

ICS 17.020
CCS A 61

JJF

**INDUSTRY STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

JJF 1562-2016

**Calibration Specification for Condensation Particle Counters
(English Translation)**

Issued on: June 27, 2016

Implemented on: September 27, 2016

**Issued by: General Administration of Quality Supervision, Inspection and
Quarantine**

Table of Contents

1	Scope
2	References
3	Terms
3.1	Aerosols
3.2	Differential electromigration separator
3.3	Faraday cup aerosol electrometer
3.4	Particle number concentration
4	Overview
5	Metrological characteristics
6	Calibration conditions
6.1	Environmental conditions
6.2	Calibration standards and other equipment
7	Calibration items and calibration methods
7.1	Zero point
7.2	Flow indication error
7.3	Flow stability
7.4	Particle counting efficiency
7.5	Particle count repeatability
8	Calibration result expression
9	Recalibration interval

1 Scope

This specification applies to the calibration of condensation nuclei particle counters.

2 References

This specification references the following documents.

ISO 15900:2009 Measurement of aerosol particle size distribution Differential electromigration method Calibration of aerosol particle number concentration condensation nuclei particle counters for dated references, only the dated version applies to this specification; for undated references document, its latest version (including all amendments) applies to this specification.

3.1 Aerosols

A dispersion of solid and/or liquid particles suspended in a gas.

3.2 Differential electromigration separator

Aerosol particles can be selected and separated according to electrical mobility, and monodisperse samples can be obtained. A separator, also known as electrostatic classifier.

3.3 Faraday cup aerosol electrometer

An electrometer used to measure the charge concentration carried by aerosol particles, referred to as aerosol electrometer (AE).

3.4 Particle number concentration

The number of particles in a unit volume of gas.

4 Overview

Condensation nuclei particle counter (abbreviated as CPC in this specification) is mainly composed of saturation chamber, condensation chamber, optical detector (laser beam, prism, detection cavity, detector) and flow control system are composed of four parts. Figure 1 is a simplified structure diagram of CPC.

The working principle of CPC is. when the aerosol passes through the saturated cavity and the condensation cavity, due to the condensation of the supersaturated vapor of the working fluid on the particle surface, the particle size will increase accordingly. When it flows through the laser detection area at a certain speed, by measuring the scattered light signal of the particle per unit time, the particle number concentration in the aerosol is calculated. The working fluid in the saturation chamber is usually n-butanol, isopropanol or water.

5 Metrological characteristics

The measurement characteristics of CPC are shown in Table 1, and the performance indicators are for reference during calibration.

6.1 Environmental conditions

6.1.1

Ambient temperature. (18~30)°C;

6.1.2

Relative humidity. 20%~80%;

6.1.3

Laboratory cleanliness. no less than 10,000 class clean room or clean area;

6.1.4

Others. Keep away from vibration, electromagnetic interference, and avoid direct sunlight.

6.2 Calibration standards and other equipment

6.2.1

Calibration device for condensation nuclei particle counter. particle concentration range (50~10000) pieces/cm³, particle concentration the uncertainty of the calibration result is better than 3.5% (k=2). Please refer to Appendix A for the principle and composition.

6.2.2

Particle size standard material. National certified standard material should be used, and the average particle size should be in the range of (80~120)nm Within, the relative uncertainty of the average particle size is not more than 10% (k=2).

6.2.3

Soap film flowmeter. measuring range (50~5000) mL/min, accuracy grade not lower than 1.5.

7 Calibration items and calibration methods

Calibration items can be selected according to the intended use of the instrument being calibrated. Deviations from the calibration specifications shall be noted in the calibration certificate.

7.1 Zero point

Connect the high-efficiency filter (the filtration efficiency of particles not smaller than 0.1μm is better than 99.99%) to the gas of CPC at the entrance of the sol, and run continuously for more than 5 minutes. Afterwards, 30 measured values C_{0i} are recorded.

7.2 Flow indication error

7.2.1

For the CPC with adjustable flow, select 2 flow values near 1/3 and 2/3 of the flow range as calibration for a CPC with a fixed flow rate, this flow value is selected as the calibration point.

7.2.2

Connect the soap film flowmeter to the inlet of the CPC, read the three measured values of the soap film flowmeter, and calculate the Mean $\cdot Q_1$. Calculate the sampling flow error of CPC according to formula (2), and take the ΔQ with the largest absolute value as the flow indication error.

7.3 Flow stability

7.3.1

For the CPC with adjustable flow rate, select the value near the middle flow rate as the calibration point, and for the CPC with fixed flow rate CPC, choose this flow value as the calibration point.

7.3.2

Connect the soap film flowmeter to the inlet of the CPC, record the reading of the soap film flowmeter after the instrument is stable, and then Run continuously for 15 minutes without adjusting the flow rate, record the readings of the soap film flowmeter every 3 minutes, a total of 6 times, according to the formula

7.4 Particle counting efficiency

7.4.1

Connect the calibration device according to Appendix A. Use an aerosol generator to atomize the particle size standard substance and dry it by diffusion Monodisperse aerosol particle samples were obtained after drying, aerosol neutralizer and differential electromigration separator. By adjusting the granularity Standard substance concentration, adjust the flow of clean compressed air and aerosol generator, transfer the differential electromigration separator outlet the particle concentration is controlled around 7000/cm³.

7.4.2

By adjusting the dilution ratio f of the aerosol diluter, control the measured value of CPC at (50~100) pieces/cm³, (200~400)pcs/cm³, (500~1000)pcs/cm³, (2000~3000)pcs/cm³ and (6000~

7000) pieces/cm³ range. At each concentration, the measurement results of CPC and FCAE were recorded within 30 s, and a total of Count 3 times, and calculate the average CCPC and CFCAE of the 3 measurement results.

7.4.3

Calculate the particle counting efficiency of the condensation nuclei particle counter at different concentrations according to the formula (4).