

Jimco KPC A/S  
Test of air cleaner OZ500 for  
ozone release

December 2003

**Client:** Jimco KPC A/S  
Brian Kristiansen  
Ellehaven 4  
5900 Rudkøbing

**Date:** 2 February 2004- SB/HLA

**By:** Eurofins Danmark A/S  
Smedeskovvej 38, DK-8464 Galten

  
Søren L. Brødsgaard  
MSc

  
Peter Mortensen  
MSc

The test results relate only to the items tested.

The report shall not be reproduced except in full without the written approval of the testing laboratory.

## Content

<b>1.</b>	<b>Introduction</b>	<b>3</b>
<b>2.</b>	<b>Background and purpose</b>	<b>3</b>
<b>3.</b>	<b>Test scope</b>	<b>3</b>
<b>4.</b>	<b>Procedure</b>	<b>3</b>
4.1	Determination of source intensity	3
4.2	Profile of ozone concentration	4
<b>5.</b>	<b>Methods</b>	<b>5</b>
5.1	Determination of source intensity	5
5.2	Profile of ozone concentration	5
<b>6.</b>	<b>Results</b>	<b>6</b>
6.1	Determination of source intensity	6
6.2	Profile of ozone concentration	6
<b>7.</b>	<b>Conclusion</b>	<b>7</b>

## 1. Introduction

9th and 11th – 12th December 2003 Eurofins Danmark A/S has carried out a test fir ozone release from an air cleaner typed OZ500.

The test was requested by Brian Kristiansen of Jimco KPC A/S.

The test was carried out by MSc Søren L. Brødsgaard.

## 2. Background and purpose

Based on an order from the Danish Labour Inspection Jimco KPC A/S has been ordered to procure documentation for ozone concentration from the ozone releasing air cleaner OZ500 during operation.

The documentation must be carried out in a "worst-case" scenario in a room without mechanical ventilation and without noticeable amounts of organic material.

Thus Jimco KPC A/S has contacted Eurofins Danmark A/S to perform the necessary documentation to provide the requested documentation for ozone release from OZ500. The test is carried out in accordance to the accepted quotation (153003) of 26th November 2003.

The purpose is not to assess the results.

## 3. Test scope

The test is divided into the following two parts:

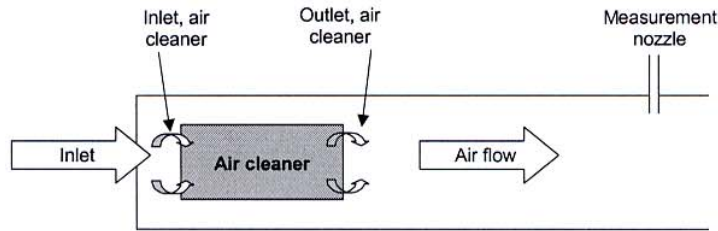
1. Determination of ozone source intensity for the air cleaner OZ500. The test was performed in a canal piece with well-defined air velocity.
2. Determination of a profile for ozone concentration from different distances to the air cleaner at different times.

## 4. Procedure

### 4.1 Determination of source intensity

The source intensity for ozone from the air cleaner is determined by placing the air cleaner in a pipe piece with the following measurements (moreover see the sketch on the following page):

- Cross section 30 x 30 cm
- Length: 1.5 m



There is an adjustable ventilator in the closed end of the pipe piece with which the air velocity through the pipe can be adjusted.

The air cleaner is placed in the closed end of the pipe piece and initiated. Following 30 minutes the air flow is determined ( $Q$ ) and the ozone concentration ( $C_{\text{ozone}}$ ) in a cross section of the pipe piece approximately 90 cm f after the air cleaner.

The source intensity is accordingly determined as  $Q \cdot C_{\text{ozone}}$  ( $\mu\text{g}/\text{hour}$ ).

## 4.2 Profile of ozone concentration

The ozone concentration profile for the air cleaner is determined in a model room with the following measurements in cm (height x width x depth) 250 x 780 x 480. The air cleaner is placed in the middle of the room approximately 1.2 meters above floor level.

The room's inventory consists primarily of fixed installations with hard surfaces (glass, steel, laminated plastic tabletops, vinyl floor, and gypsum ceiling).

There is no mechanical ventilation in the room. The air change is determined to approximately once per hour during the test period.

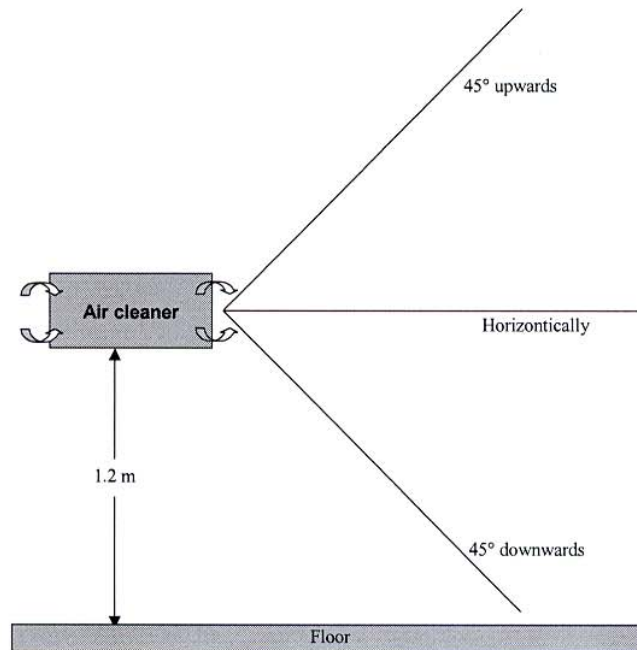
The ozone concentration is measured in different spots with different distances to the air cleaner. The measurements were performed in two positions in up to 2 meters distance from the air cleaner. This was performed for the following profiles:

1. Horizontally from the air cleaner
2. 45° downwards
3. 45° upwards

Measurements have been performed at the following points after initiation:

- $t = 30$  min.
- $t = 2$  hours
- $t = 6$  hours
- $t = 24$  hours

The test set-up is illustrated on sketch on the next page.



## 5. Methods

### 5.1 Determination of source intensity

#### Ozone:

The measurements for ozone were performed with direct indicating ozone meter typed AID 560. The instrument is calibrated to ozone generator typed AID 565.

Uncertainty at the performed measurements is estimated at  $\pm 15\%$ .

#### Determination of flow:

The determination of flow in the pipe piece is determined by measuring the air velocity in the test pipes cross section. The air velocities are measured on the outlet side and the mean velocity is determined based on nine measurements in the cross section. The measurements are performed with direct indicating air velocity meter typed Testo 457. The flow is determined accordingly by multiplying the air velocity in the cross section by the cross section area.

Uncertainty is estimated at  $\pm 15\%$ .

### 5.2 Profile of ozone concentration

#### Determination of air change

Measurement of the air change is performed at tracer gas method.

A tracer gas is dosed into the room and mixed by means of a portable ventilator. The concentration of the tracer gas is followed with continuous recording measurement equipment and the air change is calculated from the decay curve.

Isobutene is used as tracer gas in this test. A PID-meter typed HNU is used as measurement instrument.

**Ozone:**

The measurements for ozone are performed with direct indicating ozone meter typed AID 560. The instrument is calibrated to ozone generator typed AID 565.

Uncertainty at the performed measurements is estimated at  $\pm 15\%$ .

## 6. Results

The test results are given in tables 6.1 and 6.2.

### 6.1 Determination of source intensity

The flow (Q) in the pipe piece is calculated at  $0.014 \text{ m}^3/\text{s}$ .

The mean concentration of ozone ( $C_{\text{ozone}}$  in the cross section is determined at  $0.065 \text{ mg}/\text{m}^3$ .

**The source intensity for ozone for the air cleaner is calculated at  $0.9 \text{ }\mu\text{g}/\text{hour}$  based on Q and  $C_{\text{ozone}}$ .**

The background concentration of ozone in the room (9/12-03) is measured to  $< 0.01 \text{ mg}/\text{m}^3$ .

### 6.2 Profile of ozone concentration

The results of the ozone concentration measurements for the three profiles are given in the below mentioned tables.

Profile 1: Horizontal Distance from air cleaner, cm	Measured ozone concentration, $\text{mg}/\text{m}^3$			
	t = 30 min.	t = 2 hours	t = 6 hours	t = 24 hours
5	0.3 - 0.4	0.3 - 0.4	0.3 - 0.4	0.3 - 0.4
10	0.01 - 0.02	< 0.01	0.01 - 0.02	0.01 - 0.02
20	< 0.01	< 0.01	0.01 - 0.02	0.01 - 0.02
50	< 0.01	< 0.01	0.01 - 0.02	0.01 - 0.02
100	0.01 - 0.02	0.01 - 0.02	0.02 - 0.03	0.02 - 0.03
200	< 0.01	< 0.01	0.01 - 0.02	0.01 - 0.02
Background	< 0.01			

<: Means less than the stated limit of detection.

Profile 2: 45° downwards	Measured ozone concentration, mg/m <sup>3</sup>			
	t = 30 min.	t = 2 hours	t = 6 hours	t = 24 hours
Distance from air cleaner, cm				
5	0.3 - 0.4	0.3 - 0.4	0.3 - 0.4	0.3 - 0.4
10	0.12 - 0.14	0.12 - 0.14	0.16 - 0.2	0.16 - 0.2
20	0.08 - 0.10	0.08 - 0.10	0.12 - 0.14	0.12 - 0.14
50	0.06 - 0.08	0.06 - 0.08	0.08 - 0.10	0.08 - 0.10
100	< 0.01	< 0.01	< 0.01	< 0.01
Background	< 0.01			

<: Means less than the stated limit of detection.

Profile 3: 45° upwards	Measured ozone concentration, mg/m <sup>3</sup>			
	t = 30 min.	t = 2 hours	t = 6 hours	t = 24 hours
Distance from air cleaner, cm				
5	< 0.01	< 0.01	< 0.01	< 0.01
10	< 0.01	< 0.01	< 0.01	< 0.01
20	< 0.01	< 0.01	< 0.01	0.01 - 0.02
50	< 0.01	< 0.01	0.01 - 0.02	0.01 - 0.02
100	< 0.01	< 0.01	< 0.01	< 0.01
Background	< 0.01			

<: Means less than the stated limit of detection.

During the test period there was an ozone outdoor air concentration of 0.03-0.04 mg/m<sup>3</sup>.

## 7. Conclusion

The test of the air cleaner OZ500 has indicated that it emits ozone with a source intensity of approximately 0.9 µg/s. This will give rise (provided that no ozone is degraded) to a mean ozone concentration of approximately 0.03 mg/m<sup>3</sup> in the model room (room volume 94 m<sup>3</sup> and a natural air change approximately once an hour) used in the second part of the test. This concentration corresponds to what is normally measured in the outdoor air.

The ozone concentration in different distances from the air cleaner is determined in three different line profiles from the ozone cleaner. The measurements indicate the highest ozone concentrations immediately in front of the air cleaner (up to 0.4 mg/m<sup>3</sup>). Increased ozone concentrations are determinable from a distance of up to 50 cm from the air cleaner. The highest concentrations are determined in the profile 45° downwards. This is due to the fact that the air outlet from the air cleaner is oriented 45° downwards.

The profile determination shows no or only low increase in the ozone concentration as function of time at an air change of approximately one time per hour in a model room sized 94 m<sup>3</sup>.