

**Annex 7a to the Application according to
RAL-UZ 122
Umweltzeichen für Bürogeräte mit Druckfunktion
/ ecolabel for office printing devices**

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Prüflaboratorium / Test laboratory Prüfbericht Nr./ Test report number	Sumika Chemical Analysis Service Ltd. 8092741-02
Antragsteller / Customer Hersteller/ manufacturer	Brother Brother
Prüfobjekt / Subject matter Seriennummer / serial number	HL-5340D K8J000017
Tischgerät / Desk top device <input checked="" type="checkbox"/>	Standgerät / Floor device <input type="checkbox"/>
Datum der Herstellung / Date of manufacture	2008-10
Tonerbezeichnung / Toner characterization farbig / color:	schwarz / black: TN-3280
Datum der Anlieferung / Date of delivery Datum der Prüfung / Date of measurement	2008-11-4 2008-11-6~11-7
Prüfkammervolumen / Volume of test chamber Luftwechsel Druckphase/ air exchange rate	2 m ³ 4 h ⁻¹
Dauer des Druckjobs / Duration of printing job Seitenzahl / printed pages	black 11 colour – Minuten black 320 colour – Minutes

Prüfergebnisse / Test results

(Alle Werte in mg/h) / (all values in mg/h)		Schwarzdruck Black printing	<i>maximal limit</i>	Farbdruck Colour printing	<i>maximal limit</i>
Bereitschaftsphase / pre-operation phase	TVOC	0.047	1 (T-Ger.) 2 (St-Ger.)	-	1 (desk-D) 2 (Floor-D)
	Druckphase (Summe Bereitschafts + Druckphase) / printing phase (sum pre-operation- + printing phase)	8.8	10	-	18
	Benzol /benzene	0.020	0,05	-	0,05
	Styrol /styrene	0.15	1,0	-	1,8
	Ozon /ozone	0.28	1,5	-	3,0
	Staub /dust	-	4,0	-	4,0

Tatsuo Nonaka

Datum: 2008-12-1

野中辰夫

Name / Unterschrift des Prüfers

ATTN: Brother Industries, Ltd.

December 1, 2008

Reference No.	8092741-02
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SCAS Sumika Chemical
Analysis Service

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Analysis Report

1. Title of test : The determination of emissions from the Laser printer
HL-5340D (monochrome)
2. Test items : VOC, Ozone, Dust
3. Methods and results : Presented in the attached document

If you have any questions about this report, please make inquiries to the person in charge.

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The determination of emissions from the Laser Printer

1. Problem definition

Determination of VOC, ozone and dust emission rates of <HL-5340D> from <Brother> during monochrome printing in compliance with "Test method for the determination of emissions from hardcopy devices (June 2006 edition) for purposes of environmental labelling of office equipment in accordance with RAL-UZ 122".

2. Material specifications

Manufacturer	Brother	
Device designation	HL-5340D	Desk top device
Device number	K8J000017	
Toner designation	TN-3280	
Paper used	e-color 081	
Date of manufacture of device	2008/10	
Date of receipt	2008/11/4	
Type of packaging	Cardboard	
Storage prior to testing	In an air-conditioned laboratory	

3. Test conditions

Test chamber type	Emission test chamber
Test chamber volume [m ³]	2
Temperature in the vacant test chamber [°C]	23
Relative humidity in the vacant test chamber [%RH]	50-51
Temperature in the test chamber during the pre-operating phase [°C]	23
Relative humidity in the test chamber during the pre-operating phase [%RH]	50-51
Temperature (range) in the test chamber during the printing phase [°C]	23-26
Relative humidity in the test chamber during the printing phase [%RH]	4-53
Air exchange rate(s) in the test chamber up to the start of the printing phase [h ⁻¹]	1
Air exchange rate(s) in the test chamber during the printing phase [h ⁻¹]	4
Ozone half-life in the vacant test chamber [min] for n=1h ⁻¹	33
Air pressure [Pa]	101342

A print master derived from DIN 33870(2001-01) in black with 5% page coverage was used as a test page. A printout is attached as an example in the appendix of this report. The lightness value of the printout

	Black
L*	24.42

4. Experimental procedure

Date of test	2008/11/6-11/7
Time of testing	11/6 18:11-11/7 11:31
Duration of print job	11 min
Number of pages printed	320 sheets

Test phase	Start [time]	End [time]	Duration [min]
Loading the chamber	11/6 18:11	11/7 11:31	1040
Pre-operating phase	8:20	9:20	60
Printing phase	10:20	10:31	11
Post-operating phase	10:31	11:31	60
Printing and post-operating phase	10:20	11:31	71

4.1. VOC

Short description:

- sampling on Tenax TA and Carbotrap
- thermodesorption and GC/MS detection
- chromatographic evaluation

Test phase	Start [time]	Duration [min]	Sampling volume [l]	Sampling volume flow [ml/min]
Blank sample	11/6 17:10	30	6.0	200
Pre-operating phase	11/7 9:00	20	4.0	200
Printing and post-operating phase	11/7 10:20	26	5.2	200

4.2. Ozone

Short description: continuous measurement of ozone concentration using an ozone analyzer [model 2303; manufacture: Dylec Corp.]

4.3. Dust

Short description: gravimetric measurement of dust concentration by differential weighing on an ultramicrobalance (model UMX 2; manufacture: Mettler-Toledo).

Test phase	Start [time]	Duration [min]	Sampling volume [m ³]	Sampling volume flow [m ³ /h]
Blank sample	11/6 16:40	60	0.87	0.87
Printing and post-operating phase	11/7 10:20	71	1.0	0.87

5. Results

All calculation formulas used in the following are given appendix 2 of RAL-UZ122 (Test method for determining emissions from hardcopy devices, edition June 2006).

5.1. VOC

5.1.1. Pre-operating phase

The VOC emission rates for the pre-operating phase are calculated according to equation 2 of the test method, on the basis of the concentration measured during the last 20 minutes of the one-hour pre-operating phase.

An example chromatogram is included in the appendix of this report.

Substance	CAS-No.	Concentration [µg/m ³]	Emission rate [mg/h]
Benzene	71-43-2	— ^{*1)}	— ^{*1)}
Styrene	100-42-5	3.3	0.007
Hexamethylcyclotrisiloxane	541-05-9	2.6	0.005
n-Butyl acetate	123-86-4	2.9	0.006
Octamethylcyclotetrasiloxane	556-67-2	5.3	0.011
Decamethylcyclopentasiloxane	541-02-6	4.9	0.010
TVOC(calculated; identified substances only)		19	0.038
Total of non-identified VOC		4.4	0.009
TVOC(calculated; including non-identified substances)		23	0.047
TVOC[Toluene equivalent]		49	0.097

*1) Limit of detection

5.1.2. Printing and post-operating phase

The VOC emission rates for the printing phase are calculated according to equation 4 of the test method, on the basis of the concentrations measured during the printing and post-operating phase (one air exchange).

An example chromatogram is included in the appendix of this report.

Substance	CAS-No.	Concentration [µg/m ³]	Emission rate [mg/h]
Benzene	71-43-2	0.80 ^{*1)}	0.020 ^{*1)}
Styrene	100-42-5	6.6	0.15
n-Butanol	71-36-3	3.6	0.092
Toluene	108-88-3	2.3	0.059
n-Hexanal	66-25-1	8.8	0.22
Hexamethylcyclotrisiloxane	541-05-9	6.1	0.14
n-Butyl acetate	123-86-4	9.7	0.23
o-Xylene	95-47-6	3.0	0.076
iso-Propylbenzene	98-82-8	2.3	0.059
n-Propylbenzene	103-65-1	3.0	0.076
Benzaldehyde	100-52-7	4.3	0.11
Octamethylcyclotetrasiloxane	556-67-2	11	0.24
2-Ethyl-1-hexanol	104-76-7	6.3	0.16
n-Nonanal	124-19-6	4.3	0.11
Decamethylcyclopentasiloxane	541-02-6	14	0.33
n-Dodecane	112-40-3	3.7	0.093

Dodecamethylcyclohexasiloxane	540-97-6	10	0.26
n-Tridecane	629-50-5	12	0.30
n-Tetradecane	629-59-4	8.7	0.22
TVOC(calculated; identified substances only)		120	2.9
Total of non-identified VOC		230	5.8
TVOC(calculated; including non-identified substances)		350	8.7
TVOC[Toluene equivalent]		390	9.9

*1) Don't contain in the TVOC

5.2. Ozone

Emission rates during the printing and post-operating phase were calculated according to equation 5 of the test method. A diagram showing the time course of ozone concentration is included in the appendix of this report.

Ozone half-life under test conditions was 2 min.

Pre-operating phase		Printing phase	
Maximum concentration [µg/m ³]	Emission rate [mg/h]	Maximum concentration [µg/m ³]	Emission rate [mg/h]
—*1)	—*1)	7.9	0.28

*1) Limit of detection

5.3. Dust

The dust emission rate was calculated according to equation 8 of the test method.

Dust mass (corrected for climate variation) [µg]	Emission rate [mg/h]
4.9	—*1)

*1) Limit of quantitation

6. Measurement uncertainty

As a rule, 1ng(absolute) of VOC is detectable by means of GC/MS in scan mode. This implies the following limit of detection and limit of quantitation for an individual VOC in the different emission rate categories.

Limit of detection (LOD) and limit of quantitation (LOQ) of single-VOC measurements

Test chamber	Emission rate category	VOC-Emission rate [mg/h]	
		LOD[mg/h]	LOQ[mg/h]
2m ³ chamber	Determined during the printing and post-operating phase	0.003	0.007

The ozone limit of detection and limit of quantitation were estimated with due consideration to the measurement uncertainty of ozone analyzer in the measuring range from 0 to 0.1 ppm (ml/m³) as quoted by the manufacture. The following table gives the LOD and LOQ of the ozone measurements.

LOD and LOQ of ozone measurements

Test chamber	Ozone emission rate [mg/h]	
	LOD [mg/h]	LOQ [mg/h]
2m ³ chamber	0.03	0.09

The LOD and LOQ of the gravimetric dust measurements were estimated with due consideration to the measurement uncertainty of the balance as quoted by manufacture and on the assumption that the use of reference filters had provided full correction for climate variation and furthermore on the basis of an average mass of unloaded glass fiber filters of 35 ± 1 mg as determined by measurement. The following table gives the LOD and LOQ of the gravimetric dust measurements.

LOD and LOQ of the gravimetric dust measurements

Test chamber	Dust emission rate [mg/h]	
	LOD [mg/h]	LOQ [mg/h]
2m ³ chamber	0.17	0.55

7. Remarks

7.1. VVOC

7.1.1. Pre-operating phase

During Pre-operating phase, the substances of VVOC having emission rates above 0.005mg/h were not detected.

7.1.2. Printing and post-operating phase

During printing and post-operating phase, the substances of VVOC having emission rates above 0.05 mg/h were not detected.

Substance	CAS-No.	Concentration [µg/m ³]	Emission rate [mg/h]
Acetone	67-64-1	5.9	0.15

8. Summary

Emitted substance	Requirements for award of the Environmental label		Measured emission rates	
	Sum of Printing and Pre-operating phase [mg/h]	Pre-operating phase [mg/h]	Printing phase [mg/h]	Pre-operating phase [mg/h]
TVOC	10	1	8.8	0.047
Benzene	<0.05	—	0.020 ^{*1)}	—
Styrene	1.0	—	0.15	—
Ozone	1.5	—	0.28	—
Dust	4.0	—	— ^{*2)}	—

*1) Don't contain in the TVOC

*2) Limit of quantitation

When used in combination with the present paper and toner the device < HL-5340D > on test fulfils the requirements for the award of the Blue Angel Environmental Label for monochrome printing.

Sumika Chemical Analysis Service Ltd.

General supervisor

Person in charge

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Appendix

1. Monochrome printout
2. Course of climate parameters during the test (graphic representation)
3. Chromatogram of pre-operating phase
4. Chromatogram of printing and post-operating phase
5. Ozone concentration during printing