

# ISO 16890-2:2022-07 (E)

## Air filters for general ventilation - Part 2: Measurement of fractional efficiency and air flow resistance

---

<b>Contents</b>		<b>Page</b>
Foreword .....		vi
Introduction .....		viii
<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>3.1</b>	<b>Air flow and resistance .....</b>	<b>2</b>
<b>3.2</b>	<b>Test device .....</b>	<b>2</b>
<b>3.3</b>	<b>Aerosol .....</b>	<b>2</b>
<b>3.4</b>	<b>Particle counter .....</b>	<b>3</b>
<b>3.5</b>	<b>Efficiency .....</b>	<b>3</b>
<b>3.6</b>	<b>Other terms .....</b>	<b>4</b>
<b>4</b>	<b>Symbols and abbreviated terms .....</b>	<b>4</b>
<b>4.1</b>	<b>Symbols .....</b>	<b>4</b>
<b>4.2</b>	<b>Abbreviated terms .....</b>	<b>6</b>
<b>5</b>	<b>General test requirements .....</b>	<b>6</b>
<b>5.1</b>	<b>Test device requirements .....</b>	<b>6</b>
<b>5.2</b>	<b>Test device installation .....</b>	<b>6</b>
<b>5.3</b>	<b>Test rig requirements .....</b>	<b>7</b>
<b>6</b>	<b>Test materials .....</b>	<b>7</b>
<b>6.1</b>	<b>Liquid phase aerosol .....</b>	<b>7</b>
<b>6.1.1</b>	<b>DiEthylHexylSebacate (DEHS) test aerosol .....</b>	<b>7</b>
<b>6.1.2</b>	<b>DEHS properties .....</b>	<b>7</b>
<b>6.1.3</b>	<b>Liquid phase aerosol generation .....</b>	<b>7</b>
<b>6.2</b>	<b>Solid phase aerosol .....</b>	<b>8</b>
<b>6.2.1</b>	<b>Potassium chloride (KCl) test aerosol .....</b>	<b>8</b>
<b>6.2.2</b>	<b>KCl properties .....</b>	<b>8</b>
<b>6.2.3</b>	<b>Solid phase aerosol generation .....</b>	<b>9</b>
<b>6.3</b>	<b>Reference aerosols .....</b>	<b>10</b>
<b>6.3.1</b>	<b>Reference aerosol for 0,3 µm to 1,0 µm .....</b>	<b>10</b>
<b>6.3.2</b>	<b>Reference aerosol for 1,0 µm to 10,0 µm .....</b>	<b>10</b>
<b>6.4</b>	<b>Aerosol loading .....</b>	<b>10</b>
<b>7</b>	<b>Test equipment .....</b>	<b>11</b>
<b>7.1</b>	<b>Test rig .....</b>	<b>11</b>
<b>7.1.1</b>	<b>Dimensions .....</b>	<b>11</b>
<b>7.1.2</b>	<b>Construction materials .....</b>	<b>11</b>
<b>7.1.3</b>	<b>Test rig shape .....</b>	<b>12</b>
<b>7.1.4</b>	<b>Test rig air supply .....</b>	<b>12</b>
<b>7.1.5</b>	<b>Test rig isolation .....</b>	<b>12</b>
<b>7.1.6</b>	<b>D/S mixing orifice .....</b>	<b>12</b>
<b>7.1.7</b>	<b>Aerosol sampling .....</b>	<b>13</b>
<b>7.1.8</b>	<b>Test rig air flow rate measurement .....</b>	<b>15</b>
<b>7.1.9</b>	<b>Resistance to air flow measurement .....</b>	<b>15</b>
<b>7.1.10</b>	<b>Test devices not measuring 610 mm × 610 mm (24.0 inches × 24.0 inches) .....</b>	<b>16</b>

7.1.11	Dust injection testing .....	16
7.2	Aerosol particle counter .....	17
7.2.1	General .....	17
7.2.2	OPC sampled size range .....	17
7.2.3	OPC particle size ranges .....	17
7.2.4	Sizing resolution .....	18
7.2.5	Calibration .....	18
7.2.6	Air flow rate .....	18
7.2.7	Zero counting .....	18
7.2.8	Dual OPC(s) .....	18
7.3	Temperature, relative humidity .....	18
8	Qualification of test rig and apparatus .....	19
8.1	Schedule of qualification testing requirements .....	19
8.1.1	General .....	19
8.1.2	Qualification testing .....	19
8.1.3	Qualification documentation .....	19
8.2	Qualification testing .....	20
8.2.1	Test rig -- Pressure system testing .....	20
8.2.2	OPC -- Air flow rate stability test .....	21
8.2.3	OPC -- Zero test .....	21
8.2.4	OPC -- Sizing accuracy .....	21
8.2.5	OPC -- Overload test .....	22
8.2.6	Aerosol generator -- Response time .....	22
8.2.7	Aerosol generator -- Neutralizer .....	23
8.2.8	Test rig -- Air leakage test .....	24
8.2.9	Test rig -- Air velocity uniformity .....	24
8.2.10	Test rig -- Aerosol uniformity .....	25
8.2.11	Test rig -- Downstream mixing .....	26
8.2.12	Test rig -- Empty test device section pressure .....	28
8.2.13	Test rig -- 100 % efficiency test and purge time .....	28
8.2.14	Test rig -- Correlation ratio .....	29
8.3	Maintenance .....	29
8.3.1	General .....	29
8.3.2	Test rig -- Background counts .....	30
8.3.3	Test rig -- Reference filter test .....	30
8.3.4	Test rig -- Pressure reference test .....	31
8.3.5	Test rig -- Final filter resistance .....	32
9	Test methods .....	32
9.1	Air flow rate .....	32
9.2	Measurement of resistance to air flow .....	32
9.3	Measurement of fractional efficiency .....	32
9.3.1	Aerosol sampling protocol .....	32
9.3.2	Background sampling .....	32
9.3.3	Testing sequence for a single OPC .....	33
9.3.4	Testing sequence for dual OPC .....	37
10	Data reduction and calculations .....	38
10.1	Correlation ratio .....	38
10.1.1	Correlation ratio general .....	38
10.1.2	Correlation ratio data reduction .....	39
10.2	Penetration and fractional efficiency .....	40
10.2.1	Penetration and fractional efficiency general .....	40
10.2.2	Penetration data reduction .....	41
10.3	Data quality requirements .....	43
10.3.1	Correlation background counts .....	43
10.3.2	Efficiency background counts .....	43
10.3.3	Correlation ratio .....	43
10.3.4	Penetration .....	44
10.4	Fractional efficiency calculation .....	45

<b>11</b>	<b>Reporting results</b> .....	<b>45</b>
<b>11.1</b>	<b>General</b> .....	<b>45</b>
<b>11.2</b>	<b>Required reporting elements</b> .....	<b>45</b>
<b>11.2.1</b>	<b>Report general</b> .....	<b>45</b>
<b>11.2.2</b>	<b>Report values</b> .....	<b>45</b>
<b>11.2.3</b>	<b>Report summary</b> .....	<b>46</b>
<b>11.2.4</b>	<b>Report details</b> .....	<b>47</b>
<b>Annex A (informative) Example</b> .....		<b>50</b>
<b>Annex B (informative) Resistance to air flow calculation</b> .....		<b>57</b>
<b>Bibliography</b> .....		<b>59</b>