Turun ammattikorkeakoulu Kira Circularis -projekti
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# VIRTAUSRESISTIIVISYYDEN MÄÄRITYS STANDARDIN ISO 9053:2018 MUKAAN

## 1 TILAAJA

Turku AMK, Kira Circularis -projekti.

## 2 TARKOITUS

Tarkoitus oli määrittää virtausresistiivisyys standardin ISO 9053:2018 mukaisesti. Joka tuotteesta toimitettiin kolme näytettä (vesileikattu kiekko, halkaisija 63,50 mm), joista raportoidaan mittausten keskiarvo. Mittausmenettelyt kuvataan liitteessä 1.

## 3 TULOKSET

Taulukko 1. Näytteiden ominaisvirtausvastus $R_s$ (specific airflow resistance) ja ilmavirtausresistiivisyys $\sigma$ (airflow resistivity).

| **Näytenimi**<br>Lisäkuvaus | $R_s$ **[kPa·s/m]** | $\sigma$ **[kPa·s/m²]** |
|---|---|---|
| **Näyte 1, Isku, kokonaispaksuus 48.0 mm**<br>Kerros 1: Pintakangas 119 kg/m³, paksuus 1.6 mm<br>Kerros 2: Kuitukangas 147 kg/m³, paksuus 0.1 mm<br>Kerros 3: Vaahtomuovi 23 kg/m³, paksuus 3.0 mm<br>Kerros 4: Vanu 30 kg/m³, paksuus 38.7 mm<br>Kerros 5: Vaahtomuovi 23 kg/m³, paksuus 3.0 mm<br>Kerros 6: Kuitukangas 147 kg/m³, paksuus 0.1 mm<br>Kerros 7: Pintakangas 119 kg/m³, paksuus 1.6 mm | 6.6 | 137 |
| **Näyte 2, Intermedius, kokonaispaksuus 29.2 mm**<br>Kerros 1: Pintakangas 119 kg/m³, paksuus 1.6 mm<br>Kerros 2: Pet-huopa 128 kg/m³, paksuus 26.0 mm<br>Kerros 3: Pintakangas 119 kg/m³, paksuus 1.6 mm | 34.2 | 1314 |
| **Näyte 3, Intermedius, kokonaispaksuus 55.2 mm**<br>Kerros 1: Pintakangas 119 kg/m³, paksuus 1.6 mm<br>Kerros 2: Pet-huopa 128 kg/m³, paksuus 26.0 mm<br>Kerros 3: Pet-huopa 128 kg/m³, paksuus 26.0 mm<br>Kerros 4: Pintakangas 119 kg/m³, paksuus 1.6 mm | 27.6 | 500 |

## 4 ALLEKIRJOITUKSET

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## LIITTEET

Liite 1: Mittausmenetelmä

**Measurements according to ISO 9053:2018**

Specific airflow resistance $R_s$ [Pa·s/m] is defined as

$$R_s = \frac{A \cdot \Delta p}{q_V} \quad (1)$$

and airflow resistivity $\sigma$ [Pa·s/m$^2$] is defined as

$$\sigma = \frac{R_s}{d} \quad (1)$$

where $q_V$ [m$^3$/s] is the volumetric flow rate through the specimen as generated by pressure difference $\Delta p$ [Pa] over the specimen, $A$ [m$^2$] is cross sectional area of the specimen perpendicular to the flow, and $d$ [m] is its thickness. Thus, $\sigma$ is a property of the material, and $R_s$ is the property of the specific sample. Airflow resistivity is measured according to method A (direct airflow method) of the standard ISO 9053:2018(E).

The specimen was a cylindrical piece of material, cut to fit tightly in the specimen tube with diameter 63.5 mm, see Fig. A2.1. The lateral surface of the specimen is sealed with petroleum jelly to prevent leakage flow. The flow through the specimen is produced by a vacuum pump and regulated by a rotameter equipped with a flow control valve. Since the airflow resistivity is not fully independent of the volume flow rate, the result is given at flow velocity 0.5 mm/s, corresponding to particle velocity at sound pressure level 80 dB, as recommended in the standard. With the specimen tube used in the measurement, this means volume flow rate $q_V$ = 0.095 l/min = 1.58 μm$^3$/s. Because this small flow is hard to measure precisely, the volume flow rate is reduced stepwise from 9 to 2.5 l/min and is then extrapolated to 0.095 l/min, see Fig. A2.2a.

Figure A2.1b demonstrates the analysis procedure. The airflow resistivity $\sigma$ is calculated at eight different $q_V$ values between 9 and 2.5 l/min (150 and 42×10$^{-6}$ m$^3$/s) using Eq. (1) and plotted as a function of $q_V$. A linear fit is then made and extrapolated to $q_V$ = 0.095 l/min = 1.58 μm$^3$/s.

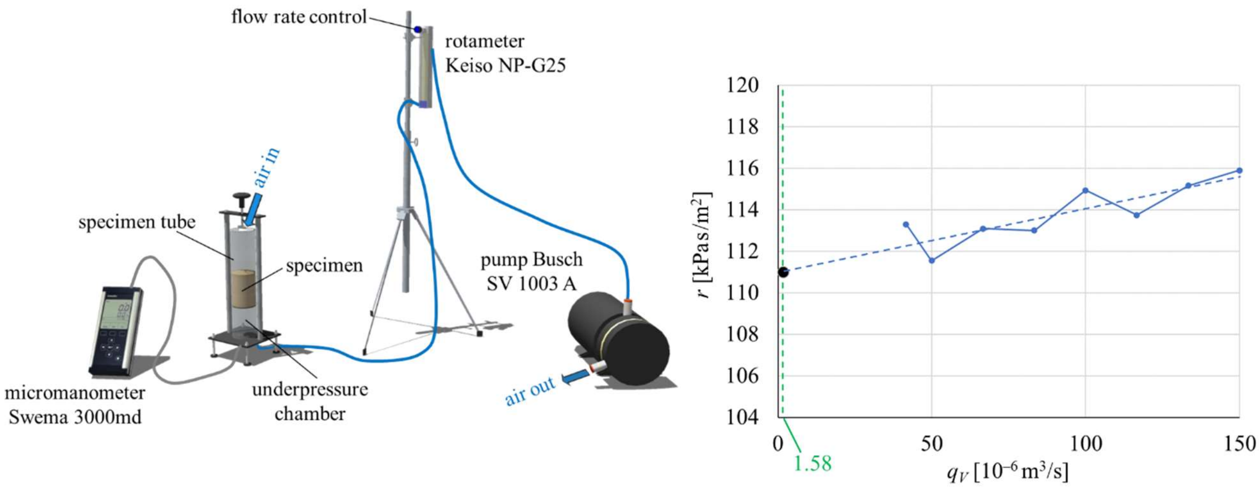


**Fig. A2.1.** a) The measurement arrangement. b) Extrapolation method.