

# ISO 19996:2024-10 (E)

## Charge conditioning of aerosol particles for particle characterization and the generation of calibration and test aerosols

---

<b>Contents</b>		<b>Page</b>
	Foreword.....	v
	Introduction.....	vi
<b>1</b>	<b>Scope</b> .....	<b>1</b>
<b>2</b>	<b>Normative references</b> .....	<b>1</b>
<b>3</b>	<b>Terms and definitions</b> .....	<b>1</b>
<b>4</b>	<b>Symbols and abbreviated terms</b> .....	<b>2</b>
<b>5</b>	<b>General principle</b> .....	<b>2</b>
5.1	General.....	2
5.2	Ionization sources.....	3
5.2.1	General.....	3
5.2.2	Sources with radioisotopes.....	3
5.2.3	Soft X-ray sources.....	5
5.2.4	Corona discharge.....	6
5.3	Charge conditioning.....	7
5.3.1	General.....	7
5.3.2	Bipolar charge conditioners.....	7
5.3.3	Unipolar charge conditioners.....	8
5.4	The charge distribution function.....	9
5.4.1	General.....	9
5.4.2	Charge distribution function for radioactive bipolar charge conditioners.....	9
5.4.3	Charge distribution functions for other bipolar and unipolar charge conditioners.....	9
<b>6</b>	<b>Factors influencing the resulting charge distribution</b> .....	<b>10</b>
6.1	General.....	10
6.2	Aerosol particle characteristics influencing the charge distribution.....	10
6.2.1	Particle size and surface area.....	10
6.2.2	Particle number and surface area size distribution and concentration.....	12
6.2.3	Particle pre-charge.....	12
6.3	Aerosol carrier gas characteristics influencing the charge distribution.....	13
6.3.1	Carrier gas composition.....	13
6.3.2	Carrier gas pressure and temperature.....	13
6.3.3	Carrier gas humidity.....	13
6.4	Charge conditioner operating parameters influencing the charge distribution.....	13
6.4.1	Aerosol flow rate.....	13
6.4.2	Ion production rate.....	14
6.5	Others.....	14
6.5.1	Surplus ions downstream of device.....	14
6.5.2	Particle losses to the chamber wall.....	14
6.5.3	Aerosol dilution in the charge conditioner.....	15
6.5.4	Generation of artefact particles.....	15
<b>7</b>	<b>Operational parameters for device specification</b> .....	<b>15</b>
<b>8</b>	<b>Test procedures for determining the suitability of charge conditioners</b> .....	<b>15</b>
8.1	Guidance to test procedures in the annexes.....	15
8.2	Charge conditioner performance verification.....	16
8.3	Particle losses in a charge conditioner.....	16
8.4	Particle generation rate.....	16
8.5	Charge distribution of bipolar charge conditioners.....	16

<b>9</b>	<b>Cleaning and maintenance including safety issues</b>	<b>17</b>
<b>Annex A (informative)</b>	<b>Implementation of bipolar steady-state charge conditioning</b>	<b>18</b>
<b>Annex B (informative)</b>	<b>Performance test procedures for charge conditioners</b>	<b>24</b>
<b>Annex C (informative)</b>	<b>Electrostatic precipitator to provide uncharged aerosol particles</b>	<b>37</b>
<b>Annex D (informative)</b>	<b>Concentration series test for charge conditioners</b>	<b>39</b>
<b>Annex E (informative)</b>	<b>Example set of tests for bipolar charge conditioners</b>	<b>45</b>
<b>Annex F (informative)</b>	<b>Test method for bipolar charge conditioners with ambient aerosols</b>	<b>53</b>
	<b>Bibliography</b>	<b>55</b>