Novembre 2020

# RAPPORT DE CONTRÔLE
# SALLE PROPRE

**Girard SA**
**CH-2022 Bevaix**
**Salle Propre Logicair**
**n° TEC 4329**

**TECHNISERV SA**
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Techniserv

# RAPPORT DE CONTRÔLE N° 55'435

## CLIENT - INSTALLATION / *CUSTOMER - INSTALLATION* :

Girard SA, CH-2022 Bevaix.
Salle Propre n° TEC 4329.

## PROTOCOLE DE TEST / *TEST PROTOCOL* :

| |
|---|
| * Test d'intégrité des filtres / *Integrity test filter.* |
| * Mesure des vitesses et débits d'air et calcul du taux de renouvellement horaire / *Airflow volume measurements and air changes calculations.* |
| * Mesure des différences de pression / *Air pressure difference* |
| * Comptage de particules "au repos" ou/et "en fonctionnement" / *Airborne particle count "at rest" or/and "in operation"* |
| * Cinétique de décontamination "au repos" / *Particle count recovery test "at rest"* |
| * Mesures d'ambiance - température et hygrométrie / bruit et luminance. *Temperature and Relative Humidity / Noise level and Light intensity* |

## APPAREILS DE TEST ETALONNES / *CALIBRATED INSTRUMENTS USED* :

| Type de mesure | Appareil de mesure | N° de série | Dernier étalonnage |
|---|---|---|---|
| Test d'intégrité | Générateur Concept | 1025558 | 24. septembre 2020 |
| Test d'intégrité | ATI-TDA2H | 21075 | 2. octobre 2020 |
| Pression différentielle | ADM-870 | M98807 | 13. octobre 2020 |
| Mesure de débit d'air | ADM-870C-Flowhood | M15483 | 9. octobre 2020 |
| Comptage de particules | Climet CI-450T | 79892 | 16. avril 2020 |
| Température & Humidité* | Rotronic HC2-S | 59900245 | 04.décembre.2019 |

* Certificat de calibration valable 2 ans

## INGENIEUR(S) / *ENGINEER(S)* :

Kobrin Antoine & Gonin Gaël

## DATE(S) DES TESTS / *DATE OF TESTS* :

Le 27 Novembre 2020.

## 1. COMPTE-RENDU DES MESURES

**2. Déviations par rapport aux spécifications [voir pages(s) suivantes(s)]**

**3. But de la visite et principe de fonctionnement [voir pages(s) suivantes(s)]**

| TEST | RESULTAT | | Critère d'acceptation (ou *valeur indicative* ) | C / NC / NA |
|---|---|---|---|---|
| | | | Conforme C / Non-conforme NC / Non Applicable NA | |
| **4. Test d'intégrité des filtres** | Concentration aval max en % | Eff. min en % | Limite efficacité de la filtration en % | **Status** |
| Local Pesées | 0.35 | **99.65** | **>95** | **C** |
| Salle Propre | 1.57 | **98.43** | **>95** | **C** |
| **5. Pressions différentielles des salles** | | | ***Mode Normal - Portes fermées*** | |
| **Entre…** | … Et | Pascal | Limite surpression | **Status** |
| Local Pesées | Salle Propre | **5** | **10 ± 5** | **C** |
| Salle Propre | Sas | **10** | **≥ 10** | **C** |
| Salle Propre | Extérieur | **20** | **≥ 20** | **C** |
| Local Pesées | Extérieur | **25** | **≥ 25** | **C** |
| Sas | Extérieur | **10** | **≥ 10** | **C** |
| **6. Débits et taux de renouvellement** | | | ***Mode Normal - Portes fermées*** | |
| **des locaux** | Débit en m3/h | Tx / h | Valeur indicative | **Status** |
| Local Pesées | 346 | **16** | **( ≥ 10)** | **C** |
| Salle Propre | 1 476 | **16** | **( ≥ 10)** | **C** |
| **7. Comptages de particules** | Taille de particules | **Nb/m$^3$** | Exigence ISO-14644-1 | |
| Local Pesées | ≥ 0,5 µm | 6 460 | ≤ 3'520'000 [ISO 8] | **C** |
| | ≥ 5,0 µm | 300 | ≤ 29'300 [ISO 8] | **C** |
| Salle Propre | ≥ 0,5 µm | 14 380 | ≤ 3'520'000 [ISO 8] | **C** |
| | ≥ 5,0 µm | 420 | ≤ 29'300 [ISO 8] | **C** |
| Sas | ≥ 0,5 µm | 80 820 | ≤ 3'520'000 [ISO 8] | **C** |
| | ≥ 5,0 µm | 1 720 | ≤ 29'300 [ISO 8] | **C** |
| **8. Temps de récupération** | Taille de particules | Temps en min | *(Valeur indicative)* | **Status** |
| Local Pesées | ≥ 0,5 µm | **9** | *CP 20 (≤ 20 min)* | **NA** |
| Salle Propre | ≥ 0,5 µm | **10** | *CP 20 (≤ 20 min)* | **NA** |
| **Mesures d'ambiance** | Temp. en °C | | Humidité en % HR | |
| Local Pesées | 23.3 | | 30.0 | |
| Salle Propre | 21.7 | | 30.6 | |
| Sas | 23.5 | | 32.5 | |

Les tests nr 4,5,6 et 7 sont couverts sous l'accréditation STS 0552; les tests 8&9 n'ont pas à ce stade été inclus dans le domaine de l'accréditation STS.

| **Annexe(s) :** |
|---|
| *** Résultats des comptages particulaires "au repos"** |
| *** Certificats d'étalonnage des appareils de mesure utilisés** |

| STATUS DE L'INSTALLATION | **CONFORME** | ~~**NON CONFORME**~~ |
|---|---|---|
| REMARQUE(S):<br>Pas de remarque particulière.<br><br>NA = Non Applicable, NM = Non Mesuré. | | |

| Techniserv SA | Date: | Signature |
|---|---|---|
| Gonin Gaël | 01-Dec-2020 |  |

| Techniserv SA (Revue) | Date: | Signature |
|---|---|---|
| Kobrin Antoine | 01-Dec-2020 |  |

## 2. DEVIATION(S) PAR RAPPORT AUX SPECIFICATIONS

| Dev. N° | Chapitre | Description | Critique? Oui / Non | Mesure(s) corrective(s) | Date d'échéance | Close le … par … |
|---|---|---|---|---|---|---|
| 1 | | | | | | |
| 2 | | | | | | |

N

A

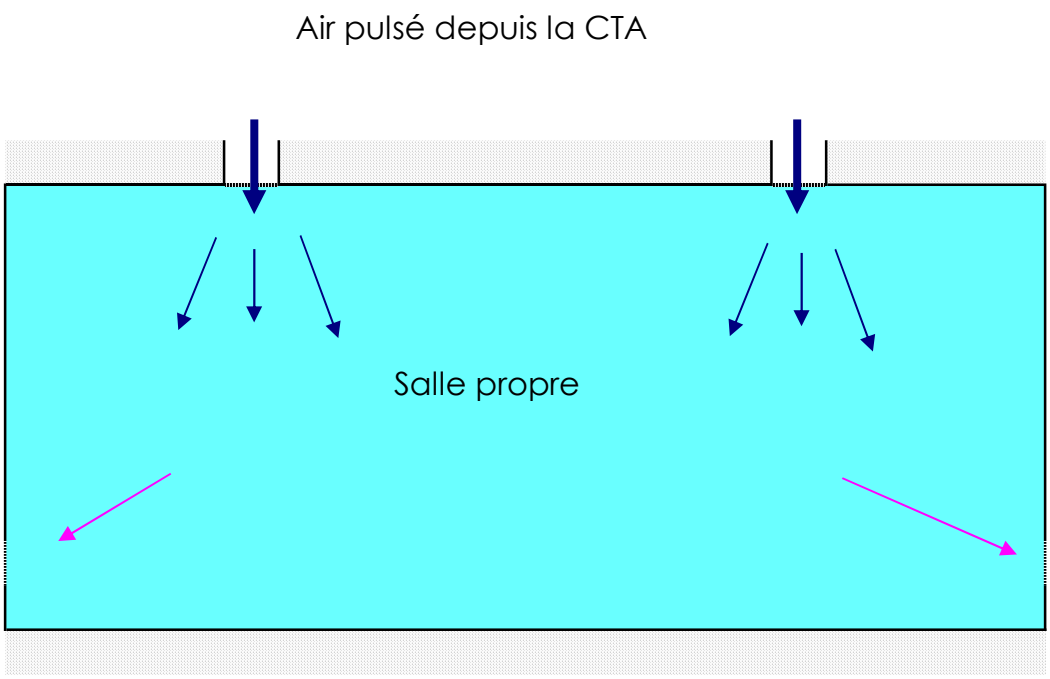
## 3. BUT DE LA VISITE

Requalifier la salle propre construite par Logicair et vérifier la conformité des locaux par rapport à la norme ISO 14644-1.

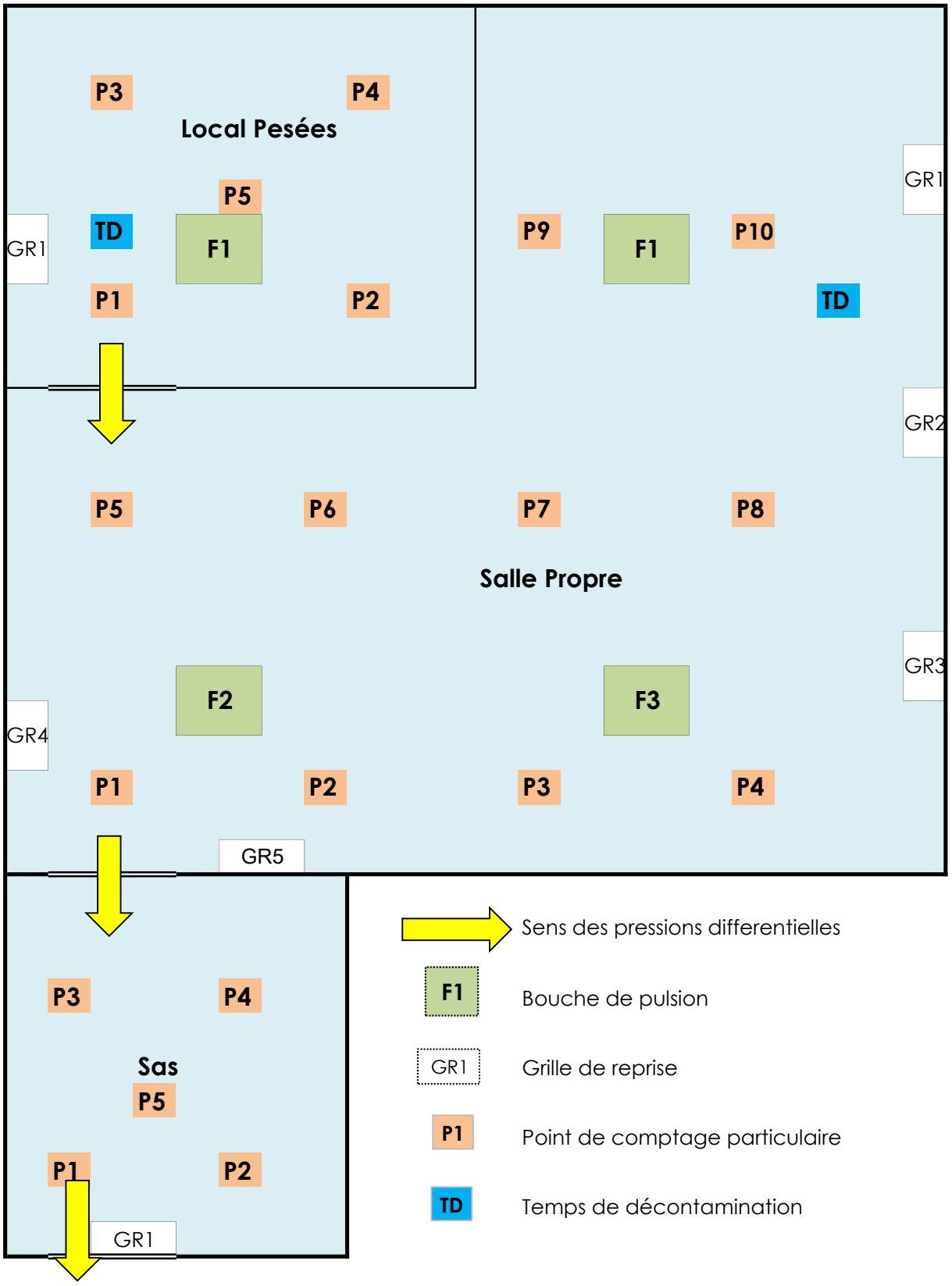
### A- Principe de fonctionnement

Depuis la centrale de traitement d'air (CTA), l'air est pulsé par 4 diffuseurs avec ultra-filtres situés au plafond.
Cet air est repris à travers six grilles de reprise situées en parois.

### B- Vue en coupe de la salle propre (principe)



## C- Plan des locaux



## 4 - TEST D'INTEGRITE DES FILTRES

***Méthode de test (selon ISO/DIS 14644-3) :***

- Générateur d'aérosol placé à l'entrée de la reprise d'air de la CTA.
- Photomètre de détection installé à coté du filtre à contrôler:
  - Entrée 1: mesure prise en amont du filtre.
  - Entrée 2: mesure aval faite avec la sonde par balayage de la surface du filtre, ainsi que des joints et cadre, à 5 cm.

1- S'assurer au préalable que la vitesse d'air est superieur à 0.20 m/s

2- Générateur d'aérosol réglé afin d'obtenir une concentration amont comprise entre 20 [µg/l] et 80 [µg/l].
Dès stabilisation du générateur d'aérosol, 100% du photomètre effectué.

3- Balayage complet de la surface du filtre, ainsi que du cadre, à une vitesse d'environ 5 cm/s et à 3 cm environ de la surface.
Valeurs de la sonde affichées sur le photomètre directement en % (rapport de la concentration mesurée par rapport à la valeur amont à 100%).

Le test d'intégrité est du type "CONFORME" ou "NON-CONFORME":
* pour les filtres H11:
  - CONFORME : pénétration < ou = à 5%, soit efficacité > ou = à 95%.
  - NON-CONFORME : pénétration > à 5%, soit efficacité < à 95%.

| Référence filtre | Vitesse d'air en [m/ supérieure à 0.2 | Concentration amont en [µg/l] | aval en % | | Efficacité minimale du filtre en % | Critère en % | Résultat **C / NC / NA** |
|---|---|---|---|---|---|---|---|
| **Local de pesée** | | | | | | | |
| F1 | oui | 65 | 100 | **0.35** | 99.65 | >95 | **C** |
| **Salle propre** | | | | | | | |
| F1 | oui | 65 | 100 | **1.57** | 98.43 | >95 | **C** |
| F2 | oui | 65 | 100 | **1.46** | 98.54 | >95 | **C** |
| F3 | oui | 65 | 100 | **1.3** | 98.7 | >95 | **C** |

**Conforme C / Non-conforme NC / Non Applicable NA**

## 5. MESURES DE SURPRESSION

Les surpressions entre salles sont mesurées à l'aide du multimètre ADM-870 sous les portes en mode normal.

On s'attend à trouver une cascade de pressions positives allant du Local Pesées vers le couloir extérieur.

**Mesurés :**

| Entre… | et… | Mesure [Pa] | Critère d'acceptation [Pa] | Résultat C / NC / NA |
|---|---|---|---|---|
| Local Pesées | Salle Propre | 5 | 10 ± 5 | C |
| Salle Propre | Sas | 10 | ≥ 10 | C |
| Sas | Extérieur | 10 | ≥ 10 | C |

**Conforme C / Non-conforme NC / Non Applicable NA**

**Calculé :**

| Entre… | et… | Mesure [Pa] | Critère d'acceptation [Pa] | Résultat C / NC / NA |
|---|---|---|---|---|
| Salle Propre | Exterieur | 20 | ≥ 20 | C |
| Local Pesées | Exterieur | 25 | ≥ 25 | C |

**Conforme C / Non-conforme NC / Non Applicable NA**

## 6. DEBITS ET TAUX DE RENOUVELLEMENT

### Résultats :

| Salle | | Caisson | Résultats | | | |
|---|---|---|---|---|---|---|
| **Salle Propre** | | Filtre 1 | 147 | l/s | 529 | $m^3/h$ |
| | | Filtre 2 | 140 | l/s | 504 | $m^3/h$ |
| | | Filtre 3 | 123 | l/s | 443 | $m^3/h$ |
| | | | | | | |
| Volume en $m^3$ | 90 | Total | | | 1 476 | $m^3/h$ |
| | | | | | **16** | chgt/h |
| **Local Pesées** | | Filtre 1 | 96 | l/s | 346 | $m^3/h$ |
| | | | | | | |
| Volume en $m^3$ | 22 | Total | | | 346 | $m^3/h$ |
| | | | | | **16** | chgt/h |

### Résultats pour les grilles de reprise :

| Salle | Grilles | Résultats | | | |
|---|---|---|---|---|---|
| **Salle Propre** | Grille 1 | 72 | l/s | 259 | $m^3/h$ |
| | Grille 2 | 78 | l/s | 281 | $m^3/h$ |
| | Grille 3 | 85 | l/s | 306 | $m^3/h$ |
| | Grille 4 | 82 | l/s | 295 | $m^3/h$ |
| | Grille 5 | 62 | l/s | 223 | $m^3/h$ |
| **Local Pesées** | Grille 1 | 85 | l/s | 306 | $m^3/h$ |
| **Sas** | Grille 1 | 68 | l/s | 245 | $m^3/h$ |

## 7. COMPTAGES DE PARTICULES

### A - Rappel de la norme appliquable aux locaux à empoussièrement contrôlé

| GMP/BPF Classe selon GMP | | Classe ISO 14644-1 : 2015 | Nb limite des particules | | | | | |
|---|---|---|---|---|---|---|---|---|
| Au repos | En activité | | 0.1 µm | 0.2 µm | 0.3 µm | 0.5 µm | 1.0 µm | 5.0 µm |
| | | | /m3 | /$m^3$ | /$m^3$ | /$m^3$ | /$m^3$ | /$m^3$ |
| | | **1** | 10 | -- | -- | -- | -- | -- |
| | | **2** | 100 | 24 | 10 | -- | -- | -- |
| | | **3** | 1 000 | 237 | 102 | 35 | -- | -- |
| | | **4** | 10 000 | 2 370 | 1 020 | 352 | 83 | -- |
| **A** | **A** | | -- | -- | -- | **3 520** | **--** | **20** |
| **B** | | | -- | -- | -- | **3 520** | **--** | **29** |
| | | **5** | 100 000 | 23 700 | 10 200 | 3 520 | 832 | * |
| | | **6** | 1 000 000 | 237 000 | 102 000 | 35 200 | 8 320 | 293 |
| **C** | **B** | | -- | -- | -- | **352 000** | **--** | **2 900** |
| | | **7** | -- | -- | -- | 352 000 | 83 200 | 2 930 |
| **D** | **C** | | -- | -- | -- | **3 520 000** | **--** | **29 000** |
| | | **8** | -- | -- | -- | 3 520 000 | 832 000 | 29 300 |
| | | **9** | -- | -- | -- | 35 200 000 | 8 320 000 | 293 000 |

-- Taille de particules non prise en compte dans la classification

* Pour réaliser une classification à cette taille de particules, pour la classe ISO5 on peut adapter le descripteur macroparticules M en l'associant à au moins une autre taille de particules : ISO M (29; ≥ 5 µm); LSAPC.

GMP = Volume 4 - Good manufacturing practices - Annex 1

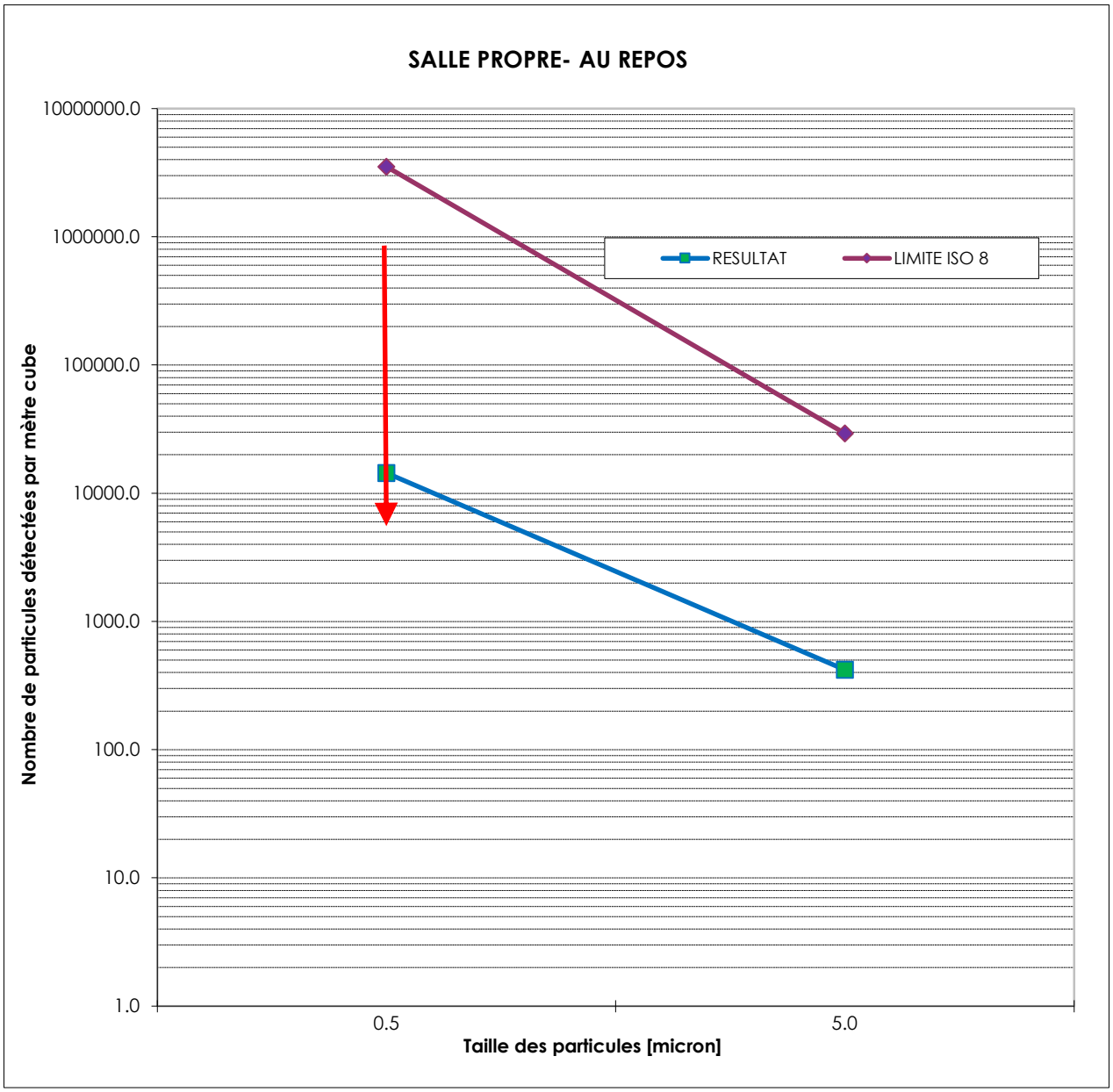
BPF = La réglementation des médicaments dans l'Union Européenne
Bonnes Pratiques de Fabrication - médicaments à usage humain et médicaments vétérinaires - Volume 4 - Annexe 1

## B - Comptages particulaires dans la Salle Propre

| Résultat Comptages | Nombre de particules (Cumulatif) | | Salle au repos |
|---|---|---|---|
| Taille Particules (≥) | 0.5 | 5.0 | *Microns* |
| **RESULTAT** | **14 380** | **420** | *Mesure par mètre cube [1/m3]* |
| LIMITE ISO 8 | 3 520 000 | 29 300 | |

| | | | |
|---|---|---|---|
| **Critère d'acceptation [ISO 8]** | **≤ 3'520'000** | **≤ 29'300** | *Mesure par mètre cube [1/m3]* |
| **RESULTAT** | **C** | **C** | |

**Conforme C / Non-conforme NC / Non Applicable NA**

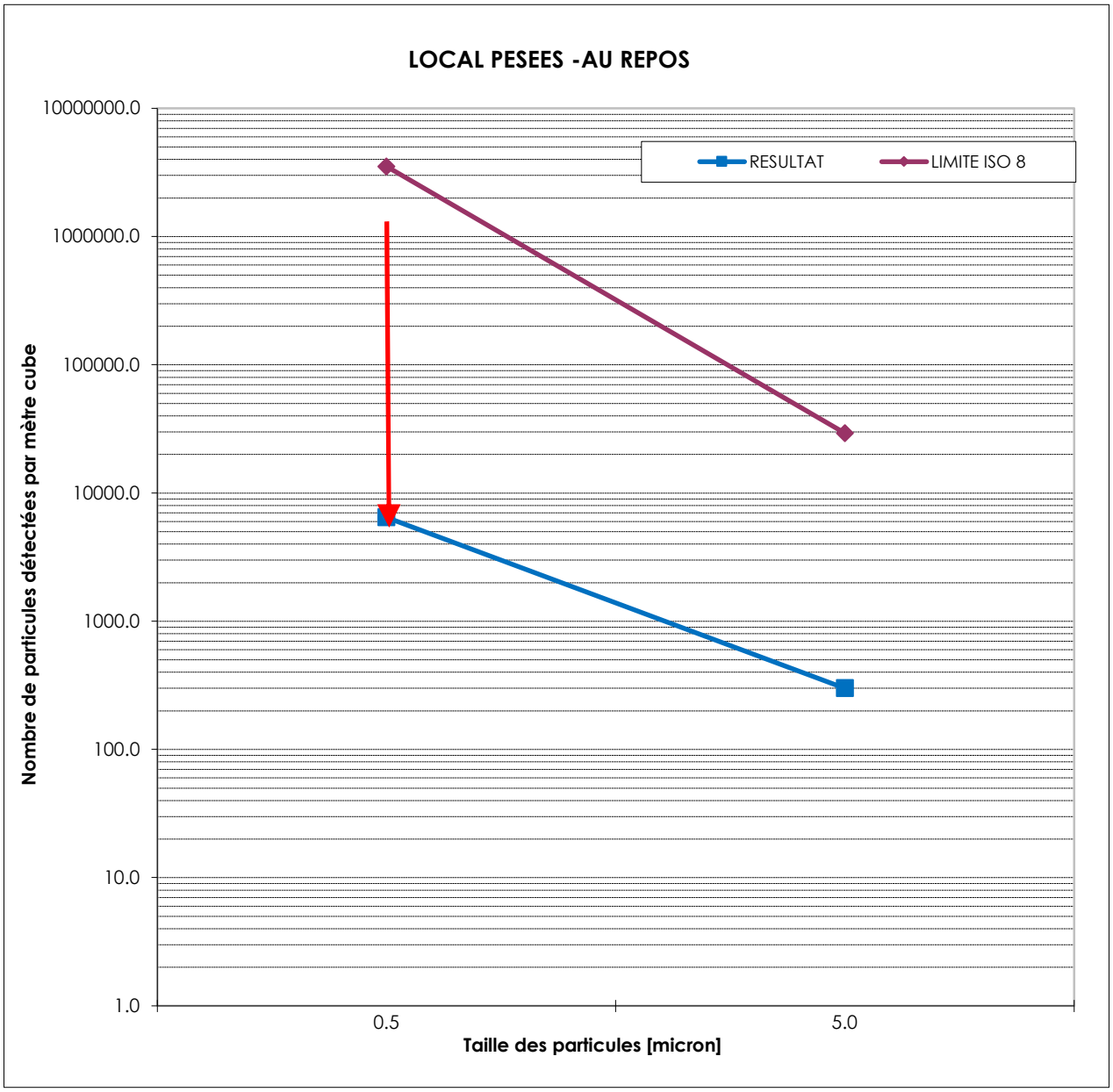


## C - Comptages particulaires dans le Local Pesées

| Résultat Comptages | Nombre de particules (Cumulatif) | | Salle au repos |
|---|---|---|---|
| Taille Particules (≥) | 0.5 | 5.0 | *Microns* |
| **RESULTAT** | **6 460** | **300** | *Mesure par mètre cube [1/m3]* |
| LIMITE ISO 8 | 3 520 000 | 29 300 | |

| | | | |
|---|---|---|---|
| **Critère d'acceptation [ISO 8]** | **≤ 3'520'000** | **≤ 29'300** | *Mesure par mètre cube [1/m3]* |
| **RESULTAT** | **C** | **C** | |

**Conforme C / Non-conforme NC / Non Applicable NA**

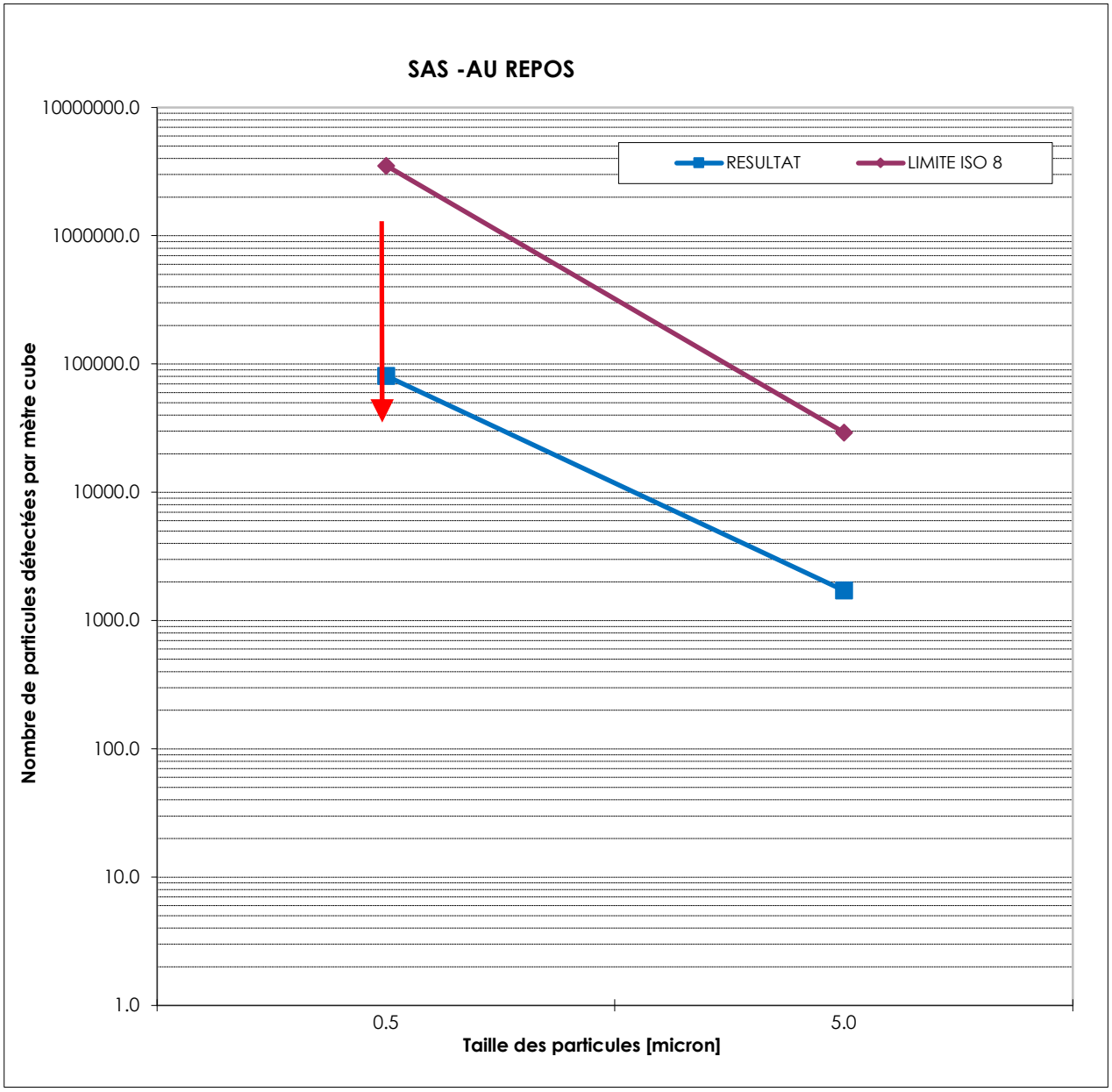


## D - Comptages particulaires dans le Sas

| Résultat Comptages | Nombre de particules (Cumulatif) | | Salle au repos |
|---|---|---|---|
| Taille Particules (≥) | 0.5 | 5.0 | *Microns* |
| **RESULTAT** | **80 820** | **1 720** | *Mesure par mètre cube [1/m3]* |
| LIMITE ISO 8 | 3 520 000 | 29 300 | |

| | | | |
|---|---|---|---|
| **Critère d'acceptation [ISO 8]** | **≤ 3'520'000** | **≤ 29'300** | *Mesure par mètre cube [1/m3]* |
| **RESULTAT** | **C** | **C** | |

**Conforme C / Non-conforme NC / Non Applicable NA**



## 8. ESSAI DE RECUPERATION

### Principe

Il s'agit d'une mesure dynamique avec simulation d'une charge de particules
et étude du temps mis par la salle pour récupérer la classe de propreté souhaitée.

**Principe de mesure**
La capacité de récupération est évaluée en utilisant le temps de récupération de 10 à 1 et/ou le taux de récupération de la propreté initiale au repos. Le temps de récupération de 10 à 1 est défini comme étant le temps nécessaire pour réduire la concentration initiale par un facteur 10.

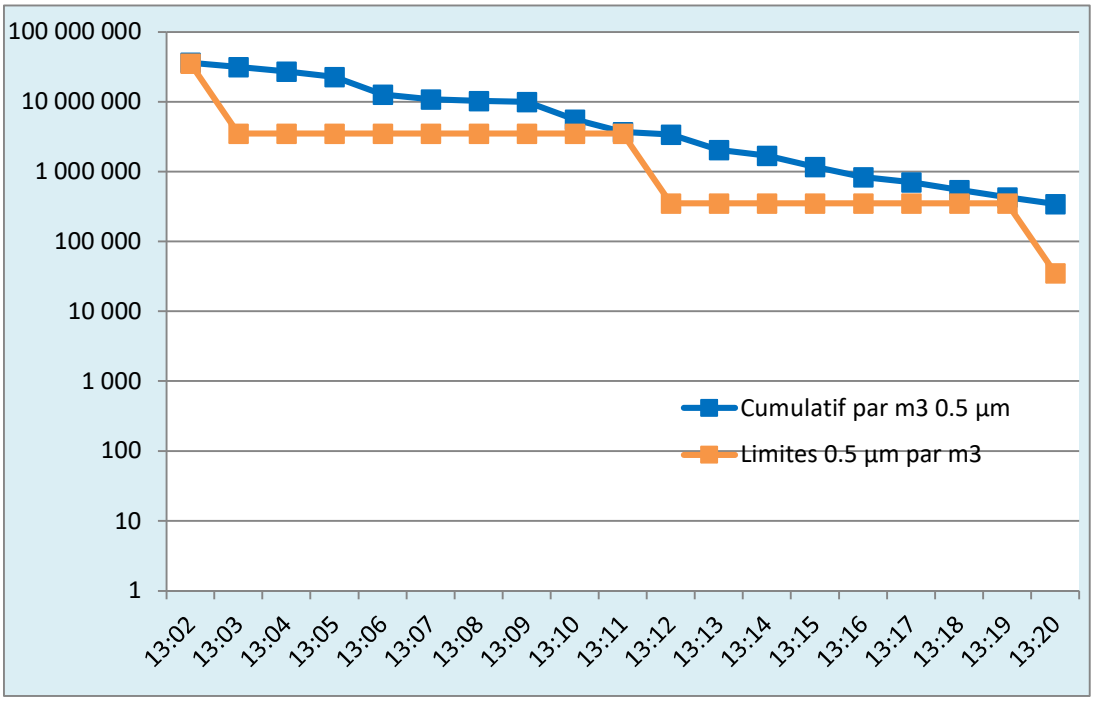
**Critère d'acceptation:**
On considère que 20 minutes suffisent pour une salle de classe ISO-8.

## Salle Propre

**Point de mesure n° 1**

| Time | Cumulatif par CF | Cumulatif par $m^3$ | Classe ISO | Limites 0.5 µm |
|---|---|---|---|---|
| h:mm | **0.5 µm** | **0.5 µm** | ISO 14644-1 | **par $m^3$** |
| 13:02 | **1 813 123** | 36 262 460 | 9 | 35 200 000 |
| 13:03 | 1 567 939 | 31 358 780 | 8 | 3 520 000 |
| 13:04 | 1 349 687 | 26 993 740 | 8 | 3 520 000 |
| 13:05 | 1 129 988 | 22 599 760 | 8 | 3 520 000 |
| 13:06 | 635 662 | 12 713 240 | 8 | 3 520 000 |
| 13:07 | 542 088 | 10 841 760 | 8 | 3 520 000 |
| 13:08 | 513 414 | 10 268 280 | 8 | 3 520 000 |
| 13:09 | 499 608 | 9 992 160 | 8 | 3 520 000 |
| 13:10 | 277 937 | 5 558 740 | 8 | 3 520 000 |
| 13:11 | 184 223 | 3 684 460 | 8 | 3 520 000 |
| 13:12 | **170 217** | 3 404 340 | 7 | 352 000 |
| 13:13 | 101 979 | 2 039 580 | 7 | 352 000 |
| 13:14 | 84 374 | 1 687 480 | 7 | 352 000 |
| 13:15 | 58 727 | 1 174 540 | 7 | 352 000 |
| 13:16 | 41 503 | 830 060 | 7 | 352 000 |
| 13:17 | 35 123 | 702 460 | 7 | 352 000 |
| 13:18 | 27 453 | 549 060 | 7 | 352 000 |
| 13:19 | 21 466 | 429 320 | 7 | 352 000 |
| 13:20 | 17 240 | 344 800 | 6 | 35 200 |
| Temps de récupération mesuré (Min) : | | | **10** | |

## Courbe de récupération

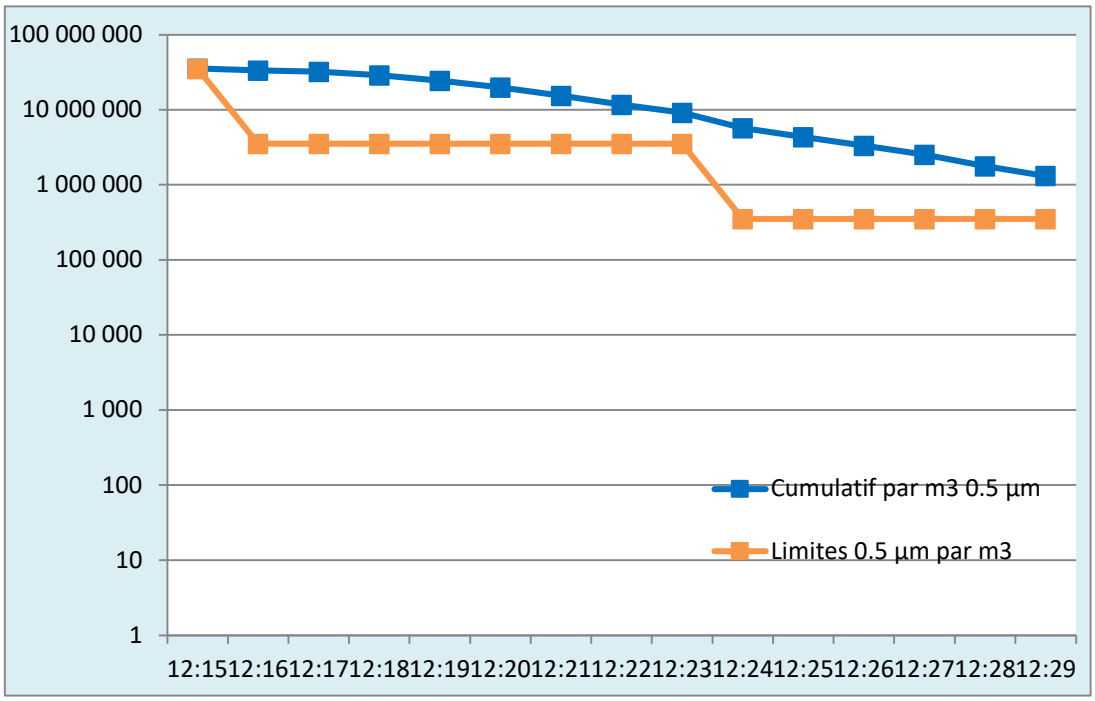


## Local pesées

**Point de mesure n° 2**

| Time | Cumulatif par CF | Cumulatif par m³ | Classe ISO | Limites 0.5 µm |
|---|---|---|---|---|
| h:mm | **0.5 µm** | **0.5 µm** | ISO 14644-1 | **par m³** |
| 12:15 | **1 773 045** | 35 460 900 | 9 | 35 200 000 |
| 12:16 | 1 663 689 | 33 273 780 | 8 | 3 520 000 |
| 12:17 | 1 612 328 | 32 246 560 | 8 | 3 520 000 |
| 12:18 | 1 444 625 | 28 892 500 | 8 | 3 520 000 |
| 12:19 | 1 220 751 | 24 415 020 | 8 | 3 520 000 |
| 12:20 | 990 650 | 19 813 000 | 8 | 3 520 000 |
| 12:21 | 771 986 | 15 439 720 | 8 | 3 520 000 |
| 12:22 | 583 703 | 11 674 060 | 8 | 3 520 000 |
| 12:23 | 457 641 | 9 152 820 | 8 | 3 520 000 |
| 12:24 | **286 068** | 5 721 360 | 7 | 352 000 |
| 12:25 | 215 987 | 4 319 740 | 7 | 352 000 |
| 12:26 | 166 781 | 3 335 620 | 7 | 352 000 |
| 12:27 | 125 841 | 2 516 820 | 7 | 352 000 |
| 12:28 | 88 943 | 1 778 860 | 7 | 352 000 |
| 12:29 | 65 933 | 1 318 660 | 7 | 352 000 |
| Temps de récupération mesuré (Min): | | | **9** | |

## Courbe de récupération



Salle propre

## STORED DATA

UNIT= SN:079892
#LOCATIONS= 10 #SAMPLES= 10
PROGRAM=

| | | | |
|---|---|---|---|
| ID= P1 | | | 27/11/20 |
| SAMPLE VOL= | 50L | | TOTAL COUNT |
| TIME | >0.5 | >5.0 | FLOW |
| 11:22:24 | 719 | 8 | 50.0 |
| ID= P2 | | | 27/11/20 |
| SAMPLE VOL= | 50L | | TOTAL COUNT |
| TIME | >0.5 | >5.0 | FLOW |
| 11:23:53 | 542 | 9 | 50.0 |
| ID= P3 | | | 27/11/20 |
| SAMPLE VOL= | 50L | | TOTAL COUNT |
| TIME | >0.5 | >5.0 | FLOW |
| 11:25:16 | 520 | 9 | 50.0 |
| ID= P4 | | | 27/11/20 |
| SAMPLE VOL= | 50L | | TOTAL COUNT |
| TIME | >0.5 | >5.0 | FLOW |
| 11:26:38 | 470 | 9 | 50.0 |
| ID= P5 | | | 27/11/20 |
| SAMPLE VOL= | 50L | | TOTAL COUNT |
| TIME | >0.5 | >5.0 | FLOW |
| 11:28:20 | 455 | 19 | 50.0 |
| ID= P6 | | | 27/11/20 |
| SAMPLE VOL= | 50L | | TOTAL COUNT |
| TIME | >0.5 | >5.0 | FLOW |
| 11:29:33 | 515 | 21 | 50.0 |
| ID= P7 | | | 27/11/20 |
| SAMPLE VOL= | 50L | | TOTAL COUNT |
| TIME | >0.5 | >5.0 | FLOW |
| 11:34:37 | 549 | 8 | 50.0 |
| ID= P8 | | | 27/11/20 |
| SAMPLE VOL= | 50L | | TOTAL COUNT |
| TIME | >0.5 | >5.0 | FLOW |
| 11:36:02 | 571 | 16 | 50.0 |
| ID= P9 | | | 27/11/20 |
| SAMPLE VOL= | 50L | | TOTAL COUNT |
| TIME | >0.5 | >5.0 | FLOW |
| 11:37:29 | 531 | 11 | 50.0 |
| ID= P10 | | | 27/11/20 |
| SAMPLE VOL= | 50L | | TOTAL COUNT |
| TIME | >0.5 | >5.0 | FLOW |
| 11:38:58 | 478 | 7 | 50.0 |

27-NOV-2020 GGO

Salle propre

## ISO 14644-1:2015
## PASS

UNIT= SN:079892
ISO CLASS 8 (AT 5.0 uM)
PRINTED 27/11/20 11:39:31
FIRST 27/11/20 11:22:24
LAST 27/11/20 11:38:58

PROGRAM=
SAMPLE VOLUME= 50L
SIZE= >5.0uM

| ID | #SAMPLES | AVERAGE COUNTS | AVERAGE CONC/CM |
|---|---|---|---|
| P1 | 1 | 8.0 | 160.0 |
| P2 | 1 | 9.0 | 180.0 |
| P3 | 1 | 9.0 | 180.0 |
| P4 | 1 | 9.0 | 180.0 |
| P5 | 1 | 19.0 | 380.0 |
| P6 | 1 | 21.0 | 420.0 |
| P7 | 1 | 8.0 | 160.0 |
| P8 | 1 | 16.0 | 320.0 |
| P9 | 1 | 11.0 | 220.0 |
| P10 | 1 | 7.0 | 140.0 |

## ISO 14644-1:2015
## PASS

UNIT= SN:079892
ISO CLASS 8 (AT 0.5 uM)
PRINTED 27/11/20 11:39:31
FIRST 27/11/20 11:22:24
LAST 27/11/20 11:38:58

PROGRAM=
SAMPLE VOLUME= 50L
SIZE= >0.5uM

| ID | #SAMPLES | AVERAGE COUNTS | AVERAGE CONC/CM |
|---|---|---|---|
| P1 | 1 | 719.0 | 14380.0 |
| P2 | 1 | 542.0 | 10840.0 |
| P3 | 1 | 520.0 | 10400.0 |
| P4 | 1 | 470.0 | 9400.0 |
| P5 | 1 | 455.0 | 9100.0 |
| P6 | 1 | 515.0 | 10300.0 |
| P7 | 1 | 549.0 | 10980.0 |
| P8 | 1 | 571.0 | 11420.0 |
| P9 | 1 | 531.0 | 10620.0 |
| P10 | 1 | 478.0 | 9560.0 |

27-NOV-2020 GGO

Local pesées

## STORED DATA

UNIT= SN:079892
#LOCATIONS= 5 #SAMPLES= 5
PROGRAM=

| | | | |
|---|---|---|---|
| ID= P1 | | | 27/11/20 |
| SAMPLE VOL= | 50L | | TOTAL COUNT |
| TIME | >0.5 | >5.0 | FLOW |
| 11:43:52 | 323 | 9 | 50.0 |
| ID= P2 | | | 27/11/20 |
| SAMPLE VOL= | 50L | | TOTAL COUNT |
| TIME | >0.5 | >5.0 | FLOW |
| 11:46:12 | 264 | 6 | 50.0 |
| ID= P3 | | | 27/11/20 |
| SAMPLE VOL= | 50L | | TOTAL COUNT |
| TIME | >0.5 | >5.0 | FLOW |
| 11:47:28 | 347 | 15 | 50.0 |
| ID= P4 | | | 27/11/20 |
| SAMPLE VOL= | 50L | | TOTAL COUNT |
| TIME | >0.5 | >5.0 | FLOW |
| 11:48:50 | 319 | 7 | 50.0 |
| ID= P5 | | | 27/11/20 |
| SAMPLE VOL= | 50L | | TOTAL COUNT |
| TIME | >0.5 | >5.0 | FLOW |
| 11:50:29 | 211 | 7 | 50.0 |

27-NOV-2020 GGO

Local Pesées

## ISO 14644-1:2015 PASS

UNIT= SN:079892
ISO CLASS 8 (AT 5.0 uM)

| | | |
|---|---|---|
| PRINTED | 27/11/20 | 11:51:21 |
| FIRST | 27/11/20 | 11:43:52 |
| LAST | 27/11/20 | 11:50:29 |

PROGRAM=
SAMPLE VOLUME= 50L
SIZE= >5.0uM

| ID | #SAMPLES | AVERAGE COUNTS | AVERAGE CONC/CM |
|---|---|---|---|
| P1 | 1 | 9.0 | 180.0 |
| P2 | 1 | 6.0 | 120.0 |
| P3 | 1 | 15.0 | 300.0 |
| P4 | 1 | 7.0 | 140.0 |
| P5 | 1 | 7.0 | 140.0 |

## ISO 14644-1:2015 PASS

UNIT= SN:079892
ISO CLASS 8 (AT 0.5 uM)

| | | |
|---|---|---|
| PRINTED | 27/11/20 | 11:51:21 |
| FIRST | 27/11/20 | 11:43:52 |
| LAST | 27/11/20 | 11:50:29 |

PROGRAM=
SAMPLE VOLUME= 50L
SIZE= >0.5uM

| ID | #SAMPLES | AVERAGE COUNTS | AVERAGE CONC/CM |
|---|---|---|---|
| P1 | 1 | 323.0 | 6460.0 |
| P2 | 1 | 264.0 | 5280.0 |
| P3 | 1 | 347.0 | 6940. |
| P4 | 1 | 319.0 | 6380.0 |
| P5 | 1 | 211.0 | 4220.0 |

27-NOV-2020 GGO

Sas

## STORED DATA

UNIT= SN:879892
#LOCATIONS= 5 #SAMPLES= 5
PROGRAM=

| | | | |
|---|---|---|---|
| ID= P1 | | | 27/11/20 |
| SAMPLE VOL= | 50L | | TOTAL COUNT |
| TIME | >0.5 | >5.0 | FLOW |
| 11:58:23 | 2603 | 79 | 50.0 |
| ID= P2 | | | 27/11/20 |
| SAMPLE VOL= | 50L | | TOTAL COUNT |
| TIME | >0.5 | >5.0 | FLOW |
| 12:01:14 | 4028 | 107 | 50.0 |
| ID= P3 | | | 27/11/20 |
| SAMPLE VOL= | 50L | | TOTAL COUNT |
| TIME | >0.5 | >5.0 | FLOW |
| 12:02:35 | 4041 | 97 | 49.5 |
| ID= P4 | | | 27/11/20 |
| SAMPLE VOL= | 50L | | TOTAL COUNT |
| TIME | >0.5 | >5.0 | FLOW |
| 12:04:26 | 1808 | 30 | 50.0 |
| ID= P5 | | | 27/11/20 |
| SAMPLE VOL= | 50L | | TOTAL COUNT |
| TIME | >0.5 | >5.0 | FLOW |
| 12:05:48 | 2956 | 86 | 49.5 |

27-NOV-2020 GGO

Sas

## ISO 14644-1:2015
## PASS

UNIT= SN:879892
ISO CLASS 8 (AT 5.0 uM)

| | |
|---|---|
| PRINTED | 27/11/20 12:07:52 |
| FIRST | 27/11/20 11:58:23 |
| LAST | 27/11/20 12:05:48 |

PROGRAM=
SAMPLE VOLUME= 50L
SIZE= >5.0uM

| ID | #SAMPLES | AVERAGE COUNTS | AVERAGE CONC/CM |
|---|---|---|---|
| P1 | 1 | 79.0 | 1580.0 |
| P2 | 1 | 107.0 | 2140.0 |
| P3 | 1 | 97.0 | 1940.0 |
| P4 | 1 | 30.0 | 760.0 |
| P5 | 1 | 86.0 | 1720.0 |

## ISO 14644-1:2015
## PASS

UNIT= SN:879892
ISO CLASS 8 (AT 0.5 uM)

| | |
|---|---|
| PRINTED | 27/11/20 12:07:52 |
| FIRST | 27/11/20 11:58:23 |
| LAST | 27/11/20 12:05:48 |

PROGRAM=
SAMPLE VOLUME= 50L
SIZE= >0.5uM

| ID | #SAMPLES | AVERAGE COUNTS | AVERAGE CONC/CM |
|---|---|---|---|
| P1 | 1 | 2603.0 | 52060.0 |
| P2 | 1 | 4028.0 | 80560.0 |
| P3 | 1 | 4041.0 | 80820.0 |
| P4 | 1 | 1808.0 | 36080.0 |
| P5 | 1 | 2956.0 | 59120.0 |

27-NOV-2020 GGO

TR Salle blanche

STORED DATA

UNIT= SN:879892
#LOCATIONS= 1 #SAMPLES= 28
PROGRAM=

ID= P1 27/11/20
SAMPLE VOL= 58L TOTAL COUNT
TIME >0.5 FLOW
13:02:49 1813123 50.0
13:03:49 1567939 49.5
13:04:49 1349687 49.5
13:05:49 1129988 49.5
13:06:49 635662 50.0
13:07:49 542088 49.5
13:08:49 513414 49.5
13:09:49 499608 50.0
13:10:49 277937 50.0
13:11:49 184223 50.0
13:12:49 170217 50.0
13:13:49 101979 49.5
13:14:49 84374 49.5
13:15:49 58727 50.0
13:16:49 41503 50.0
13:17:49 35123 49.5
13:18:49 27453 50.0
13:19:49 21466 50.0
13:20:49 17248 49.5

27-NOV-2020 GGO

TR Local pesées

STORED DATA

UNIT= SN:879892
#LOCATIONS= 1 #SAMPLES= 15
PROGRAM=

ID= P1 27/11/20
SAMPLE VOL= 58L TOTAL COUNT
TIME >0.5 FLOW
12:15:53 1773045 50.0
12:16:53 1663689 50.0
12:17:53 1612328 50.0
12:18:53 1444625 50.0
12:19:53 1220571 49.5
12:20:53 998650 49.5
12:21:53 771986 49.5
12:22:53 583703 49.5
12:23:53 457641 50.0
12:24:53 286068 50.0
12:25:53 215987 50.0
12:26:53 166781 50.0
12:27:53 125841 50.0
12:28:53 88943 50.0
12:29:53 65933 50.0

27-NOV-2020 GGO

BLANC

STORED DATA

UNIT= SN:879892
#LOCATIONS= 1 #SAMPLES= 1
PROGRAM=

ID= BLANC 27/11/20
SAMPLE VOL= 58L TOTAL COUNT
TIME >0.3 >0.5 >1.0 FLOW
10:51:30 0 0 0 50.0

ID= BLANC 27/11/20
SAMPLE VOL= 58L TOTAL COUNT
TIME >5.0
10:51:30 0

**Techniserv SA**
Chemin de Valérie 17
CH-1292 Chambésy
T : +41 22 758 94 60
E : services@techniserv.ch

**CERTIFICATE OF MAINTENANCE.**

| | | | |
|---|---|---|---|
| Certificate n° : | 2020-1019-558 | Maintenance date : | 19.10.2020 |
| Serial Number : | 1025558 | Maintenance due : | 19.10.2021 |
| Type of Equipment | Smoke Generator | | |
| Make and Model : | Concept ViCount | | |

The above smoke generator has been manufactured by Concept Engineering Ltd and maintenance has been executed by Techniserv SA. The nozzle has been thoroughly cleaned. The sintered filter has been cleaned, compressed air at 40 PSI was applied down the brass dip tube.

After maintenance the equipement was fully tested and found to be in good working order, the smoke generated was visually sufficient and the temperature needed reached.

**TEST CONDITIONS.**

| | |
|---|---|
| Ambient Temperature : | 23°C |
| Ambiant Humidity : | 37.90% |
| Smoke Oil : | DURASYN 164 Polyalphaolefins |

Tested by :

Gaël GONIN
Technician

Antoine KOBRIN
Manager

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infofr@cmitest.com
www.cmitest.com

# CONSTAT DE VERIFICATION

## CV200404HVAC

Date du constat: 2 octobre 2020

Information client

| | | | |
|---|---|---|---|
| Société: | SARL TECHNISERV | | |
| Contact: | M. David PARISI | | |
| Adresse: | 1 Allée de la Bruyère<br>Le Clos Sainte Catherine | | |
| Pays: | France | Localité: | 74850 VIRY |

Information Instrument

| | | | |
|---|---|---|---|
| Description: | Photomètre | Numéro de série: | 21075 |
| Marque: | ATI | Numéro d'identification: | TEC4584 |
| Type: | 2H | Version firmware: | 2.4 |

Références étalons utilisées

| Description | Type | N° série | Date d'étalonnage | Date de validité |
|---|---|---|---|---|
| Photomètre ATI - PH003 | 2i | 29880 | 10-09-2020 | 10-03-2021 |
| Débitmètre TSI - DE003 | 4043 E | 40431142001 | 12-03-2020 | 12-03-2021 |
| Source courant Pico-ampère KEITHLEY | 220 | 0860601 | 10-12-2019 | 10-12-2020 |
| Multimètre FLUKE - EL006 | 789 | 24750085 | 26-04-2019 | 26-04-2021 |

Résultats de mesures

| Débit : L/min ±5% de la lecture | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| AS FOUND | | | | | AS LEFT | | | | |
| Instr. Val. A | Ref. Val. B | Diff. A - B | Tol. | Concl. | Instr. Val. A | Ref. Val. B | Diff. A - B | Tol. | Concl. |
| 28.8 | 28.3 | 0.5 | 1.4 | Ok | 28.3 | 28.3 | 0.0 | 1.4 | Ok |
| DOP Concentration : µg/L ±10% de la lecture | | | | | | | | | |
| Points de mesures : 20-50-100µg/L | | | | | | | | | |
| AS FOUND | | | | | AS LEFT | | | | |
| Instr. Val. A | Ref. Val. B | Diff. A - B | Tol. | Concl. | Instr. Val. A | Ref. Val. B | Diff. A - B | Tol. | Concl. |
| 13.7 | 21.2 | -7.5 | 1.4 | NOk | 22.2 | 23.4 | -1.3 | 2.2 | Ok |
| 34.5 | 51.0 | -16.5 | 3.5 | NOk | 47.9 | 50.4 | -2.5 | 4.8 | Ok |
| 67.8 | 99.5 | -31.7 | 6.8 | NOk | 98.7 | 100.8 | -2.1 | 9.9 | Ok |
| PAO Concentration : µg/L ±10% de la lecture | | | | | | | | | |
| Points de mesures : 20-50-100µg/L | | | | | | | | | |
| AS FOUND | | | | | AS LEFT | | | | |
| Instr. Val. A | Ref. Val. B | Diff. A - B | Tol. | Concl. | Instr. Val. A | Ref. Val. B | Diff. A - B | Tol. | Concl. |
| 18.2 | 22.1 | -3.9 | 1.8 | NOk | 23.9 | 25.0 | -1.2 | 2.4 | Ok |
| 43.6 | 51.3 | -7.7 | 4.4 | NOk | 46.6 | 48.1 | -1.5 | 4.7 | Ok |
| 85.1 | 98.2 | -13.1 | 8.5 | NOk | 100.8 | 100.4 | 0.4 | 10.1 | Ok |
| HIGH Concentration : 100µg/L ±30µg/L | | | | | | | | | |
| AS FOUND | | | | | AS LEFT | | | | |
| Instr. Val. A | Ref. Val. B | Diff. A - B | Tol. | Concl. | Instr. Val. A | Ref. Val. B | Diff. A - B | Tol. | Concl. |
| 73.0 | 100.2 | -27.2 | 30.0 | Ok | 99.5 | 100.4 | -0.9 | 30.0 | Ok |

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**CONSTAT DE VERIFICATION**

**CV200404HVAC**

Mesures électriques:

| | AS FOUND | AS LEFT | Tolérances |
|---|---|---|---|
| J6 - white | 491.4 | 301.0 | >220mV/Def |
| J9-1 | 5.05 | 5.00 | +5V±0,1V |
| J9-5 | 14.94 | 14.94 | +15V±0,45V |
| J9-6 | -14.97 | -14.96 | -15V±0,45V |
| U4-3 | -12.22 | -12.22 | -12V±0,5V |
| U8-1 | 11.96 | 11.96 | +12V±0,5V |
| U12-6 | 5.00 | 5.00 | +5V±20mV |
| U13-1 | 9.97 | 9.92 | +10V+0,1/-0,4V |
| A/D V @ 10 LPM | 1.82 | 1.80 | N/A |
| A/D V @ 28.3 LPM | 2.79 | 2.83 | N/A |
| Stray light | 0.0017 | 0.0011 | N/A |

Vérification de la linéarité:

| Lecture affichage (en %) | AS FOUND | AS LEFT | Tolérances (en A) |
|---|---|---|---|
| 100.0 | $0,8 \times 10^{-5}$ | $0,8 \times 10^{-5}$ | $0,8 \pm 0,04 \times 10^{-5}$ |
| 10.0 | $0,8 \times 10^{-6}$ | $0,8 \times 10^{-6}$ | $0,8 \pm 0,04 \times 10^{-6}$ |
| 1.0 | $0,8 \times 10^{-7}$ | $0,8 \times 10^{-7}$ | $0,8 \pm 0,04 \times 10^{-7}$ |
| 0.10 | $0,8 \times 10^{-8}$ | $0,8 \times 10^{-8}$ | $0,8 \pm 0,04 \times 10^{-8}$ |
| 0.010 | $0,8 \times 10^{-9}$ | $0,8 \times 10^{-9}$ | $0,8 \pm 0,04 \times 10^{-9}$ |
| 0.001 | $0,8 \times 10^{-10}$ | $0,8 \times 10^{-10}$ | $0,8 \pm 0,04 \times 10^{-10}$ |

Comparaison de l'affichage du photomètre et de la sonde scan:

| valeur lue sur photomètre | valeur lue sur sonde scan |
|---|---|
| 16.207 | 16.207 |
| 49.924 | 49.924 |
| 93.171 | 93.171 |

Etat à réception: ~~Dans les tolérances~~ - Hors Tolerance - ~~Hors service~~ - ~~Instrument neuf~~

Etat après ajustage/réparation: Dans les tolérances - ~~Hors Tolerance~~ - ~~Hors service~~

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**CONSTAT DE VERIFICATION**

**CV200404HVAC**

Maintenance:

| Opérations réalisées (OUI/NON) | | | |
|---|---|---|---|
| OUI | Nettoyage de la chambre | NON | Remplacement des joints |
| NON | Remplacement de la chambre | OUI | Contrôle présence de fuite |
| OUI | Nettoyage du système d'échantillonnage | OUI | Remplacement du filtre Hepa REJET |
| NON | Remplacement de la lampe | OUI | Remplacement des filtres de pompe |
| OUI | Alignement des optiques | OUI | Remplacement du filtre Hepa CLEAR |
| OUI | Test de la sonde de scan. | OUI | Remplacement du filtre Hepa Chambre |
| OUI | Test des connexions électriques | OUI | Ajout du filtre de Protection |
| NON | Test du filtre absolu | OUI | Test de fonctionnement final |

Remarque(s):

procédure: CI006-IT019 Etalonnage Photomètre ATI 2H
nombre d'heures de fonctionnement: 29h à réception

Photomètre encrassé. La pompe a été nettoyée ce qui a permis de mettre en évidence une fuite sur un filtre de pompe. Les tuyaux de pompe ont été nettoyés.
Tous les filtres ont été remplacés car des éléments solides s'y sont logés. Un filtre de protection est ajouté en entrée de chambre optique.

Conditions environnementales

Température: 17.9 °C
Humidité: 61.4 %RH

Vérification

Réalisée par: Vincent DESSAINT
Réalisée le: 1 octobre 2020
Signature:

Validée par: Rachel NOULIN
02 OCT. 2020
Responsable Métrologie



Visa : GGO

# CERTIFICATE OF CALIBRATION

**Issued By** BSRIA Instrument Solutions **Certificate Number** UK20787
**Date of Issue** 13 October 2020

BSRIA Quality Approved M J Trotter

Page 1 of 6 Pages
Approved Signatory

Old Bracknell Lane West, Bracknell
Berkshire, RG12 7AH
T: +44 (0)1344 459 314 | 0800 254 5566
E: calibration@bsria.co.uk
W: www.bsria.co.uk/instruments

ilac-MRA UKAS CALIBRATION 0807

**Customer :** Crowthorne Hi-Tec Services Ltd
Beech House, Ancells Business Park, Ancells Road, Fleet, Hampshire. GU51 2UN
On behalf of Techniserv

Date Received : 25 September 2020

**Instrument -**

| | | | |
|---|---|---|---|
| System ID : | 113505 | Job Number : | H50568-1 |
| Description : | AirData meter (dP/°C/m/s) | Ref. Number : | TEC 2202 |
| Manufacturer : | Shortridge | Site : | |
| Model Number : | ADM870 | Location : | |
| Serial Number : | M98807 | Last Certificate Number : | UK20465 |
| Procedure Version : | RUS200s1/N | Last Calibration Date : | 26/09/2019 |

**Environmental Conditions**

Temperature : 20°C +/- 4°C
Relative Humidity :50% +/- 20%
Mains Voltage : 240V +/- 10V
Mains Frequency : 50Hz +/- 1Hz

**Comments**

This certificate only applies to those calibration parameters shown within.
The calibration was performed over the period 08/10/2020 to 13/10/2020.

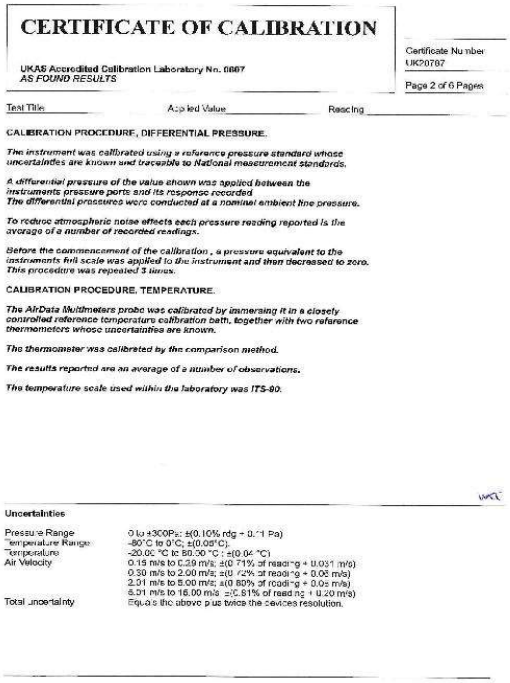
Results recorded as received. No adjustment performed.

**Calibration Information**

The instrument was calibrated against laboratory standards whose values are traceable to recognised National Standards. The uncertainty limits quoted refer to the measured values only, with no account being taken of the instruments ability to maintain its calibration.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

**Calibrated By :** M. Bray **Date of Calibration :** 13 October 2020



CERTIFICATE OF CALIBRATION

UKAS Accredited Calibration Laboratory No. 0807
*AS FOUND RESULTS*

Certificate Number
UK20787

Page 2 of 6 Pages

Test Title | Applied Value | Reading

**CALIBRATION PROCEDURE, DIFFERENTIAL PRESSURE.**

*The instrument was calibrated using a reference pressure standard whose uncertainties are known and traceable to National measurement standards.*

*A differential pressure of the value shown was applied between the instruments pressure ports and its response recorded.*
*The differential pressures were conducted at a nominal ambient line pressure.*

*To reduce atmospheric noise effects each pressure reading reported is the average of a number of recorded readings.*

*Before the commencement of the calibration , a pressure equivalent to the instruments full scale was applied to the instrument and then decreased to zero. This procedure was repeated 3 times.*

**CALIBRATION PROCEDURE, TEMPERATURE.**

*The AirData Multimeters probe was calibrated by immersing it in a closely controlled reference temperature calibration bath, together with two reference thermometers whose uncertainties are known.*

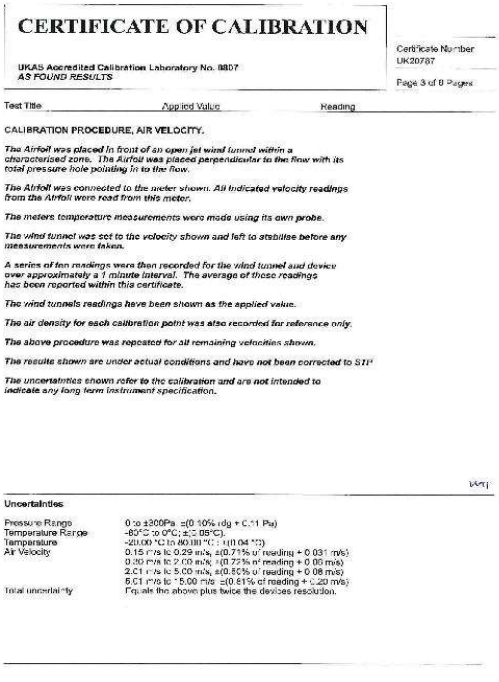
*The thermometer was calibrated by the comparison method.*

*The results reported are an average of a number of observations.*

*The temperature scale used within the laboratory was ITS-90.*

**Uncertainties**

| | |
|---|---|
| Pressure Range | 0 to ±300Pa: ±(0.10% rdg + 0.11 Pa) |
| Temperature Range | -80°C to 0°C; ±(0.05°C). |
| Temperature | -20.00 °C to 80.00 °C : ±(0.04 °C) |
| Air Velocity | 0.15 m/s to 0.29 m/s; ±(0.71% of reading + 0.031 m/s)<br>0.30 m/s to 2.00 m/s; ±(0.72% of reading + 0.08 m/s)<br>2.01 m/s to 5.00 m/s; ±(0.80% of reading + 0.08 m/s)<br>5.01 m/s to 16.00 m/s ±(0.81% of reading + 0.20 m/s) |
| Total uncertainty | Equals the above plus twice the devices resolution. |



CERTIFICATE OF CALIBRATION

UKAS Accredited Calibration Laboratory No. 0807
*AS FOUND RESULTS*

Certificate Number
UK20787

Page 3 of 6 Pages

Test Title | Applied Value | Reading

**CALIBRATION PROCEDURE, AIR VELOCITY.**

*The Airfoil was placed in front of an open jet wind tunnel within a characterised zone. The Airfoil was placed perpendicular to the flow with its total pressure hole pointing in to the flow.*

*The Airfoil was connected to the meter shown. All indicated velocity readings from the Airfoil were read from this meter.*

*The meters temperature measurements were made using its own probe.*

*The wind tunnel was set to the velocity shown and left to stabilise before any measurements were taken.*

*A series of ten readings were then recorded for the wind tunnel and device over approximately a 1 minute interval. The average of these readings has been reported within this certificate.*

*The wind tunnels readings have been shown as the applied value.*

*The air density for each calibration point was also recorded for reference only.*

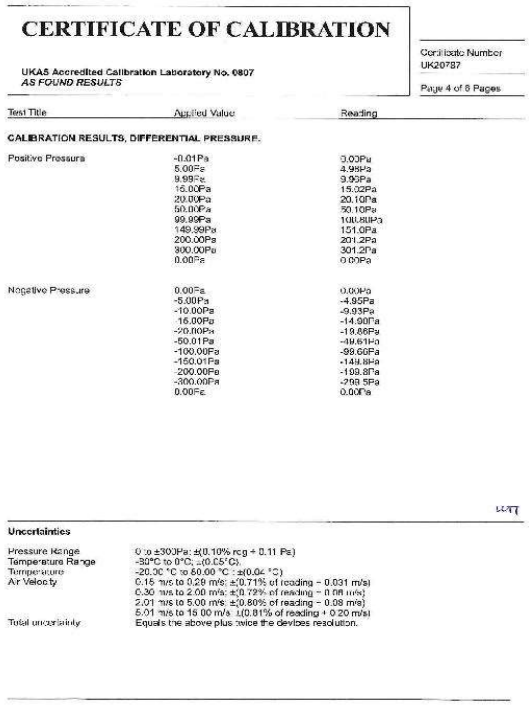
*The above procedure was repeated for all remaining velocities shown.*

*The results shown are under actual conditions and have not been corrected to STP.*

*The uncertainties shown refer to the calibration and are not intended to indicate any long term instrument specification.*

**Uncertainties**

| | |
|---|---|
| Pressure Range | 0 to ±300Pa: ±(0.10% rdg + 0.11 Pa) |
| Temperature Range | -80°C to 0°C; ±(0.05°C). |
| Temperature | -20.00 °C to 80.00 °C : ±(0.04 °C) |
| Air Velocity | 0.15 m/s to 0.29 m/s; ±(0.71% of reading + 0.031 m/s)<br>0.30 m/s to 2.00 m/s; ±(0.72% of reading + 0.08 m/s)<br>2.01 m/s to 5.00 m/s; ±(0.80% of reading + 0.08 m/s)<br>5.01 m/s to 16.00 m/s; ±(0.81% of reading + 0.20 m/s) |
| Total uncertainty | Equals the above plus twice the devices resolution. |



CERTIFICATE OF CALIBRATION

UKAS Accredited Calibration Laboratory No. 0807
*AS FOUND RESULTS*

Certificate Number
UK20787

Page 4 of 6 Pages

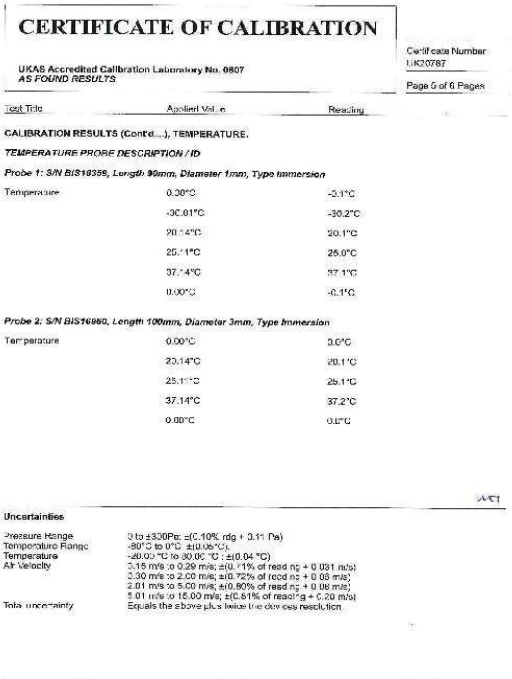
Test Title | Applied Value | Reading

**CALIBRATION RESULTS, DIFFERENTIAL PRESSURE.**

| | | |
|---|---|---|
| Positive Pressure | -0.01Pa | 0.00Pa |
| | 5.00Pa | 4.99Pa |
| | 9.99Pa | 9.90Pa |
| | 15.00Pa | 15.02Pa |
| | 20.00Pa | 20.10Pa |
| | 50.00Pa | 50.10Pa |
| | 99.99Pa | 100.08Pa |
| | 149.99Pa | 151.0Pa |
| | 200.00Pa | 201.2Pa |
| | 300.00Pa | 301.2Pa |
| | 0.00Pa | 0.00Pa |
| Negative Pressure | 0.00Pa | 0.00Pa |
| | -5.00Pa | -4.95Pa |
| | -10.00Pa | -9.93Pa |
| | -15.00Pa | -14.90Pa |
| | -20.00Pa | -18.86Pa |
| | -50.01Pa | -49.61Pa |
| | -100.00Pa | -99.66Pa |
| | -150.01Pa | -148.8Pa |
| | -200.00Pa | -199.8Pa |
| | -300.00Pa | -298.5Pa |
| | 0.00Pa | 0.00Pa |

**Uncertainties**

| | |
|---|---|
| Pressure Range | 0 to ±300Pa: ±(0.10% rdg + 0.11 Pa) |
| Temperature Range | -80°C to 0°C; ±(0.05°C). |
| Temperature | -20.00 °C to 80.00 °C : ±(0.04 °C) |
| Air Velocity | 0.15 m/s to 0.29 m/s; ±(0.71% of reading + 0.031 m/s)<br>0.30 m/s to 2.00 m/s; ±(0.72% of reading + 0.08 m/s)<br>2.01 m/s to 5.00 m/s; ±(0.80% of reading + 0.08 m/s)<br>5.01 m/s to 16.00 m/s; ±(0.81% of reading + 0.20 m/s) |
| Total uncertainty | Equals the above plus twice the devices resolution. |



CERTIFICATE OF CALIBRATION

UKAS Accredited Calibration Laboratory No. 0807
*AS FOUND RESULTS*

Certificate Number
UK20787

Page 5 of 6 Pages

Test Title | Applied Value | Reading

**CALIBRATION RESULTS (Contd....), TEMPERATURE.**

***TEMPERATURE PROBE DESCRIPTION / ID***

***Probe 1: S/N BIS16355, Length 90mm, Diameter 1mm, Type Immersion***

| | | |
|---|---|---|
| Temperature | 0.00°C | -0.1°C |
| | -30.01°C | -30.2°C |
| | 20.14°C | 20.1°C |
| | 25.14°C | 25.0°C |
| | 37.14°C | 37.1°C |
| | 0.00°C | -0.1°C |

***Probe 2: S/N BIS16960, Length 100mm, Diameter 3mm, Type Immersion***

| | | |
|---|---|---|
| Temperature | 0.00°C | 0.0°C |
| | 20.14°C | 20.1°C |
| | 25.14°C | 25.1°C |
| | 37.14°C | 37.2°C |
| | 0.00°C | 0.0°C |

**Uncertainties**

| | |
|---|---|
| Pressure Range | 0 to ±300Pa: ±(0.10% rdg + 0.11 Pa) |
| Temperature Range | -80°C to 0°C; ±(0.05°C). |
| Temperature | -20.00 °C to 80.00 °C : ±(0.04 °C) |
| Air Velocity | 0.15 m/s to 0.29 m/s; ±(0.71% of reading + 0.031 m/s)<br>0.30 m/s to 2.00 m/s; ±(0.72% of reading + 0.08 m/s)<br>2.01 m/s to 5.00 m/s; ±(0.80% of reading + 0.08 m/s)<br>5.01 m/s to 16.00 m/s; ±(0.81% of reading + 0.20 m/s) |
| Total uncertainty | Equals the above plus twice the devices resolution. |

## CERTIFICATE OF CALIBRATION

UKAS Accredited Calibration Laboratory No. 0807
*AS FOUND RESULTS*

Certificate Number
UK20767

Page 6 of 6 Pages

| Test Title | Applied Value | Reading |
|---|---|---|

**CALIBRATION RESULTS (Cont'd...), AIR VELOCITY, AIRFOIL.**

***AIRFOIL DESCRIPTION / ID***
***S/N BIS16367, Length 520mm, Diameter 9mm***

| | | |
|---|---|---|
| Airfoil velocity | 0.19m/s | 0.15m/s |
| *Ambient air density 1.1886 kg/m³* | | |
| | 0.51m/s | 0.46m/s |
| *Ambient air density 1.1878 kg/m³* | | |
| | 1.01m/s | 0.96m/s |
| *Ambient air density 1.1870 kg/m³* | | |
| | 2.00m/s | 1.96m/s |
| *Ambient air density 1.1810 kg/m³* | | |
| | 4.00m/s | 3.96m/s |
| *Ambient air density 1.1798 kg/m³* | | |
| | 6.99m/s | 6.95m/s |
| *Ambient air density 1.1811 kg/m³* | | |
| | 10.0m/s | 9.96m/s |
| *Ambient air density 1.1805 kg/m³* | | |

*The actual ambient conditions during the velocity calibration were as follows*
*Start: Air Temperature: 19.0°C, Baro. Pressure: 1009.9 mbar, RH: 46.1%rh*
*End: Air Temperature: 21.1°C, Baro. Pressure: 1008.9 mbar, RH: 43.7%rh*

*End.*

**Uncertainties**

| | |
|---|---|
| Pressure Range | 0 to ±500Pa: ±(0.10% rdg + 0.11 Pa) |
| Temperature Range | -30°C to 0°C: ±(0.05°C) |
| Temperature | -20.00 °C to 80.00 °C : ±(0.04 °C) |
| Air Velocity | 0.15 m/s to 0.29 m/s, ±(0.71% of reading + 0.031 m/s)<br>0.30 m/s to 2.00 m/s: ±(0.72% of reading + 0.06 m/s)<br>2.01 m/s to 5.00 m/s: ±(0.82% of reading + 0.06 m/s)<br>5.01 m/s to 15.00 m/s: ±(0.81% of reading + 0.20 m/s) |
| Total uncertainty | Equals the above plus twice the devices resolution |

## CERTIFICATE OF CALIBRATION

This is to certify that the instrument detailed below has been calibrated using standards which are periodically verified and are traceable to national standards where these exist.

| | | |
|---|---|---|
| Customer | : | **Crowthorne Hi-Tec Services Ltd**<br>**On behalf of TECHNISERV** |
| Customer Identifier | : | **TEC 2202** |
| Manufacturer Name | : | **Shortridge** |
| Type | : | **Multimeter ADM – 870 with velgrid** |
| Manufacturers Serial Number | : | **M98807** |
| BSRIA Identifier | : | **113505** |
| Previous BSRIA Identifier | : | **n/a** |
| Calibration Date | : | **13 October 2020** |
| Recommended Next Calibration Date | : | **13 October 2021** |
| Certificate Number | : | **113505 – 13/10/2020** |
| Laboratory Conditions | : | **Temperature** 20 ± 4°C |
| | : | **Humidity** 50 ± 25% rh |

Approved Signature

BSRIA
Instrument Solutions
Old Bracknell Lane West, Bracknell
Berkshire, RG12 7WH, United Kingdom
T: +44 (0) 1344 465314 F: +44 (0) 1344 465556
E: info@bsria.co.uk W: www.bsria.co.uk



## BSRIA CALIBRATION SHEET

| Manufacturers Name & Model | Serial No. | BSRIA Identifier Previous | New |
|---|---|---|---|
| MULTIMETER ADM - 870 WITH VELGRID | M98807 | | 113505 |

| 1) Ref Standard Used | Accuracy | Customer Identifier |
|---|---|---|
| ZZWIN03 | 0.15 to 0.46m/s; ±(2.7% of rdg + 0.02m/s)<br>0.46 to 0.64m/s; ±(2.8% of rdg + 0.02m/s)<br>0.64 to 2.13m/s; ±(2.8% of rdg + 0.03m/s)<br>2.13 to 3.43m/s; ±(2.55% of rdg + 0.04m/s)<br>3.42 to 6.53m/s; ±(2.4% of rdg + 0.06m/s) | TEC 2202 |
| **2) Ref Standard Used** | **Accuracy** | |
| N/A | N/A | |

**CALIBRATION RESULTS**

| FUNCTION | TRUE (m/s) | INDICATED (m/s) | CORRECTION (m/s) |
|---|---|---|---|
| Calibration, 0.1 to 10.0 m/sec range. | 0.00 | 0.00 | 0.00 |
| | 0.15 | 0.18 | -0.01 |
| | 0.31 | 0.32 | -0.01 |
| | 0.40 | 0.42 | -0.02 |
| | 0.50 | 0.54 | -0.04 |
| | 0.60 | 0.65 | -0.05 |
| | 1.01 | 1.08 | -0.07 |

Laboratory conditions :

Temperature : 20.8 °C  Humidity : 44.0 %RH  Barometric Pressure : 1001.5 mbar

Comments :-
Results as found

Date 13 October 2020  Engineer M Bray

All calibrations are traceable to national measurement standards.

# CERTIFICATE OF CALIBRATION

**Issued By** BSRIA Instrument Solutions **Certificate Number** UK20784
**Date of Issue** 09 October 2020

BSRIA Quality Approved M J Trotter

Old Bracknell Lane West, Bracknell
Berkshire, RG12 7AH
T: +44 (0)1344 459 314 | 0800 254 5566
E: calibration@bsria.co.uk
W: www.bsria.co.uk/instruments

ilac-MRA UKAS CALIBRATION 0807



Approved Signatory

**Customer :** Crowthorne Hi-Tec Services Ltd
Beech House, Ancells Business Park, Ancells Road, Fleet. GU51 2UN
On behalf of Techniserv

Date Received : 25 September 2020

**Instrument -**

| | | | |
|---|---|---|---|
| System ID : | 116783 | Job Number : | H51173-3 |
| Description : | Meter + 8400 Hood | Ref. Number : | TEC5642 |
| Manufacturer : | Shortridge | Site : | |
| Model Number : | ADM870C | Location : | |
| Serial Number : | M15483 | Last Certificate Number : | UK20293 |
| Procedure Version : | BAL006V2/N | Last Calibration Date : | 13/05/2019 |

**Environmental Conditions**

| | | | |
|---|---|---|---|
| Temperature : | 20°C +/- 4°C | Mains Voltage : | 240V +/- 10V |
| Relative Humidity : | 50% +/- 20% | Mains Frequency : | 50Hz +/- 1Hz |

**Comments**

The following certificate only relates to the ADM870C capture hood function.
Capture hood measurement section Serial Number :- BIS17594.

Results recorded as received. No adjustment performed.

**Calibration Information**

The instrument was calibrated against laboratory standards whose values are traceable to recognised National Standards. The uncertainty limits quoted refer to the measured values only, with no account being taken of the instruments ability to maintain its calibration.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

**Calibrated By :** M. Bray M. Bray **Date of Calibration :** 09 October 2020

## CERTIFICATE OF CALIBRATION

Certificate Number UK20784

**UKAS Accredited Calibration Laboratory No. 0807**
***AS FOUND RESULTS***

Page 2 of 4 Pages

| Test Title | Applied Value | Reading |
|---|---|---|
| **CALIBRATION PROCEDURE** | | |

***Before the commencement of the calibration , a pressure equivalent to the ADM meters full scale was applied to the instrument and then decreased to zero. This procedure was repeated 3 times.***

***The balometer was affixed to the front face of a bidirectional reference wind tunnel using a nominal 610 x 610mm fabric hood.***

***The balometer was mounted in a horizontal orientation with the display uppermost***

***The wind tunnel was set to the volume flow rates shown and left to stabilise before any measurements were taken.***

***Over a 1 minute interval 10 readings were recorded for the wind tunnel and the balometer being calibrated. The average of these readings is shown within this certificate. The wind tunnels readings are shown as the applied value.***

***The ADM meter was fitted with temperature probe S/N BIS17595.***

***The above procedure was repeated for all volume flow rates shown.***

***The results shown are at actual conditions.***

***The air density for each calibration point was also recorded for reference only.***

***The balometer was calibrated with no diffuser fitted to the front of the wind tunnel, the balometers hood was then placed over this. The balometers performance may differ when other diffuser are used.***

***The balometer was operated with back pressure compensation off.***

**Uncertainties**

| | |
|---|---|
| Volume Flow Rate | 20 l/s to 60 l/s; ±(2.7 % of reading + 3.2 l/s)<br>60 l/s to 110 l/s; ±(2.6 % of reading + 3.6 l/s)<br>110 l/s to 280 l/s; ±(1.9 % of reading + 4.0 l/s)<br>280 l/s to 450 l/s; ±(2.5 % of reading + 7.0 l/s)<br>450 l/s to 900 l/s (Supply) or 780 l/s (Extract); ±(2.4 % of reading + 8.8 l/s) |
| Total uncertainty | Equals the above plus the devices indicated resolution shown in this certificate |

## CERTIFICATE OF CALIBRATION

Certificate Number UK20784

**UKAS Accredited Calibration Laboratory No. 0807**
***AS FOUND RESULTS***

Page 3 of 4 Pages

| Test Title | Applied Value | Reading |
|---|---|---|
| **CALIBRATION RESULTS** | | |
| ***SUPPLY MODE*** | | |
| SUPPLY POINT 1<br>***Ambient Air Density 1.1983 kg/m³*** | 20.4l/s | 20l/s |
| SUPPLY POINT 2<br>***Ambient Air Density 1.1977 kg/m³*** | 50.1l/s | 53l/s |
| SUPPLY POINT 3<br>***Ambient Air Density 1.1958 kg/m³*** | 100.4l/s | 106l/s |
| SUPPLY POINT 4<br>***Ambient Air Density 1.1944 kg/m³*** | 150.8l/s | 157l/s |
| SUPPLY POINT 5<br>***Ambient Air Density 1.1920 kg/m³*** | 200.2l/s | 206l/s |
| SUPPLY POINT 6<br>***Ambient Air Density 1.1941 kg/m³*** | 400.9l/s | 412l/s |
| SUPPLY POINT 7<br>***Ambient Air Density 1.1901 kg/m³*** | 702.2l/s | 725l/s |

**Uncertainties**

| | |
|---|---|
| Volume Flow Rate | 20 l/s to 60 l/s; ±(2.7 % of reading + 3.2 l/s)<br>60 l/s to 110 l/s; ±(2.6 % of reading + 3.6 l/s)<br>110 l/s to 280 l/s; ±(1.9 % of reading + 4.0 l/s)<br>280 l/s to 450 l/s; ±(2.5 % of reading + 7.0 l/s)<br>450 l/s to 900 l/s (Supply) or 780 l/s (Extract); ±(2.4 % of reading + 8.8 l/s) |
| Total uncertainty | Equals the above plus the devices indicated resolution shown in this certificate |

## CERTIFICATE OF CALIBRATION

Certificate Number UK20784

**UKAS Accredited Calibration Laboratory No. 0807**
***AS FOUND RESULTS***

Page 4 of 4 Pages

| Test Title | Applied Value | Reading |
|---|---|---|
| ***EXTRACT MODE*** | | |
| EXTRACT POINT 1<br>***Ambient Air Density 1.1976 kg/m³*** | -20.3l/s | -22l/s |
| EXTRACT POINT 2<br>***Ambient Air Density 1.1976 kg/m³*** | -50.2l/s | -52l/s |
| EXTRACT POINT 3<br>***Ambient Air Density 1.1963 kg/m³*** | -100.8l/s | -104l/s |
| EXTRACT POINT 4<br>***Ambient Air Density 1.1925 kg/m³*** | -151.3l/s | -156l/s |
| EXTRACT POINT 5<br>***Ambient Air Density 1.1948 kg/m³*** | -200.3l/s | -205l/s |
| EXTRACT POINT 6<br>***Ambient Air Density 1.1980 kg/m³*** | -401.2l/s | -414l/s |
| EXTRACT POINT 7<br>***Ambient Air Density 1.1920 kg/m³*** | -695.2l/s | -700l/s |

***End.***

**Uncertainties**

| | |
|---|---|
| Volume Flow Rate | 20 l/s to 60 l/s; ±(2.7 % of reading + 3.2 l/s)<br>60 l/s to 110 l/s; ±(2.6 % of reading + 3.6 l/s)<br>110 l/s to 280 l/s; ±(1.9 % of reading + 4.0 l/s)<br>280 l/s to 450 l/s; ±(2.5 % of reading + 7.0 l/s)<br>450 l/s to 900 l/s (Supply) or 780 l/s (Extract); ±(2.4 % of reading + 8.8 l/s) |
| Total uncertainty | Equals the above plus the devices indicated resolution shown in this certificate |

## Calibration Certificate
**No. 079892 – 200415**
**According to ISO 21501-4**

| | |
|---|---|
| **Customer:** | **Techniserv SA**<br>**CH – 1292 Chambésy** |
| **Customer No.:** | **10018** |
| **CRT order No.:** | **20207075** |
| **CLiMET Model:** | **CI-450t** |
| **Serial number:** | **079892** |
| **Calibration date:** | **15.04.2020** |
| **Next Calibration:** | **15.04.2021** |
| **Calibrated by:** | **Huu Nguyen** |
| **Calibration result:** | **The device complies with the manufacturer specifications** |

### Calibration of CLiMET Particle Counter according to ISO 21501-4

As official distributor of CLiMET Instruments Company (in the following referred to as „CLiMET") CRT Cleanroom-Technology GmbH (in the following referred to as „CRT") runs a calibration laboratory in D-52477 Alsdorf and CH-4332 Stein, fully equipped according to the specifications of CLiMET. For the instrument mentioned above, the manufacturer recommends annual recalibration.

CLiMET particle counters are factory-calibrated prior to delivery and recalibrated by CRT on arrival in accordance with current standards. The standards and corresponding operating procedures are subject to ongoing internal quality review and can be viewed at any time.

Calibration traceability to a National Measurement Standard (NIST) is established by using monodisperse latex spheres as a calibration standard. These spheres are sized by methods traceable, by lot number, to NIST. Therefore, traceability to national and international standards is constantly assured and copies of the filed calibration certificates can be requested at any time.

Stein, the 15.04.2020

Huu Nguyen
Calibration technician

Stein, the 16.04.2020

Manuel Kalt
Quality management

CRT Cleanroom-Technology GmbH
Carl-Zeiss-Straße 25
D-52477 Alsdorf

Phone: +49 (0)2404 95690 0
Fax: +49 (0)2404 95690 11
E-Mail: info@crt-gmbh.de

page 1 of 4

**Calibration Certificate**
**No. 079892 – 200415**
**According to ISO 21501-4**

| | |
|---|---|
| Customer: | Techniserv SA |
| | CH – 1262 Chambilly |
| Customer No.: | 10018 |
| CRT order No.: | 20207075 |
| CLiMET Model: | CI-450i |
| Serial number: | 079892 |
| Calibration date: | 15.04.2020 |
| Next Calibration: | 15.04.2021 |
| Calibrated by: | Huu Nguyen |

Calibration result: **The device complies with the manufacturer specifications**

**Calibration of CLiMET Particle Counter according to ISO 21501-4**

As official distributor of CLiMET Instruments Company (in the following referred to as „CLiMET") CRT Cleanroom-Technology GmbH (in the following referred to as „CRT") runs a calibration laboratory in D-52477 Alsdorf and CH-4332 Stein, fully equipped according to the specifications of CLiMET. For the instrument mentioned above, the manufacturer recommends annual recalibration.

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Stein, the 15.04.2020

Huu Nguyen
Calibration technician

Stein, the 15.04.2020

Manuel Kalt
Quality management



page 2 of 4

**Calibration Certificate**
**No. 079892 – 200415**
**According to ISO 21501-4**

**As found values**

| Test point | Set point and tolerance | As found | Pass |
|---|---|---|---|
| Flow | 50.0 l/min ± 2.5 l/min | 49.0 l/min | Yes |
| Background noise | ≤ 220 mV | 185 mV | Yes |
| Particle size 0.3 µm | 307 mV ± 60 mV | 333 mV | Yes |
| Particle size 0.5 µm | 305 mV ± 30 mV | 314 mV | Yes |
| Particle size 1.0 µm | 783 mV ± 155 mV | 739 mV | Yes |
| Particle size 5.0 µm | 368 mV ± 60 mV | 391 mV | Yes |

Status of device as found: The device complies with the manufacturer specifications

Comments: N.A.

**As left values**

| Test point | As left | Pass |
|---|---|---|
| Flow | 50.0 l/min | Yes |
| Background noise | 179 mV | Yes |
| Particle size 0.3 µm | 300 mV | Yes |
| Particle size 0.5 µm | 301 mV | Yes |
| Particle size 1.0 µm | 948 mV | Yes |
| Particle size 5.0 µm | 389 mV | Yes |

Status of device as left: The device complies with the manufacturer specifications

Comments: N.A.

CRT Cleanroom-Technology GmbH | Phone: +49 (0)2404 95690 0 | PO-CAL-44
Carl-Zeiss-Straße 25 | Fax: +49 (0)2404 95690 11 | Certificate CI-15x DN
D-52477 Alsdorf | E-Mail: info@crt-gmbh.de | V2.0

page 3 of 4

**Calibration Certificate**
**No. 079892 – 200415**
**According to ISO 21501-4**

**Output Values ISO 21501-4**

**Zero Count Test**

| Test point | Set point and tolerance | Measurement value | Pass |
|---|---|---|---|
| Zero count test at 0.3 µm channel | Max. 4 particles / cubicmeter at 95 % UCL | 0 particles | Yes |

**Count Efficiency Test**

| Test point | Set point and tolerance | Measurement value | Pass |
|---|---|---|---|
| Count efficiency test 0.3 µm | 50 % ± 20 % | 62 % | Yes |
| Count efficiency test 0.5 µm | 100 % ± 10 % | 102 % | Yes |

**Resolution**

| Test point | Set point and tolerance | Measurement value | Pass |
|---|---|---|---|
| Resolution at 0.4 µm channel | ≤ 15 % | 6 % | Yes |

CRT Cleanroom-Technology GmbH | Phone: +49 (0)2404 95690 0 | PO-CAL-44
Carl-Zeiss-Straße 25 | Fax: +49 (0)2404 95690 11 | Certificate CI-45x DN
D-52477 Alsdorf | E-Mail: info@crt-gmbh.de | V2.0

page 4 of 4

**Calibration Certificate**
**No. 079892 – 200415**
**According to ISO 21501-4**

**Reference Instruments on Calibration Rig S2**

| Manufacturer | Label | Type | Serial number |
|---|---|---|---|
| Climet | Aerosol Generator | CI-328 | 191918 |
| Climet | Reference Counter | CI-68R | 182864 |
| Novasina AG | Thermohygrometer | neSens-HT-ENS | HT-ne190431 6 |
| TSI | Flowmeter | 4040 | 40401931001 |
| Fluke | Multimeter | 177 | 44230324 |

**Calibration Standards (Latex Spheres)**

| Manufacturer | Diameter | Tolerance | LOT number |
|---|---|---|---|
| Thermo Scientific | 0.303 µm | ±0.006 µm | 189603 |
| Thermo Scientific | 0.400 µm | ±0.009 µm | 189604 |
| Thermo Scientific | 0.496 µm | ±0.008 µm | 190396 |
| Thermo Scientific | 0.904 µm | ±0.015 µm | 19329 |
| Thermo Scientific | 4.964 µm | ±0.042 µm | 220148 |

**Environmental conditions during calibration**

| Test point | Set point and tolerance | Measurement value | Pass |
|---|---|---|---|
| Room temperature | 18 °C to 26 °C | 22 °C | Yes |
| Relative humidity | N.A. | 18 % | N.A. |
| Barometric pressure | N.A. | 99 kPa | N.A. |

**Spare Parts**

N.A.

CRT Cleanroom-Technology GmbH | Phone: +49 (0)2404 95690 0 | PO-CAL-44
Carl-Zeiss-Straße 25 | Fax: +49 (0)2404 95690 11 | Certificate CI-45x DN
D-52477 Alsdorf | E-Mail: info@crt-gmbh.de | V2.0

SWISS CALIBRATION SERVICE / LABOR 1

Calibration Laboratory accredited by the Swiss Accreditation Service according to ISO/IEC 17025

rotronic MEASUREMENT SOLUTIONS

Zertifikat-Nr. / N° de certificat / Certificate No. / No. di certificato: **SZ-20192184**

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# Kalibrierzertifikat / Certificat d'étalonnage
# Calibration Certificate / Certificato di calibrazione

Gemäss ILAC Abkommen vom 12.10.2010 wird dieses Zertifikat von mehr als 50 Signatarstaaten anerkannt.
Ce certificat est reconnu par plus de 50 pays signataires des accords du 12.10.2010 et membres de l'ILAC.
According to the agreement of 12.10.2010, this certificate is recognised by more than 50 ILAC signatory states.
In conformità all'accordo ILAC del 12.10.2010, il presente certificato è riconosciuto da più di 50 paesi firmatari. www.ilac.org

| | |
|---|---|
| Auftraggeber / Donneur d'ordre / Customer / Committente | **Techniserv SA** |
| Auftrags-Datum / Date de commande / Date of order / Data dell'ordine | **27.11.2019** |
| Auftrags-Nr. / N° de commande / Order No. / No. d'ordine | **103490** |
| Gegenstand / Objet / Object / Oggetto | **Sensormodul** |
| Hersteller / Fabricant / Manufacturer / Fabbricante | **Rotronic AG** |
| Typ / Type / Model / Tipo | **HC2-SH** |
| Serie-Nr. / Numéro de série / Serial no. / Numero di serie | **0059900245** |
| Prüfmittel-ID / N° d´Ident. de l´instrument / Test equipment-ID / Numero d'identificazione dello strumento | **TEC 5683** |
| Spezifikation / Spécification / Specification / Specifica | **STY11009_v2** |
| Kalibrier-Datum / Date d'étalonnage / Date of calibration / Data della calibrazione | **04.12.2019** |
| Bemerkungen / Remarques / Remarks / Osservazioni | **HC2-SH mit HP23-A S/N 61471459 kalibriert** |

Messresultate, Messunsicherheiten mit Vertrauensbereich und Messverfahren sind Teil dieses Zertifikates.
Der Inhalt dieses Zertifikates darf nur in vollständiger Form veröffentlicht oder weitergegeben werden. Zertifikate ohne Unterschrift und Stempel haben keine Gültigkeit.
Dieses Kalibrierzertifikat dokumentiert die Rückverfolgbarkeit auf nationale Normale zur Darstellung der physikalischen Einheiten (SI).
Die angegebene erweiterte Messunsicherheit ist die Standardunsicherheit der Messung multipliziert mit einem Erweiterungsfaktor k = 2, was für eine Normalverteilung einem Vertrauensniveau von etwa 95% entspricht.

Les résultats de mesures, incertitudes de mesure et méthodes de mesure sont parties intégrantes de ce certificat.
Le contenu de ce certificat ne peut être publié ou transmis que sous sa forme complète. Les certificats dépourvus de signature et de cachet ne sont pas valables.
Ce certificat d'étalonnage documente la tracabilité aux étalons nationaux pour matérialisation des unités physiques (SI).
L'incertitude de mesure élargie indiquée est l'incertitude de mesure standard multipliée par un facteur d'extension k = 2 qui correspond, pour une répartition normale, à un niveau de fiabilité d'environ 95%.

The measurements, the uncertainties with confidance probability and the calibration methods are part of the certificate.
This certificate shall not be published or reproduced other than in full. The certificate is not valid without signature and stamp.
This calibration certificate documents the traceability to national standards which represent the physical units of measurements (SI).
The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

I risultati di misurazione, le incertezze di misurazione - compreso il grado di attendibilità - e il metodo di misurazione fanno parte del presente certificato.
Il contenuto del presente certificato potrà essere pubblicato o ceduto ad altri solo in forma completa. I certificati privi di firma e di timbro non sono validi.
Il presente certificato di calibrazione documenta la tracciabilità in base agli standard nazionali relativi alle unità fisiche di misurazione (SI).
L'incertezza di misurazione estesa indicata corrisponde all'incertezza di misurazione standard moltiplicata per un fattore di estensione k = 2, che per una distribuzione normale corrisponde a un grado di attendibilità di circa il 95%.

| Stempel und Datum / Cachet et date / Stamp and date / Timbro e data | Leiter der Kalibrierstelle / Chef du laboratoire d'étalonnage / Head of the calibration laboratory / Direttore del laboratorio di calibrazione | Für die Kalibrierung / Pour l'étalonnage / For the calibration / Per la calibrazione |
|---|---|---|
| rotronic ag<br>Grindelstrasse 6, • CH-8303 Bassersdorf<br>Tel. 044 838 11 11 • Fax 044 836 44 24<br>info@rotronic.ch • www.rotronic.com<br>4.12.19 | **Raphael von Bergen** | **Christian Walder** |

Re: Vorlage : SZY-12004_v3 Datum: 19.06.2019 Ersteller: VOR Kontrolle: VOR Freigabe: 19.06.2019 VOR

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MEASUREMENT SOLUTIONS

| ROTRONIC AG<br>SCS 065 Labor 1 | Kalibrierzertifikat / Certificat d'étalonnage<br>Calibration Certificate / Certificato di calibrazione | SZ-20192184<br>Seite: 3 von 3 |
|---|---|---|

**WERTE-TABELLE / TABLEAU DE MESURES / MEASUREMENT TABLE / TABELLA DIE VALORI**

| Sollwerteinstellungen<br>Valeurs de consigne<br>Setpoint values<br>Taratura dei valori reali | | Gemessene Werte Bezugsnormal<br>Valeurs mesurées de référence<br>Measured reference values<br>Valori standard di riferimento misurati | | Gemessene Werte Prüfling<br>Valeurs mesurées par l'instrument étalonné<br>Values measured by the calibrated instrument<br>Valori misurati dallo strumento | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Relative Feuchte [%rF]<br>Humidité relative [%HR]<br>Relative humidity [%rh]<br>Umidità relativa [%UR] | Temperatur [°C]<br>Température [°C]<br>Temperature [°C]<br>Temperatura [°C] | Relative Feuchte [%rF]<br>Humidité relative [%HR]<br>Relative humidity [%rh]<br>Umidità relativa [%UR] | Temperatur [°C]<br>Température [°C]<br>Temperature [°C]<br>Temperatura [°C] | Relative Feuchte [%rF]<br>Humidité relative [%HR]<br>Relative humidity [%rh]<br>Umidità relativa [%UR] *1) | Messunsicherheit [%rF]<br>Incertitude de mesure [%HR]<br>Uncertainty of measurement [%rh]<br>Incertezza di misura [%UR] | Temperatur [°C]<br>Température [°C]<br>Temperature [°C]<br>Temperatura [°C] *1) | Messunsicherheit<br>Incertitude de mesure<br>Uncertainty of measurement [K]<br>Incertezza di misura [K] | Relative Feuchte [%rF]<br>Humidité relative [%HR]<br>Relative humidity [%rh]<br>Umidità relativa [%UR] *2) | Messunsicherheit [%rF]<br>Incertitude de mesure [%HR]<br>Uncertainty of measurement [%rh]<br>Incertezza di misura [%UR] | Temperatur [°C]<br>Température [°C]<br>Temperature [°C]<br>Temperatura [°C] *2) | Messunsicherheit<br>Incertitude de mesure<br>Uncertainty of measurement [K]<br>Incertezza di misura [K] |
| 10 | 23 | 10.26 | 23.04 | 9.40 | 0.4 | 23.05 | 0.15 | | | | |
| 35 | 23 | 35.06 | 23.05 | 34.00 | 0.5 | 23.05 | 0.15 | | | | |
| 65 | 23 | 65.02 | 23.06 | 63.87 | 0.9 | 23.08 | 0.15 | | | | |
| 95 | 23 | 94.81 | 23.10 | 93.60 | 0.9 | 23.13 | 0.15 | | | | |
| 10 | 5 | 10.27 | 4.95 | 9.57 | 0.5 | 4.92 | 0.15 | | | | |
| 35 | 5 | 35.08 | 4.97 | 34.47 | 0.6 | 4.96 | 0.15 | | | | |
| 65 | 5 | 65.11 | 4.99 | 64.64 | 1.2 | 4.97 | 0.15 | | | | |
| 95 | 5 | 94.54 | 4.99 | 93.05 | 1.2 | 4.99 | 0.15 | | | | |
| 10 | 50 | 10.20 | 49.99 | 9.53 | 0.5 | 50.02 | 0.2 | | | | |
| 35 | 50 | 35.03 | 50.04 | 34.18 | 0.6 | 50.08 | 0.25 | | | | |
| 65 | 50 | 65.00 | 50.12 | 64.31 | 1.0 | 50.18 | 0.25 | | | | |
| 95 | 50 | 94.25 | 50.17 | 92.99 | 1.6 | 50.21 | 0.25 | | | | |

*1) Datenübernahme 1 / Acquisition de données 1 / Data acquisition 1/ Acquisizione dati 1

*2) Datenübernahme 2 / Acquisition de données 2 / Data acquisition 2/ Acquisizione dati 2

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|---|---|---|---|---|---|

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MEASUREMENT SOLUTIONS

| ROTRONIC AG<br>SCS 065 Labor 1 | Kalibrierzertifikat / Certificat d'étalonnage<br>Calibration Certificate / Certificato di calibrazione | SZ-20192184<br>Seite: 2 von 3 |
|---|---|---|

**KALIBRIERBEDINGUNGEN**
Der Prüfling wurde unter Laborbedingungen mindestens 8 Std. gelagert.

Der Prüfling muss bei jeder Prüftemperatur mindestens 2 Stunden stabilisiert werden.
Der Prüfling muss bei jeder Solltemperatur mindestens 20 Min. auf ±2 %rF / ±0.5 °C des Sollwertes klimatisiert werden.
Die Messung erfolgt wenn der Ist- und Sollwert mindestens 5 Mn. stabil bleiben (Kontrollpunkt, KP4).

Während dieser Zeit ist der Prüfling elektrisch gespeist resp. Eingeschaltet.
Vor jedem Datentransfer wurden eventuelle Abweichungen zu Toleranzen der Kontrollpunkte (KP1 - 4) überprüft.

**KALIBRIERVERFAHREN**
Die Prüfung wird mit dem Dynamic-Calibrator ROTRONIC Model 922 durchgeführt.
Die Durchflussmenge der aufbereiteten Luft am Prüfling beträgt ca.10 l/min. (KP1)

**BEZUGSNORMALE**
Feuchtegenerator , DPH922 (Thunder 2500)
Feuchte-Normal , rückgeführt auf nationalen Standard
Temperatur-Normal , rückgeführt auf nationalen Standard
Spannungs-Strom-Normal , SCS kalibriert

**LABORBEDINGUNGEN**
Raumtemperatur, 23 °C ±2 °C (KP2)

Luftfeuchte , 45 %rF ±15 %rF (KP3)

**GELTUNGSBEREICH DER MESSUNGEN**
Alle ermittelten Werte gelten nur unter vorgenannten Bedingungen für den Zeitpunkt der Messung. Dieses Kalibrierzertifikat dokumentiert die Rückverfolgbarkeit auf nationale Normale zur Darstellung der physikalischen Einheiten (SI).
Ein Anteil für Langzeitstabilität ist nicht enthalten.

**KENNZEICHNUNG**
Geräte und Fühler wurden mit der Kontrollmarke SCS 065 versehen.

**DATUM DER KALIBRIERUNG**
Die Messungen erfolgten am 04.12.2019

**CONDITIONS D'ETALONNAGE**
L'instrument a été entreposé pendant 8 heures minimum sous conditions climatiques du laboratoire.
L'instrument est stabilisé pendant 2 heures minimum pour chaque point de temperature.
L'instrument doit être acclimaté pendant au moins 20 min à ±2 %HR et ±0,5 °C de la valeur de chaque point de consigne.
La mesure a lieu lorsque la valeur de référence et la valeur mesurée par l'instrument étalonné sont stables pendant au moins 5 min.
(Point de contrôle KP4).
L'appareil reste sous tension et enclenché pendant tout ce temps.
Avant chaque transfert de données, d'éventuelles déviations sont vérifiées par rapport aux tolérances des points de contrôle (KP1 - 4).

**PROCÉDÉ D'ETALONNAGE**
Les mesures sont realisées avec un calibrateur dynamique ROTRONIC Modèle 922
Le débit d'air conditionné au niveau de l'éprouvette est d'environ 10l/min (KP1)

**REFERENCES ETALONS**
Générateur d'humidité , DPH922 (Thunder 2500)
Référence étalon d'humidité , traçable au standard national
Référence étalon de température , traçable au standard national
Norme de tension et courant, certifiée SCS

**CONDITIONS CLIMATIQUES DU LABORATOIRE**
Température ambiante, 23 °C ±2 °C (KP2)
Humidité de l'air , 45 %HR ±15 %HR (KP3)

**VALIDITE DES MESURES**
Les valeurs de mesures relevées ne sont valables que sous les conditions précitées et à l'instant de la mesure.
Ce certificat documente la traçabilité aux étalons nationaux pour matérialisation des unités physiques (SI).

La stabilité à long terme n'est pas prise en compte.

**ETIQUETAGE**
L'instrument est marqué au moyen d'une étiquette autocollante SCS 065.

**DATE D'ETALONNAGE**
Date d'étalonnage 04.12.2019

**CALIBRATION CONDITIONS**
The instrument was stored under laboratory conditions during at least 8 hours.
The instrument must be stabilized at each testing temperature at least 2 hours.
The calibrated instrument must be acclimated, at least during 20 min. at ±2 %rh / ±0.5 °C of each temperature setpoint.
The measurement is carried out when the reference value and the value of the calibrated instrument are stable during at least 5 min.
(Control point KP4).
During this time the instrument is powered, respectively switched on.
Before each data transfer, possible deviations to the tolerances of the control points (KP1 - 4) are checked.

**CALIBRATION METHOD**
The testing is carried out with the calibration unit ROTRONIC Model 922

The air flow for testing is approx. 10 l/min. (KP1)

**STANDARDS**
Humidity generator , DPH922 (Thunder 2500)
Humidity standard , traceable to national standard
Temperature standard , traceable to national standard
Voltage-current standard, SCS calibrated

**LABORATORY CONDITIONS**
Room temperature, 23 °C ±2 °C (KP2)

Air humidity , 45 %rh ±15 %rh (KP3)

**VALID RANGE OF THE MEASUREMENTS**
All established values are only valid under above named conditions for the moment of measuring. This calibration certificate documents the traceability to national standards, which materializes the physical units of measurements (SI).
A share for long-term stability is not contained.

**MARK**
The instrument was provided with the control sticker SCS 065.

**DATE OF CALIBRATION**
The measurements occured on 04.12.2019

**CONDIZIONI DI CALIBRAZIONE**
Lo strumento è stato tenuto per un minimo di 8 ore alle condizioni climatiche del laboratorio.
In ogni misurazione della temperatura, lo strumento deve essere stabilizzato per almeno 2 ore.
Per ogni temperatura nominale, lo strumento deve essere acclimatizzato per almeno 20 minuti a ±2 %HR e ±0,5 °C del valore nominale.
La misurazione avviene quando il valore reale e il valore nominale dello strumento sono stabili per almeno 5 minuti (punto di controllo KP4).

Durante questo periodo lo strumento è sotto tensione ed è acceso.
Prima di ogni trasferimento dei dati, sono stati controllati eventuali scarti dalle tolleranze dei punti di controllo (KP1 - 4).

**PROCEDIMENTO DI CALIBRAZIONE**
Il test è effettuato con il Dynamic-calibrator 922 Modello ROTRONIC

Il flusso d'aria per il test è di circa 10l/min. (KP1)

**STANDARD DI RIFERIMENTO**
Generatore di umidità, DPH922 (Thunder 2500)
Umidità standard, conforme agli standard nazionali
Temperatura standard, conforme agli standard nazionali
Tensione e corrente standard, calibrazione SCS

**CONDIZIONI CLIMATICHE DEL LABORATORIO**
Temperatura ambiente, 23 °C ±2 °C (KP2)
Umidità dell'aria, 45 %ur ±15 %ur (KP3)

**GAMMA DEI VALORI DI MISURAZIONE**
Tutti i valori misurati sono validi solo alle condizioni menzionate per il momento della misurazione. Il presente certificato di calibrazione documenta la tracciabilità con gli standard nazionali relativi alle unità fisiche di misurazione (SI).
La stabilità a lungo termine non è presa in considerazione.

**ETICHETTATURA**
Gli strumenti sono forniti con un'etichetta di controllo SCS 065.

**DATA DELLA CALIBRAZIONE**
Data della misurazione 04.12.2019

**PRÜFLING / ECHANTILLON / CALIBRATED INSTRUMENT / STRUMENTO CALIBRATO**

| | |
|---|---|
| Speisung / Alimentation / Supply / Alimentazione | via USB |
| *1) Datenübernahme 1 / Acquisition de données 1 / Data acquisition 1/ Acquisizione dati 1 | UART, auto |
| Ausgang H / Sortie H / Output H / Uscita H | |
| Ausgang T / Sortie T / Output T / Uscita T | |
| Koeffizienten/ Coefficients / Coefficients / Coefficienti | |
| *2) Datenübernahme 2 / Acquisition de données 2 / Data acquisition 2/ Acquisizione dati 2 | |
| Ausgang H / Sortie H / Output H / Uscita H | |
| Ausgang T / Sortie T / Output T / Uscita T | |
| Anschlusskabel / Câble de raccordement / Connecting cable / Cavo di connessione | AC3001-L |
| SCS-Kontrollmarke / Vignette de contrôle SCS / SCS control sticker / Etichetta di controllo SCS | 1 x HC2-SH / 1 x HP23 |

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|---|---|---|---|---|---|



Visa : GGO