

# ISO Accredited Fan Calibration Certificate



Issued by: **Retrotec**

Date & time of calibration: from **2015-05-26 0945** to **2015-05-26 1138**

Certificate Number: **600261138**

Results: **As Left**

Calibration laboratory:

**Retrotec**  
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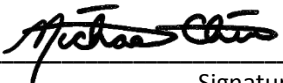
AC-1943

This calibration laboratory has been assessed by the ANSI-ASQ National Accreditation Board and meets the requirements of international standard ISO/IEC 17025:2005. All pressure and flow devices used in this calibration are traceable to the National Institute of Standards and Technology.

Device being calibrated:

Description: **Test Fan**  
Manufacturer: **Retrotec**  
Model Number: **6000**  
Shell Serial Number: **3PH600026**  
Mains Voltage: **120V AC ±10V**  
Mains Frequency: **60Hz ±1Hz**

Calibrated By:

  
Signature

Reference Flow:

Nozzle Chamber, in accordance with ANSI/AMCA 210-07:

**Nozzles #2, #4, #5, #6** – 8" diameter  
**Nozzles #1, #3** – 7" diameter  
**Nozzle #7** – 6" diameter  
**Nozzle #8** – 4" diameter  
**Nozzle #9** – 3" diameter  
**Nozzle #10** – 2" diameter  
**Nozzle #11** – 1" diameter

Chamber Pressure measured on: **DM2-5 Gauge Serial number 205303-A**

Device's Fan Pressure measured on: **DM2-5 Gauge Serial number 203503-B**

Laminar Flow Elements (LFE) Chamber:

**LFE#2**, Model **50MC2-4LHL**, Serial number **712110-A3**, on **DM2-5 Gauge Serial number 200795-B**

**LFE#3**, Model **50MC2-2LHL**, Serial number **712110-A2**, on **DM32-20 Gauge Serial number 401969-A**

**LFE#4**, Model **50MH10-2**, Serial number **712110-A1**, on **DM32-20 Gauge Serial number 401969-B**

Chamber Pressure measured on: **DM2-5 Gauge Serial number 205274-A**

Device's Fan Pressure measured on: **DM2-5 Gauge Serial number 205274-B**

Calibration Information:

The Device was calibrated against laboratory standards whose values are traceable to recognized national standards. The results and uncertainty limits refer to the measured values only, with no account being taken of the instrument's ability to maintain its calibration. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with ANSI/ISO/IEC 17025:2005 requirements.

Calibration Procedure: **Procedure ID No. CP-60-01**

This Calibration Certificate shall not be reproduced except in full, without written approval from Retrotec

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## Calibration Results:

Start of calibration: Barometric pressure= **101.4 kPa**, Temperature= **19.2°C**, Humidity= **54.4%**

End of calibration: Barometric pressure= **101.7 kPa**, Temperature= **22.7°C**, Humidity= **35.4%**

Flow rates are corrected to STP conditions of 20°C, 101.325 Pa and 50% RH.

| From Flow Chamber Reference |                               |              |                          |                     | Test Fan being Calibrated |           |                  |               |                             |       |
|-----------------------------|-------------------------------|--------------|--------------------------|---------------------|---------------------------|-----------|------------------|---------------|-----------------------------|-------|
| Chamber Pressure (BP), Pa   | Background leakage at BP, CFM | Nozzles Used | Nozzle wall pressure, Pa | Total STP Flow, CFM | Range Configuration       | Fan speed | Fan Pressure, Pa | STP Flow, CFM | STP Flow, m <sup>3</sup> /h | Error |
| 24.8                        | 8.44                          | 1,3,4,6,7    | 452.0                    | 7601                | Open                      | 100%      | 194.5            | 7562          | 12848                       | -0.5% |
| 25.0                        | 8.49                          | 1,3,4,6,7    | 170.0                    | 4653                | Open                      | 40%       | 75.0             | 4705          | 7994                        | 1.1%  |
| 25.0                        | 8.49                          | 1,3,4,6,7    | 30.0                     | 1949                | Open                      | 6%        | 13.0             | 1966          | 3340                        | 0.9%  |
| 24.6                        | 8.40                          | 4,6,9        | 626.5                    | 4690                | Ring A                    | 100%      | 260.5            | 4684          | 7958                        | -0.1% |
| 25.0                        | 8.49                          | 4,6,9        | 260.0                    | 3020                | Ring A                    | 40%       | 110.0            | 3039          | 5163                        | 0.6%  |
| 25.0                        | 8.49                          | 4,6,9        | 55.0                     | 1389                | Ring A                    | 15%       | 24.0             | 1415          | 2404                        | 1.9%  |
| 24.7                        | 8.42                          | 5,8          | 656.0                    | 2808                | B8                        | 100%      | 394.0            | 2855          | 4851                        | 1.7%  |
| 25.0                        | 8.49                          | 5,8          | 280.0                    | 1836                | B8                        | 40%       | 175.0            | 1842          | 3130                        | 0.3%  |
| 25.0                        | 8.49                          | 5,8          | 65.0                     | 888.2               | B8                        | 17%       | 45.0             | 884.7         | 1503                        | -0.4% |
| 25.2                        | 8.54                          | 7            | 640.0                    | 1257                | B4                        | 100%      | 401.5            | 1266          | 2151                        | 0.7%  |
| 25.0                        | 8.49                          | 7            | 250.0                    | 789.4               | B4                        | 40%       | 165.0            | 788.6         | 1340                        | -0.1% |
| 25.0                        | 8.49                          | 8,9          | 70.0                     | 297.6               | B4                        | 15%       | 25.0             | 301.5         | 512.3                       | 1.3%  |
| 24.6                        | 8.40                          | 8            | 581.0                    | 540.2               | B2                        | 100%      | 404.0            | 544.8         | 925.6                       | 0.9%  |
| 25.0                        | 8.49                          | 8            | 220.0                    | 337.7               | B2                        | 40%       | 165.0            | 337.5         | 573.4                       | -0.1% |
| 25.0                        | 8.49                          | 9            | 80.0                     | 124.8               | B2                        | 15%       | 30.0             | 124.5         | 211.5                       | -0.3% |
| 25.3                        | 8.57                          | 9            | 458.5                    | 277.8               | B1                        | 100%      | 415.5            | 273.2         | 464.2                       | -1.7% |
| 25.0                        | 8.49                          | 9            | 170.0                    | 174.9               | B1                        | 41%       | 175.0            | 173.8         | 295.3                       | -0.6% |
| 25.0                        | 8.49                          | 10           | 110.0                    | 73.0                | B1                        | 15%       | 30.0             | 73.4          | 124.7                       | 0.6%  |

Calibration and measurement capability (Expanded Uncertainty) is 1.2% of reading, based on a 95% confidence interval, using a coverage of k=2

| From Flow Chamber Reference |                               |          |                  |                     | Test Fan being Calibrated |           |                  |               |                             |       |
|-----------------------------|-------------------------------|----------|------------------|---------------------|---------------------------|-----------|------------------|---------------|-----------------------------|-------|
| Chamber Pressure (BP), Pa   | Background leakage at BP, CFM | LFE Used | LFE pressure, Pa | Total STP Flow, CFM | Range Configuration       | Fan speed | Fan Pressure, Pa | STP Flow, CFM | STP Flow, m <sup>3</sup> /h | Error |
| 25.3                        | 0.056                         | 2        | 242.0            | 157.9               | B74                       | 100%      | 435.0            | 160.3         | 272.4                       | 1.5%  |
| 25.0                        | 0.055                         | 2        | 155.0            | 100.0               | B74                       | 40%       | 190.0            | 101.3         | 172.1                       | 1.3%  |
| 25.0                        | 0.055                         | 2        | 60.0             | 38.2                | B74                       | 12%       | 35.0             | 37.5          | 63.7                        | -1.7% |
| 25.1                        | 0.055                         | 3        | 460.0            | 71.6                | B47                       | 100%      | 432.0            | 71.9          | 122.2                       | 0.5%  |
| 25.0                        | 0.055                         | 3        | 300.0            | 46.8                | B47                       | 40%       | 190.0            | 47.2          | 80.2                        | 0.9%  |
| 25.0                        | 0.055                         | 3        | 150.0            | 23.3                | B47                       | 16%       | 50.0             | 23.4          | 39.8                        | 0.3%  |
| 25.7                        | 0.056                         | 4        | 1225             | 25.9                | B29                       | 100%      | 460.0            | 26.0          | 44.2                        | 0.5%  |
| 25.0                        | 0.055                         | 4        | 750.0            | 16.1                | B29                       | 40%       | 170.0            | 16.3          | 27.7                        | 1.1%  |
| 25.0                        | 0.055                         | 4        | 300.0            | 6.58                | B29                       | 10%       | 25.0             | 6.60          | 11.2                        | 0.3%  |

Calibration and measurement capability (Expanded Uncertainty) is 3.5% of reading, based on a 95% confidence interval, using a coverage of k=2

  
Initial

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Date & time of calibration: from **2015-05-26 0945** to **2015-05-26 1138**

Results: **As Left**

## Published Flow Equation Parameters:

| Range Configuration | Serial number | N, exponent | K, constant, CFM/Pa <sup>N</sup> | Minimum flow, m <sup>3</sup> /h | Maximum flow, m <sup>3</sup> /h at 25 Pa |
|---------------------|---------------|-------------|----------------------------------|---------------------------------|--|
| Open                | 3PH600026     | 0.498       | 548                              | 4625                            | 12848                                    |
| Ring A              | 3PH600026-A   | 0.502       | 287                              | 2454                            | 7958                                     |
| B8                  | 3PH600026-B   | 0.54        | 113.25                           | 1410                            | 4851                                     |

$$\text{Flow, CFM} = P^N * K$$

Where  $P$  = Fan Pressure, in Pascals

| Range Configuration | Serial number | g  | f     | a           | b           | c      | d     | Minimum flow, m <sup>3</sup> /h | Maximum flow, m <sup>3</sup> /h at 25 Pa |
|---------------------|---------------|----|-------|-------------|-------------|--------|-------|---------------------------------|--|
| B4                  | 3PH600026-B   | 0  | 0.7   | 0.00000662  | -0.0078     | 4.75   | 205   | 541.9                           | 2151                                     |
| B2                  | 3PH600026-B   | 40 | 0.85  | 0.000003    | -0.0037     | 2.2    | 49    | 247.6                           | 925.6                                    |
| B1                  | 3PH600026-B   | 65 | 0.2   | 0.00000106  | -0.001382   | 0.937  | 38.5  | 133.2                           | 464.2                                    |
| B74                 | 1023695       | 25 | 0.145 | 0.000000796 | -0.0009501  | 0.59   | 18    | 69.9                            | 272.4                                    |
| B47                 | 1022957       | 25 | 0.09  | 2.69043E-07 | 0.000359055 | 0.2435 | 12.05 | 43.5                            | 122.2                                    |
| B29                 | 1023251       | 25 | -0.02 | 0.000000111 | -0.000149   | 0.092  | 4.4   | 10.4                            | 44.2                                     |

$$\text{Flow, CFM} = P^3*a+P^2*b+P*c+d+(g-|PrA|)*f$$

Where  $P$  = Fan Pressure, in Pascals

Published Flow Equation Parameters shown are designated as "Round B" for traceability purposes.