# TEST REPORT

# HALO P

## *in situ*

Tests conducted by ERLAB à

Crèche Cascadine, Louviers, Normandy

21, 22 and 23 septembrer, 2021


Tests conducted by :

Alex BEAL
*HALO Business Development*

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# 1 CONTEXT

Due to the ongoing COVID-19 pandemic, officials from the Seine-Eura Agglomeration Community have expressed concern about the air quality, particularly in recently reopened public spaces such as Creche Cascadine in Louviers. Questions were posed by officials concerning the risk of virus transmission at the creche, as well as the prevention measures that might reduce that risk. This led them to contact ERLAB and request the installation of two Halo P air purifiers in a playroom to measure their impact on particle content.

## 1.1 Presentation of Halo P

ERLAB specialises in air treatment solutions for chemical laboratories. Since 2015, ERLAB has manufactured and distributed Halo, an air purifier. More recently, ERLAB has launched Halo P, an air purification solution for both biological and non-biological particles. Halo P contains a HEPA H14 filter with a minimum efficiency of 99.995% according to MPPS (approximately 0.1 µm), as described in EN 1822. Halo P filters the air in a given room, reducing particle concentration.

## 1.2 Test Environment : Playroom

The playroom is used by children when the weather stops them from doing activities outside. It contains toys and is fitted with a door and windows. Two Halo P devices were installed on the ceiling. The volume of the room in which Halo P is operating should not exceed 75 $m^3$ (the maximum recommended value). As the volume of the room in this case was 140 $m^3$, two Halo P were installed. As far as possible, the two Halo P were positioned to cover the entirety of the room. Their air vents faced the room's widest point.

Measurement of the ambient particle concentration was taken with the prior agreement of the director of the institution. A sampling point was chosen in the most central position possible, considering fittings already in the room and accessibility for children and staff (see Figure 1).

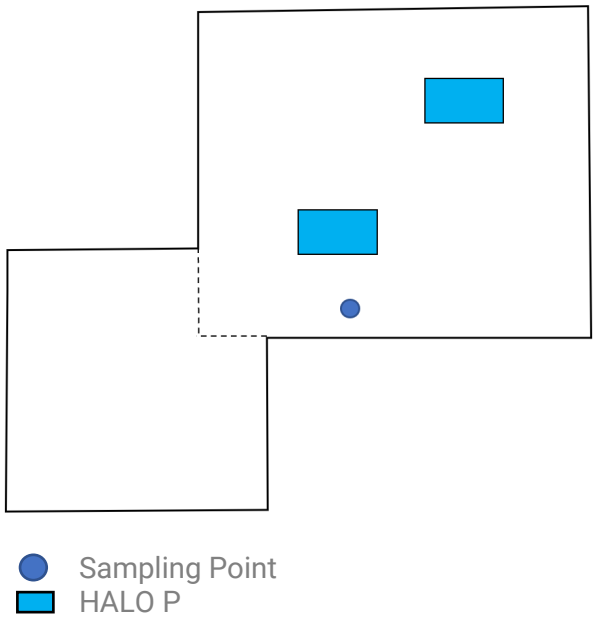



**Figure 1 : Representative Diagram of Test Room**

### 1.3 Pollution Monitoring

The concentration of particles of ≥0.5 µm was measured as close as possible to the emission area at a height of 170 cm. The room's doors and windows remained closed for the duration of the tests.

## 2 TESTING PROCESS

Tests were carried out on two representative days. Real constraints were respected and efforts were made to limit disturbance to staff and children. The room's doors and windows remained closed for the duration of the tests.

### 2.1 Test Phases

Tests took place over three days in different configurations described in Table 1.

| Date | Playroom occupancy | State of HALO P |
|---|---|---|
| ***Tuesday 21/09*** | | |
| 16 :05 – 16 :25 | Installation of measuring equipment and calibration of Halo P settings | |
| 22 :30– 00 :00 | Measurements of empty room | Halo P switched off |
| ***Wednesday 22/09*** | | |
| 00 :00 – 5 :30 | Measurements of empty room | Halo P switched off |
| 5 :30 – 22 :30 | Measurements of room in use | Halo P switched off |
| 22 :30 – 00 :00 | Measurements of empty room | Halo P switched on |
| ***Thursday 23/09*** | | |
| 00 :00 – 5 :30 | Measurements of empty room | Halo P switched on |
| 5 :30 – 16 :30 | Measurements of room in use | Halo P switched on |

**Table 1 : Description of different test phases**

## 2.2 HALO P Settings

With the agreement of the director of the institution, the two Halo P's fans were set to 24-hour mode. First Halo P were powered down for a period of 24 hours to act as a control experiment. They were then powered up to 2,000 rpm (300 $m^3$/h) to measure their effect over 24 hours. Halo P were equipped with both a prefilter and HEPA H14 filter.

## 2.3 Materials Used

The particle concentration was measured using a portable KANOMAX optical particle counter (model 3889). This allowed for particle measurement on six channels: 0.3, 0.5, 1.0, 3.0, 5.0 and 10.0 µm. Calibrated on 14/05/2021 (certificate n° 38892105003).

## 2.4 Sampling Pattern

The measurement point was chosen to avoid disturbing children and staff (cf. Figure 1).

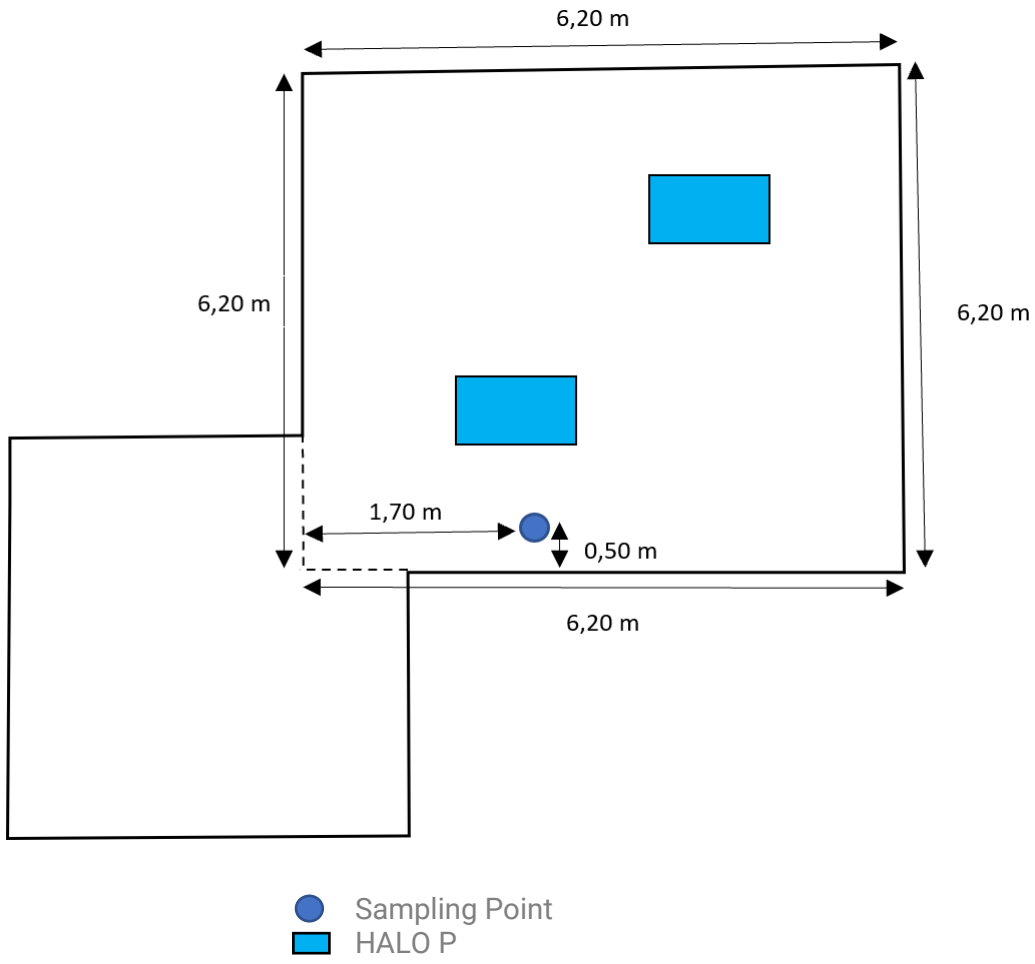



**Figure 1 : Placement of sampling point**

# 3 RESULTS

As a reminder, Table 2 shows cleanliness classifications according to ISO standard 14644-1.

| Particles per metre cubed (maximum admissible concentrations of particles of a size equal or superior to those specified below) | |
|---|---|
| **Classe** | **0,5 µm** |
| **ISO 1** | d |
| **ISO 2** | d |
| **ISO 3** | 35 |
| **ISO 4** | 352 |
| **ISO 5** | 3 520 |
| **ISO 6** | 35 200 |
| **ISO 7** | 352 000 |
| **ISO 8** | 3 520 000 |
| **ISO 9** | 35 200 000 |

d : Both the sampling and statistical limits of such low concentrations make them unsuitable for classification.

*Table 2 : Classification of air cleanliness by particle concentration according to ISO standard 14644-1*

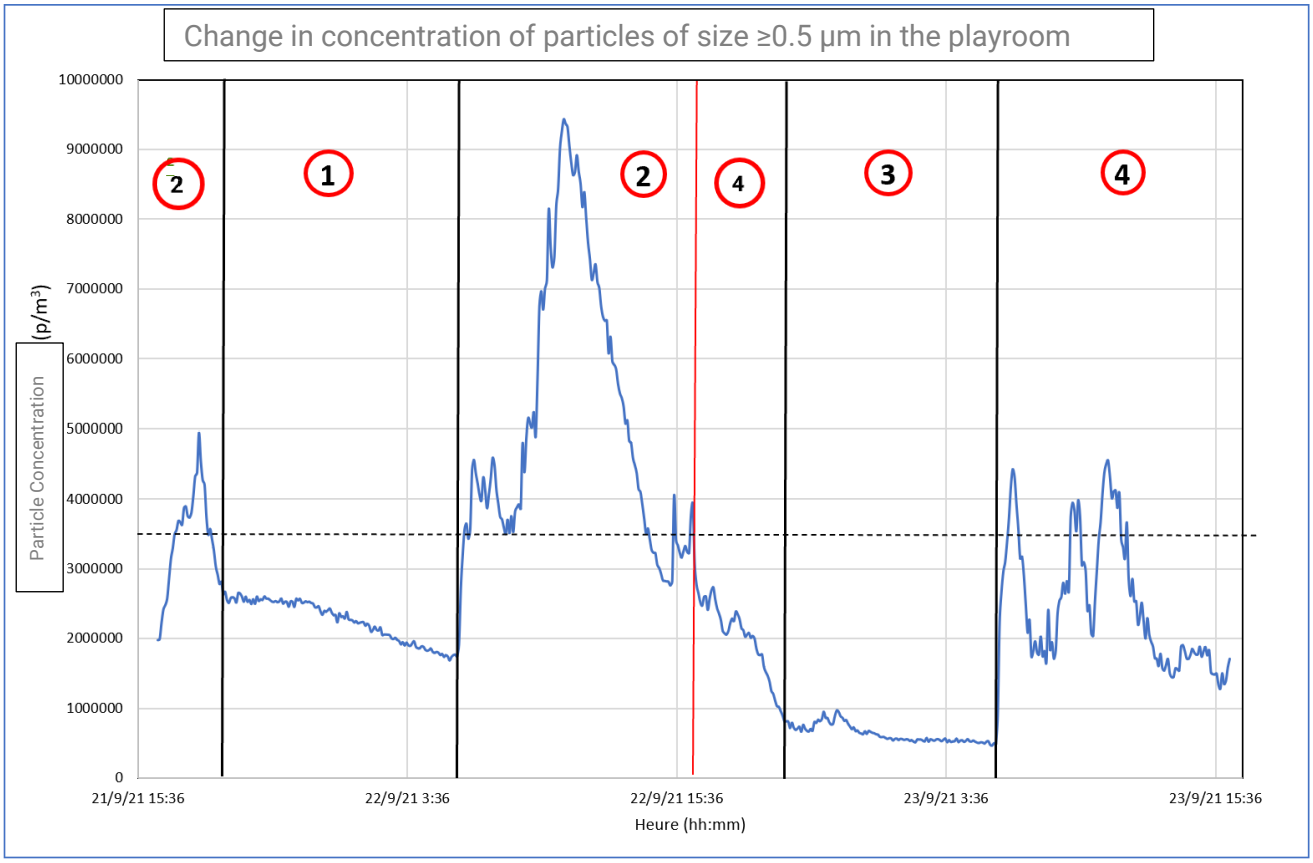
## 3.1 Sampling Implementation

For the entire duration of sampling, doors and windows remained closed. However, children as well as staff and parents entered and exited the playroom and/or its adjacent area. This occurred throughout the day, from 05:30 to 22:30.

For these tests, we have chosen to consider only particles of ≥0.5 µm. These are the particles that are least likely to settle. Instead they form an aerosol generated by respiration, speaking, coughing, spitting, sneezing, movement or cleaning.

The volume of the room using for testing was 94 $m^3$, or six air changes per hour with the aforementioned settings.

## 3.2 Continuous Measurements



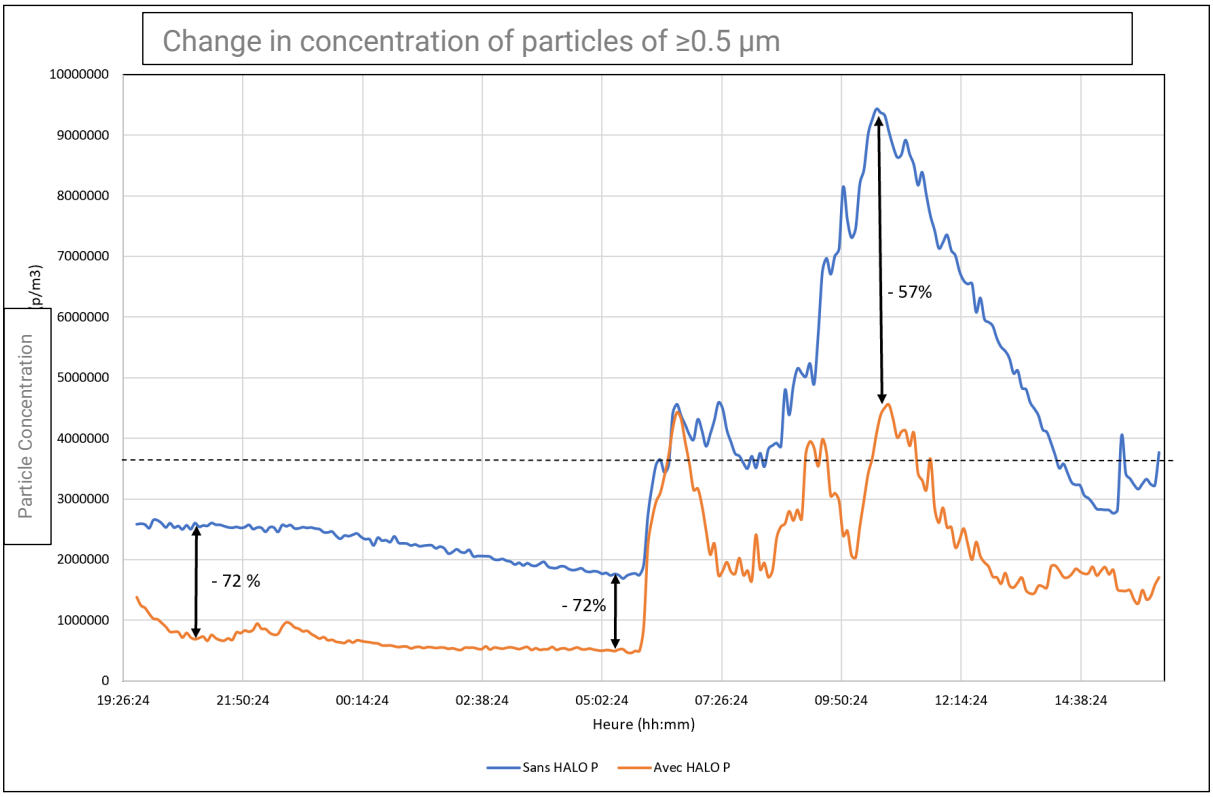

| | |
|---|---|
| 1 | Measurements of empty Room, Halo P switched off |
| 2 | Measurements of room in use, Halo P switched off |
| 3 | Measurements of empty room, Halo P switched on |
| 4 | Measurements of room in use, Halo P switched on |
| ------ | Threshold for change in particle classification (ISO 9 to ISO 8) |
| ——— | Start-up of Halo P |

Please note: Halo P was turned off at 16:25 on 21/09/21 when measurements began. This explains the low particle concentration at the beginning of measurements.

The efficiency of Halo P is clear after its start-up at 16:15 on 22/09/21.

As soon as Halo P started up, a decrease in particle concentration of ≥0.5 µm was noted. The same trend was observed after a full day of Halo P operation. The concentration of particles of ≥0.5 µm was far less than that its equivalent after a day without Halo P operating.

### 3.3 Measurements Over a 24-hour period (Day **and Night)**




------- : Threshold for change in particle classification (ISO 9 to ISO 8)

This graph compares levels of dust accumulation over 24 hours, both with and without Halo P.

Each of the one-day Halo P test periods were of equal length, whether the device was switched on or off. The use of Halo P was characterized by a lower particle concentration by up to 72% at the beginning of the inactive period. This level was maintained until the end of the inactive period. This enabled a very low particle concentration of 473,000 particles of ≥ 0.5 µm per $m^3$.

In tests when Halo P was switched on, a lower the various peaks of particle concentration that occur over a given day. As well as reducing this surge in particle concentration during the day, Halo P allow for faster transition between ISO Class 9 and ISO Class 8 according to ISO standard 14644-1 for particles smaller than ≥ 0.5 µm.

## 4 CONCLUSION

These tests show the improvements brought by Halo P on the particle concentration in a playroom in a creche.
For optimum effectiveness, we recommend starting Halo P before children even arrive at the creche. When staff arrive, the concentration of particles of ≥0.5 µm increases significantly. Throughout these tests, Halo P was able to limit this increase by up to 76%. This also reduces the viral load that may be present in the air, thus reducing the risk of airborne transmission. In this case, Halo P enables air cleanliness to reach classification ISO 8 by particle concentration. For comparison, this level of particulate cleanliness is that of post-operation rooms, sterile medical storage facilities and the corridors of operating theatres.

# 5 APPENDICES

## 5.1 Particle Counter Calibration Certificate

CALIBRATION
DUE DATE

JUL 07 2022

KANOMAX

# Test Sheet

Kanomax USA Inc
219 US Hwy 206, Andover NJ 07821
973-786-6386

Product Name Handheld Particle Counter
Model Name 3889
Serial Number 850770
Test Date 2021/05/14
Temperature/Humidity 23.6 ℃ / 45.0 %RH
Atmospheric Pressure 1007.0 hPa

| Item | Procedure/Standard | Result | Judgement |
|---|---|---|---|
| Sampling air flow rate | The flow rate shall be within 2.83 L/min±5% | 2.89 L/min | OK |
| False count level | The count value measured for 5 minutes should be 1 or less when zero filter is put onto LPC inlet. | 0 COUNTS | OK |
| Computer Threshold voltage | The PSL standard particle threshold voltage for each particle size is 10V or less, and also there is a signal waveform distribution. | $V_{0.3}$ = 0.855 V<br>$V_{0.5}$ = 0.460 V<br>$V_{1.0}$ = 1.211 V<br>$V_{3.0}$ = 3.545 V<br>$V_{5.0}$ = 5.781 V<br>$V_{10.0}$ = 7.806 V | OK |
| Counting efficiency | For the 0.3μm PSL standard and 0.5μm PSL standard, the particle counts in the 0.3μm range of the instrument to be calibrated should be within 50±20% and within 100±10% of the standard unit. | 0.3μmPSL 42.8 %<br>0.5μmPSL 97.7 % | OK |
| Particle resolution | In the 0.3μm PSL standard particles, its value should be below 15% . | 7.4 % | OK |

| | Particle resolution(μm) | Particle size(μm) | Manufacturer | Type |
|---|---|---|---|---|
| PSL standard | 0.30 | 0.303 | Thermo | 3300A |
| | 0.50 | 0.496 | Thermo | 3495A |
| | 1.00 | 0.994 | Thermo | 4009A |
| | 3.00 | 3.007 | Thermo | 4203A |
| | 5.00 | 5.049 | Thermo | 4205A |
| | 10.0 | 10.02 | Thermo | 4210A |

The procedures and the standards in the above are compliant with ISO 21501-4:2007 and JIS B 9921:2010.

Approved by

Tested by

KANOMAX INSTRUMENT (SHENYANG) INC.
No.9 Zhengkun Road Shenbei new district Shenyang city Liaoning China
TEL +86 (024) 89730178

KANOMAX

# *Certificate of Calibration*

*Handheld Particle Counter*

*Issue Date:* 2021/05/14

| | |
|---|---|
| *Model Name* | 3889 |
| *Serial Number* | 850770 |
| *Calibration Date* | 2021/05/14 |
| *CERT No.* | 38892105003 |

*This is to certify that above instrument was calibrated to following standard units on our operation standard. This calibration complies with ISO 21501-4. The standard units used for the calibration are traced to the national standard regularly based on our traceability chart.*

*Standards Used:*

*Particles*

| *Manufacturer* | *Particle Size* | *Standard Deviation* | *Lot No.* | *Expiration Date* |
|---|---|---|---|---|
| Thermo | 0.303 µm | 0.003 µm | 223077 | 2023.04 |
| Thermo | 0.496 µm | 0.004 µm | 231219 | 2023.09 |
| Thermo | 0.994 µm | 0.006 µm | 234756 | 2023.12 |
| Thermo | 3.007 µm | 0.007 µm | 226956 | 2023.06 |
| Thermo | 5.049 µm | 0.049 µm | 235600 | 2024.01 |
| Thermo | 10.02 µm | 0.020 µm | 233796 | 2023.12 |

*Flowmeter*

| *Type* | *Manufacturer* | *Serial Number* | *Calibration Date* | *Calibration Due* |
|---|---|---|---|---|
| Gilibrator2 | SENSIDYNE | 0801038/1804060-S | 2020.06 | 2021.06 |

*Reference Unit*

| *Type* | *Manufacturer* | *Serial Number* | *Calibration Date* | *Calibration Due* |
|---|---|---|---|---|
| CR LPC3782-06 | Kanomax Japan Inc | No.003 | 2020.07 | 2021.07 |

*KANOMAX INSTRUMENT (SHENYANG) INC.*
*The Quality Assurance Div.*

*Certified by:*

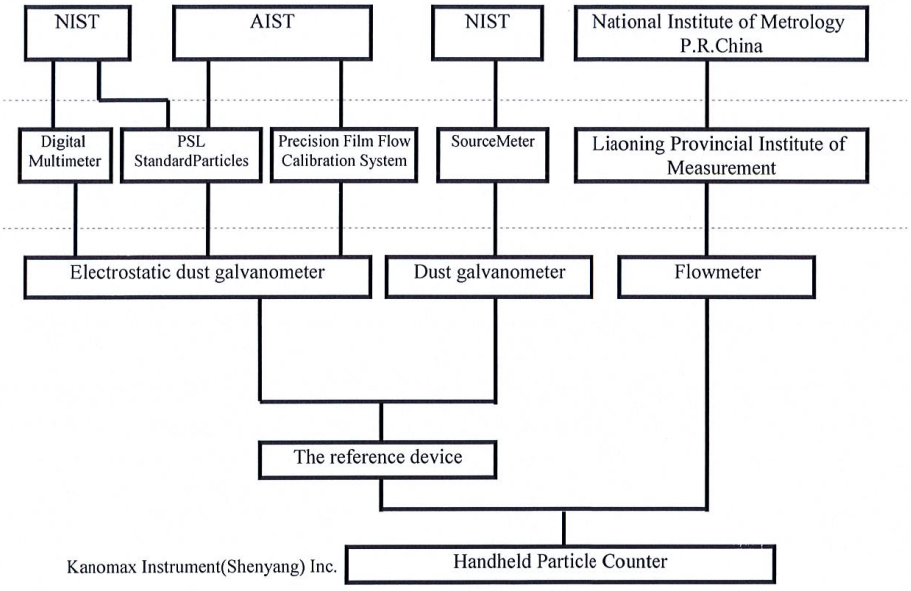
# TRACEABILITY CERTIFICATE

KANOMAX INSTRUMENT (SHENYANG) INC.
No.9 Zhengkun Road Shenbei new district Shenyang 110136 Liaoning China

| | |
|---|---|
| Product Name | Handheld Particle Counter |
| Model Name | 3889 |
| Serial Number | 850770 |
| Test Date | 2021/05/14 |

It prove that the product above is calibrated according to our company production standards. And the standards are based on ISO21501-4. The standard units used for the calibration are traced to the national standard regularly based on our traceability chart.

1. Traceable using Kanomax Calibrating system




2. Standard Component

| Product Name | Model | Serial Number | Calibrate By | Test Sheet No. |
|---|---|---|---|---|
| Electrostatic dust galvanometer | 3071 | 82 | Kanomax Japan Inc | A026-20210317 |
| Dust galvanometer | 3068 | 65 | Kanomax Japan Inc | A025-20210318 |
| Flowmeter | Gilibrator2 | 0801038/1804060-S | Liaoning Provincial Institute of Measurement. | 20020403935 |
| The reference device | CR LPC3782-06 | No.003 | Kanomax Japan Inc | 003-20200731 |