prohibition Ordinance (ChemVerbotsV),
❖ Requirements of Regulation (EC) No. 528/2012 (BiozidV),
❖ Requirements of Regulation (EC) No. 1907/2006 (REACH)
❖ Requirements of Regulation (EC) Nr. 1272/2008 (CLP)
❖ Requirements of Regulation (EU) Nr. 2019/1021 (POPs)
❖ Requirements of Derective 2011/65/EU (RoHS-II)
❖ Requirements of Produktsicherheitsgesetzes (ProdSG)

☝ Application of halogenated plastics (e.g. PVC) in the packaging of the product is not permitted.

6.6. Product Changes

The manufacturer guarantees to indicate any changes regarding the production process, the formulations used, and the materials applied including any supplier switch and to inform TRLP representatives immediately. In the scope of a component change or supplier switch, a retest of the already certified product can be claimed by TRLP. The material list must be supplemented and updated.

Indices to Test Parameters for Emission and Material Testings

1 TVOC = total volatile organic compounds

2 An exceedance of both the TVOC and the styrene value is permissible in the material examination if the guideline values for TVOC and styrene are met for the emission test.

3 CMR = carcinogenic (C), mutagenic (M), toxic to reproduction (R) classified according to the EU classification with reference to Annex VI of Regulation (EC) No. 1272/2008 (GHS) of Categories 1A and 1B.

4 The imposed requirement for the sum of CMR substances of Category 2 is not taken into account when evaluating the mattress. The quantified sum of CMR substances of Category 2 and 3 is initially classified only as supplementary information for the manufacturer for the validity period of this test specification. In the course of updating the test specification and taking into account the state-of-the-art technology, this parameter will be completely effective as an evaluation criterion.

5 Substances that are classified in Annex VI of Regulation (EC) No. 1272/2008 (GHS) as acutely toxic and specific target organ toxic. The CMR substances and the individually listed substances under aforementioned index [3] are not included since these are already limited.

6 In forming the corresponding totals, all individually quantified components are included with a mass-based emission rate of ≥ 0.3 mg/kg. Insofar as possible concentrations of all individual compounds are quantified against authentic standard. Unidentified substances are quantified on basis of substance groups against substance-like compounds from this group.

7 The substances listed under Indices [3] and the individually listed substances are not included as these are already limited.

8 Excluded are acrylate-based toners due to technical requirements.

9 Exceeding the guideline value for the sum of unidentified compounds does not lead to a rejection of the certification of a tested product within the period of validity of the current version of the test basis (presumably until 07/2026).

10 For colour toner sets, a test of the black toner by itself and a test of a mixed sample of three colours (cyan, magenta and yellow) must be carried out

11 If the limit value is exceeded, an additional determination for Cr(IV) is carried out by means of the diphenyl carbazide test method (UV-VIS). The requirement is considered as fulfilled if the Cr(IV) content is below the value of 3 mg/kg.

12 Method A is valid when extracted with methanol. If the specified guideline value of method A is exceeded, method B applies (extraction using artificial sweat solution).

13 Total of butyltin, tetrabutyltin, octyltin, dioctyltin, tricyclohexyltin and triphenyltin.

14 In forming the corresponding totals, all individually quantified components are included with a test chamber concentration of ≥ 1 µg/m³. Insofar as possible concentrations of all individual compounds are quantified against authentic standard. Unidentified substances are quantified on basis of substance groups against substance-like compounds from this group.

15 A particle measurement in compliance with the set requirement regarding particle emission is to be carried out within the scope of a certification process. However, an exceeding the specified requirements for the maximum permissible particle emissions does not lead to the rejection of a certification for a tested product within the period of validity of the current version of the test specification (presumably until July 2026).

16 Considered as constituent components are chemicals, preparations and formulations, which are deliberately used, i.e. with knowledge of the manufacturer/formulator and which are specifically used and added in the production process to achieve or guarantee a desired shape, function, product feature or characteristic value of the product. Constitutional components are therefore individual chemicals and substances/mixtures that are listed in the safety data sheet of a formulation used with a defined concentration range. Substances below the concentration limit in terms of an obligation to expel in the safety data sheet do not fall under the category of “constitutional components”.