



- 1 Modular heating/ cooling panels at the outside of the test chamber
 - 2 Heated and CO₂ emitting dummies placed inside the test chamber
 - 3 Filter (left) and flow measuring section (right)
- Figures 1–3 © Fraunhofer IBP

INDOOR AIR TEST CENTER (IATC) MOTOR VEHICLE AND FILTER TEST FACILITY

Fraunhofer Institute for Building Physics IBP

Fraunhoferstrasse 10
83626 Valley, Germany

Contacts

Energy Efficiency and Indoor Climate
Dr. Harald Will
Phone +49 8024 643-620
harald.will@ibp.fraunhofer.de

Environment, Hygiene and
Sensor Technology
Dr. Matthias Brunnermeier
Phone +49 8024 643-269
matthias.brunnermeier@
ibp.fraunhofer.de

www.ibp.fraunhofer.de/en

At its Holzkirchen site, Fraunhofer IBP has established a unique facility to carry out investigations on indoor climate and air quality. Here it is possible to perform different tests to examine the air quality, air flow and thermal behavior, as well as the effectiveness of active and passive air purification systems. The test center has a volume of 127 m³ (5 x 8,2 x 3,1 m³). Two duct systems are connected in parallel, integrated in the air supply system of the test space and can be operated at volume flow rates of up to 1800 m³/h. Different high precision admixture systems allow generating various atmospheric loads involving chemical and biological substances (incl. particles) and investigating the effectivity of air purification systems. A third test duct enables IBP experts to perform high-precision volume flow measurements and thus to evaluate complex duct systems. Both temperature and humidity of the supply air can be controlled accurately, thus guaranteeing stable test conditions in the

range of up to 40 °C and 55 % r.h. Online examinations of the air composition include the following parameters (among others):

- TVOC (0.1 to 1000 ppm)
- CO₂ (30 to 2000 ppm)
- CO (0.04 to 1 ppm)
- NO_x (1 to 1000 ppb)
- O₃ (1 to 1000 ppb)
- Particles (0.02 to 10 µm) including viruses, bacteria, spores, pollen

Air samples which are collected on special solid phase adsorbents can be investigated offline in the laboratory on the content of individual volatile organic compounds (VOCs), aldehydes, ketones, amines, phthalates, etc. as well as odorous substances. Individual compounds are identified and their concentrations in air determined.



The test space enclosure is lined with surface elements that can be separately heated or cooled; in this way, different wall temperature profiles can be simulated.

Consequently the performance of newly developed products for active and passive air purification, both in the duct system and in the test space, can be precisely measured and analyzed. The test space surfaces are entirely made of stainless steel. Low intrinsic emission minimizes the level of background pollution.

The test space is accessible by vehicles, hence also suited for performing tests in and on e. g. automobiles. Moreover, the test space complies with the requirements on class 1 operating theaters. Due to its flexible room layout, the test space allows to design a wide variety of flow concepts, air outlets, as well as the installation of ceilings with low-turbulence displacement flows and air filter devices.

Special features of the test facility

- Option of generating controlled atmospheric loads involving biological, chemical substances as well as particles of various shapes and sizes including pollen, spores, bacteria, viruses (bacteriophages as surrogate for human pathogenic viruses such as SARS-CoV-2), as well as aerosols
- Control of volume flow rates (max. 1800 m³/h)

- Option of air conditioning (max. 40 °C and 55% relative humidity)
- Removal of air pollutants using different filtration technologies, precise determination of filter functions
- Supply of accurately controllable air volume flows via a very versatile space system featuring a compatible grid of heated/cooled wall/floor and ceiling units
- Inert internal surfaces to minimize the impact on emission measurements and on the efficacy of active and passive air purification systems
- Variable heating or cooling of all wall surfaces at different temperatures
- Installation and measurement of complete air-conditioning systems for operating theaters including ceilings with low-turbulence displacement flows for class 1 operating theaters
- Accessible for vehicles (max. weight: 3.5 t, max. height: 2.5 m)
- Determination of VOC loads in vehicle cabin air, with and without activated ventilation systems (ISO 12219-1)
- VOC tests of material combinations (real scale)
- VOC tests of complete office equipment and interiors in real scale
- Determination of filter functions with regard to particles (including viruses, bacteria, spores, pollen) of air filter devices
- Measurements of different air outlets with regard to their local effects
- Examination of indoor horizontal flows to assess thermal comfort conditions at extreme indoor temperatures

- Deployment of high-tech flow measurement instrumentation including anemometers, ultrasonic measuring devices, tracer gas; visual rendering of 3D-flow patterns using smoke and Particle Image Velocimetry (PIV)

Areas of expertise covered by the multifunctional ventilation test facility

- Optimization of airflows in operating theatres
- Development and evaluation of air purification systems or active cleaning materials
- VOC measurements inside vehicles
- VOC measurements of entire spatial configurations
- Optimization of ventilation concepts with regard to comfort
- industrial ventilation concepts
- validation of simulation models

4 Filter test rig with measurement equipment

5 Vehicle test at IATC

6 Operating theater flow test

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