

# Guidelines for a weighing room for correct microbalance and mass comparator operation



## RADWAG general recommendations:

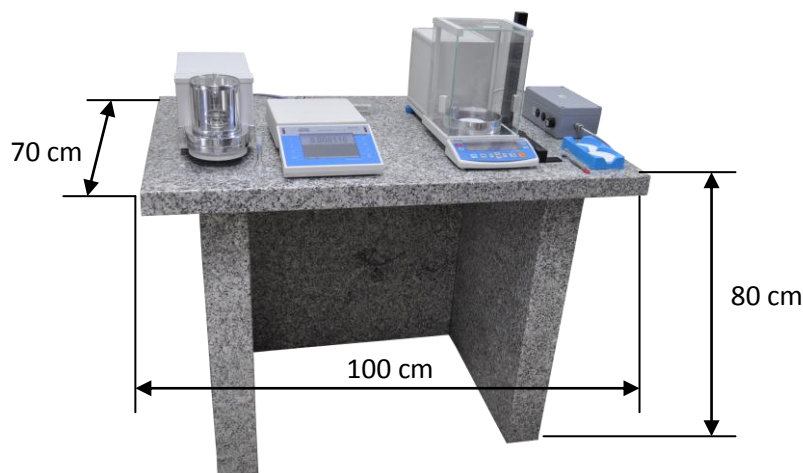
- A testing room with minimal dimensions 3 x 2,5 m.
- There can be no more than 1 person per 8 m<sup>2</sup>.
- The distance of microbalance location from windows and doors has to be at least 1 meter.
- The top (stone top) on which a microbalance is placed must not be attached to walls.
- A microbalance has to be placed on a stable weighing table (with a stone top).
- No perceptible ground vibrations.
- No perceptible air blasts or drafts.
- Microbalance location should not allow direct sunrays onto the instrument.
- Microbalance surrounding should be free from instruments generating heat, vibrations, air blasts or EMC disturbances.
- It is not recommended to use typical wall mounted air conditioning.
- Favourable locations for a microbalance are rooms in basements or on the ground floor.

## Requirements for ambient conditions:

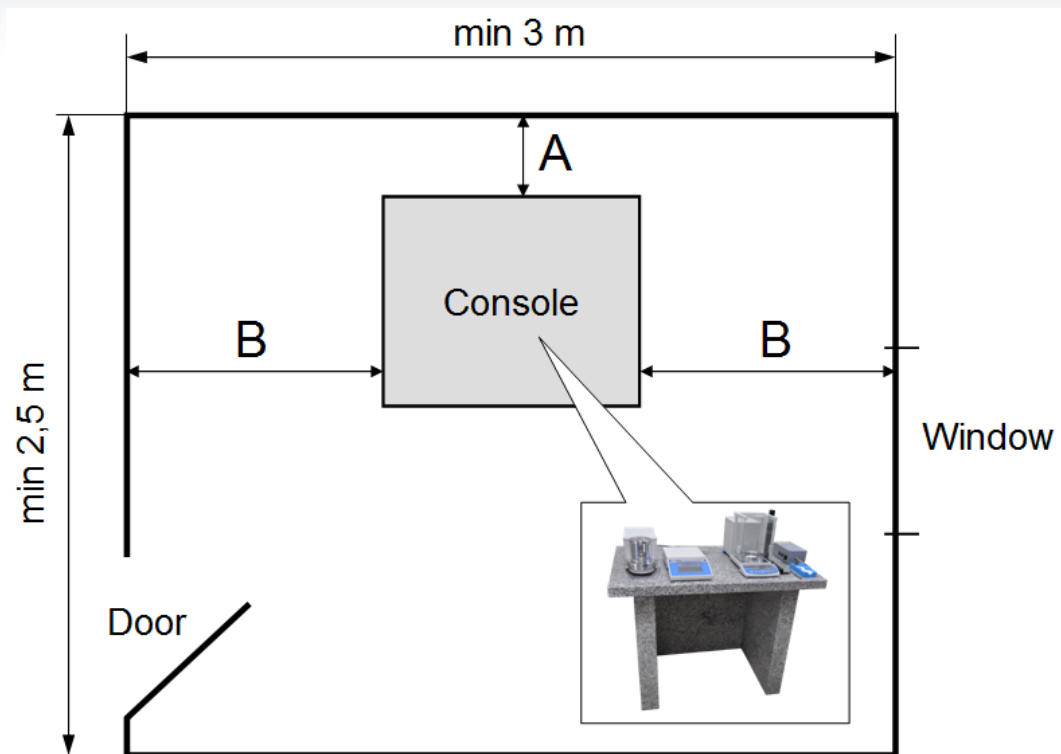
- |                                       |                       |
|---------------------------------------|-----------------------|
| • Working temperature:                | +15° ÷ +35°C          |
| • Working temperature change ratio:   | ±0,3 °C/h (±1 °C/12h) |
| • Relative air humidity:              | 40% ÷ 65%             |
| • Relative air humidity change ratio: | ±5 %/4h               |
| • Air movement near the microbalance: | below 0,1 m/s         |

## Requirements for a single measuring workstation:

- **Single console made of stone**, console dimensions: 100 x 70 x 80 cm



## Area of a single measuring workstation



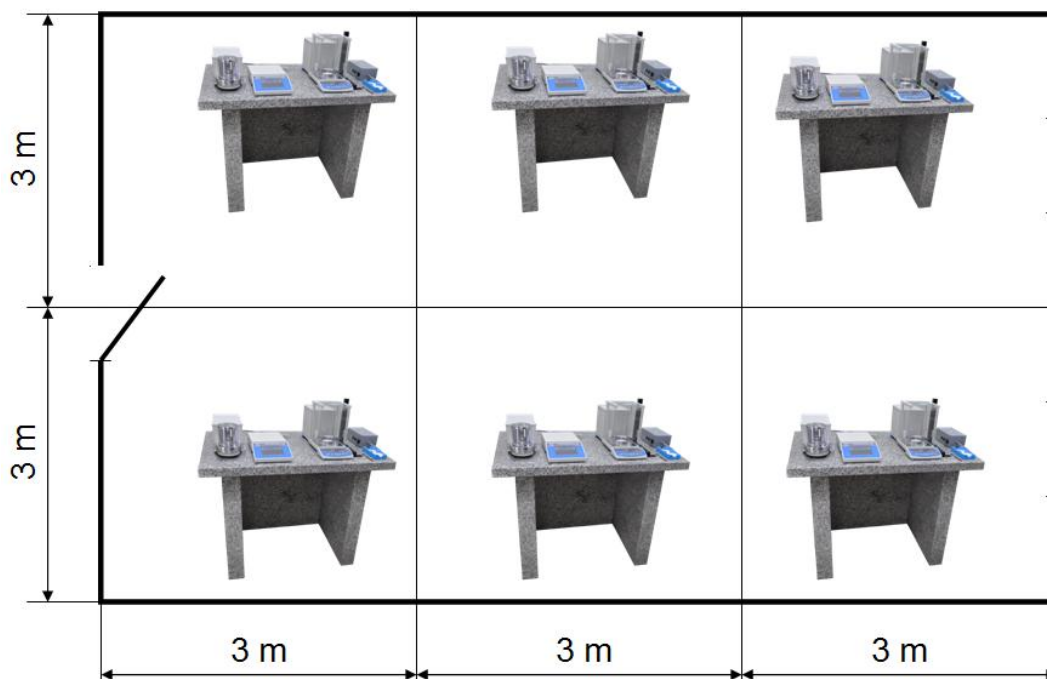
### Description:

A = 0,3 m (distance from a wall without windows)

B = 1 m (distance from a wall with windows, doors)

In case of a 7,5 m<sup>2</sup> weighing room, and while carrying out measurements, there should be max. 1 person in the room.

### • A weighing room with multiple measuring workstations



In case of a 54 m<sup>2</sup> weighing room, and while carrying out measurements, there should be max. 3 persons in the room.

## **A room with air conditioning:**

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RADWAG company utilizes different and specialized air conditioning systems for specific phases of instrument's production. The systems are installed in rooms for the purpose of creating appropriate climate conditions required for correct manufacturing and testing balances with the highest resolution. Maintaining constant climate conditions in the rooms enables:

- Carrying out tests on electromagnetic balances with the highest accuracy (readability up to 0,1 µg), i.e. microbalances and ultra-microbalances;
- Carrying out tests on high resolution mass comparators;
- Calibration of electromagnetic balances and mass comparators;
- Determining temperature coefficients for balances in production process.

## **Construction:**

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Climate rooms are built in locations distant from the sources of mechanical and acoustic vibrations. Additionally the rooms are sound-proved. Access to the room is restricted by entrance control system utilizing RFID cards. In order to limit the possibility of uncontrolled air change, there is a vestibule in front of the room entrance.

The chamber features the following components:

- ▶ Air conditioning controlled by automation system ensuring cooling and heating the air in the chamber;
- ▶ The system of intake and extraction fans cooperating with the air conditioning and system of filters;
- ▶ Automatically controlled heating system installed in the outlet manifold;
- ▶ Automatically controlled humidifiers adjusting humidity level in the chamber;
- ▶ Temperature, humidity and atmospheric pressure sensors carrying out measurements in real time;
- ▶ Control cabinet containing an automatic controller managing the complete system;
- ▶ Computer system managing ambient conditions: temperature, humidity and atmospheric pressure.

Integrating all installed system components enables continuous monitoring (in real time) and controlling the conditions in the weighing room, and maintaining stable parameters of set temperature and humidity.

Tested balances are placed on dedicated consoles ensuring separation from ground vibrations. Therefore, and for above reasons, the construction of the weighing room is suitable for testing and adjusting high resolution balances.

## System means of operation:

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The main executing component of the air conditioning is a duct air conditioner with cooperating complementary devices.

Below is a set of devices constituting for the system:

1. Duct air conditioning by LG series UB compressor type ON-OFF
  - Model : UB18/UU18
  - Cooling capacity: 5,0 kW
  - Covered area: up to 40-50 m<sup>2</sup>
2. Heating set of the outlet manifold
  - Heating capacity: 3 kW
3. Air conditioning controller
  - Type: SHIMADEN SR 9321-09A

The air conditioning with distribution components is built in the ceiling. The air conditioner comprises two components – an indoor unit (evaporator, figure 4) and an outdoor unit (condenser located on the outer wall of the building). In order to ensure correct functioning of the air conditioning system in the room, the indoor unit is set to fan's continuous operating mode. It causes forced air circulation in the room.

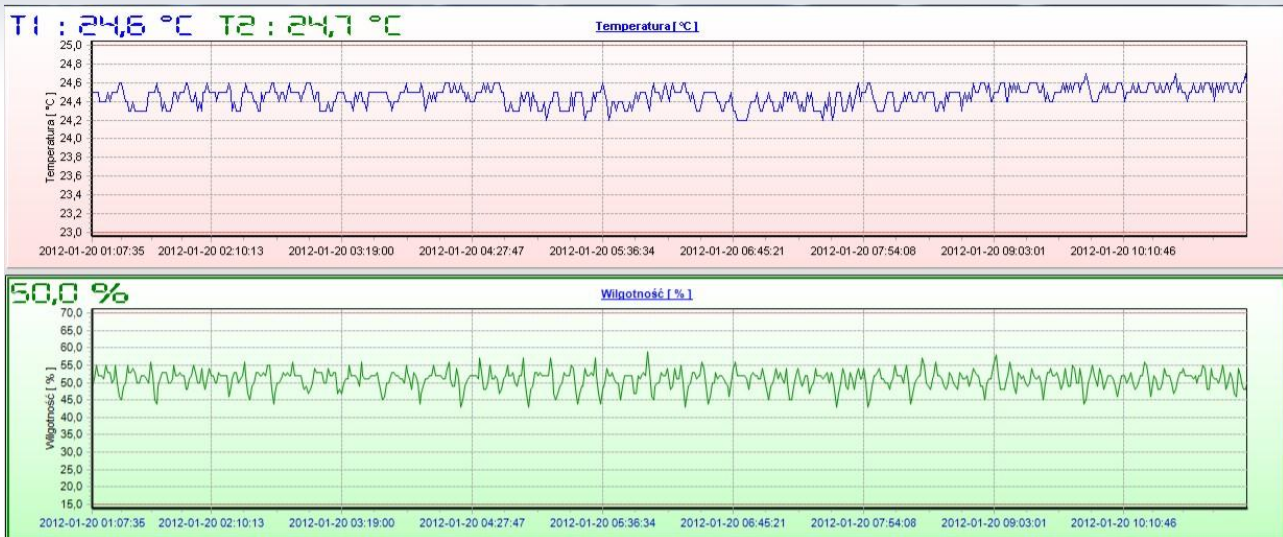
The air conditioner is controlled by a temperature programmer located in the control cabinet (figure 8). The controller is responsible for both cooling and heating, by applying a PID control unit.

Through continuous analysis of changes in the ambient conditions, the controller automatically learns to control heating and cooling processes, adjusts switching on and off times of heating and cooling elements.

The air conditioner, using the fan in the indoor unit, draws air through diffusers (figure 1) located in the intake channels in the bottom of the room. These channels are not insulated. The air is supplied through intake pipes (figures 2, 3), it cumulates in the intake manifold (figure 3) which is fixed to the air conditioner. The intake manifold features a temperature sensor which is plugged to the controller. The air is supplied to the air conditioner's indoor unit, where it can be cooled or heated by heaters located behind the indoor unit. The air from the air conditioner flows through insulated outlet manifold (figure 5), where it is distributed through insulated pipes (figure 6) and supplied to air expansion boxes (figure 7). Special design of the expansion box slows down the air and lets it out freely into the room. The air, as it heats or cools the room, is sucked by diffusers and the cycle is repeated.

Another function of the system is maintaining appropriate level of air humidity in the room. In the economical version of the system, the function is carried out by a simple humidifier (figure 9), which is controlled by the controller (figure 8).

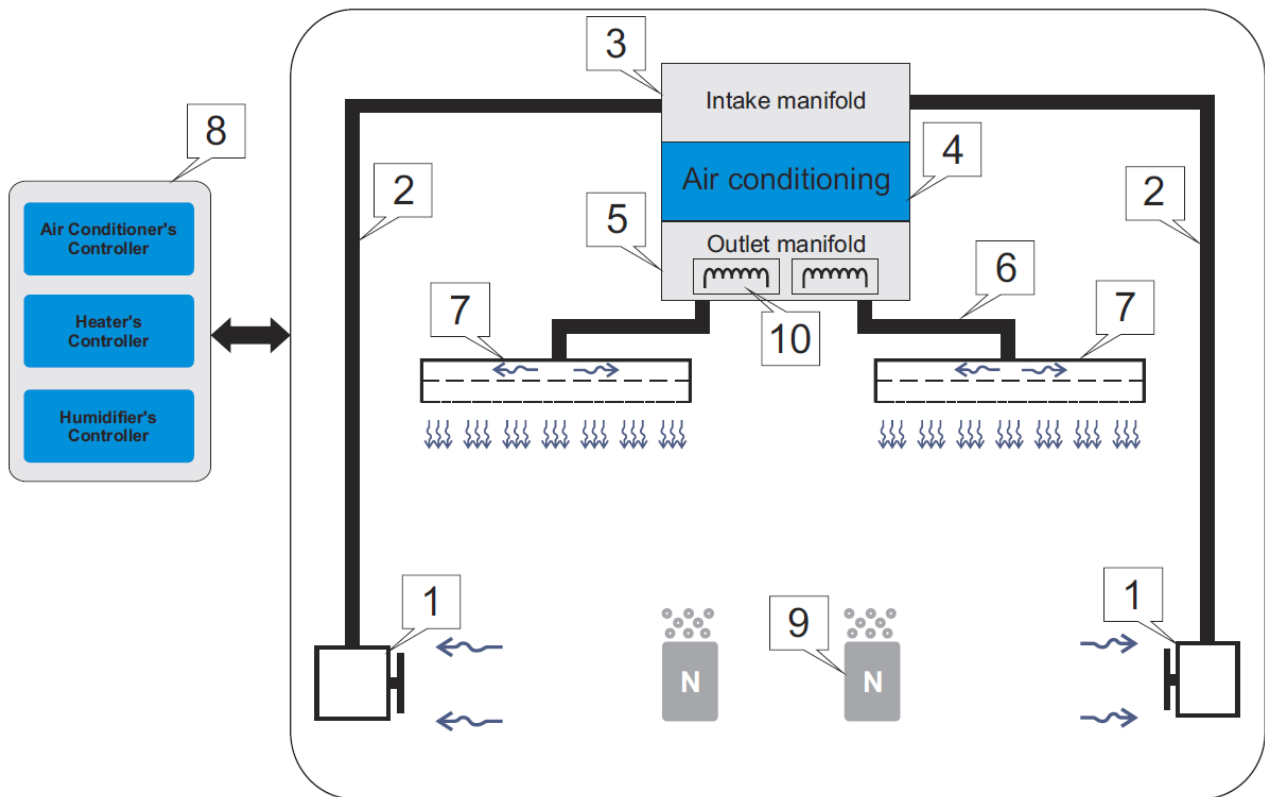
In the professional version, the system utilizes **steam humidifier Mk5 Visual 5 Swegon**.



**Fig.1** – Screenshot of a program presenting maintenance of ambient conditions in the control room of finished products

Normal operating conditions (max 3 people in the control room) and maintenance of the following parameters:

- temperature change ratio  $\pm 0,2$  °C
- humidity change ratio  $\pm 2\%$



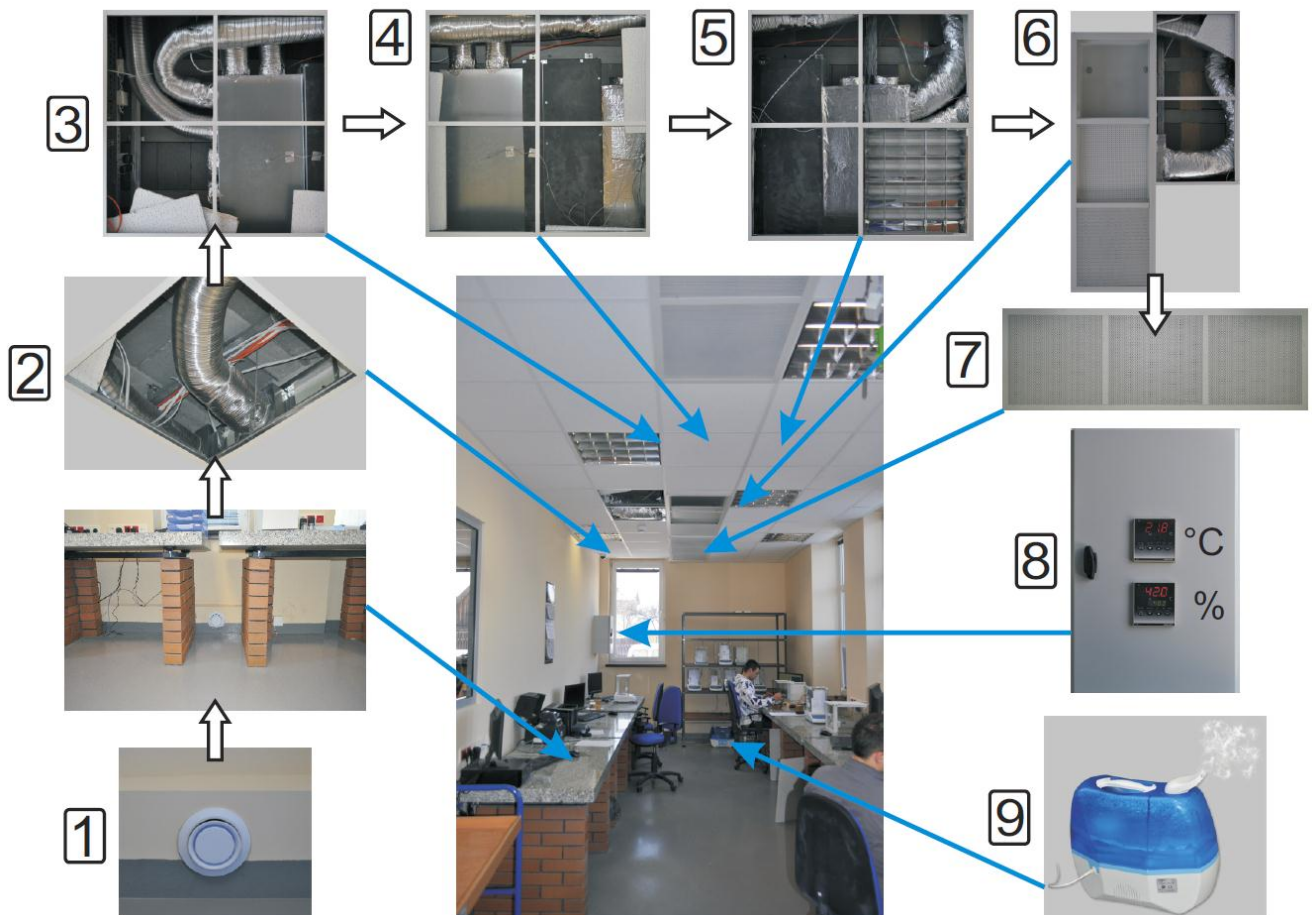
**Fig. 2** – Scheme of an air conditioned room with closed air circulation

**System components:**

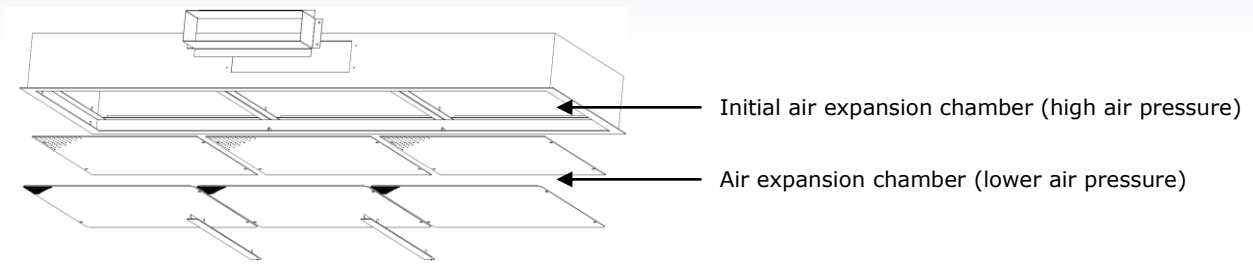
1. Diffusers
2. Intake channels + intake pipes
3. Intake manifold
4. Air conditioning
5. Outlet manifold
6. Outlet pipes
7. Air expansion boxes
8. Control cabinet
9. Air humidifiers
10. Heated installed in the outlet manifold

**Caution:** The area of air expansion boxes should cover minimum 25 % of the ceiling in the air conditioned room.

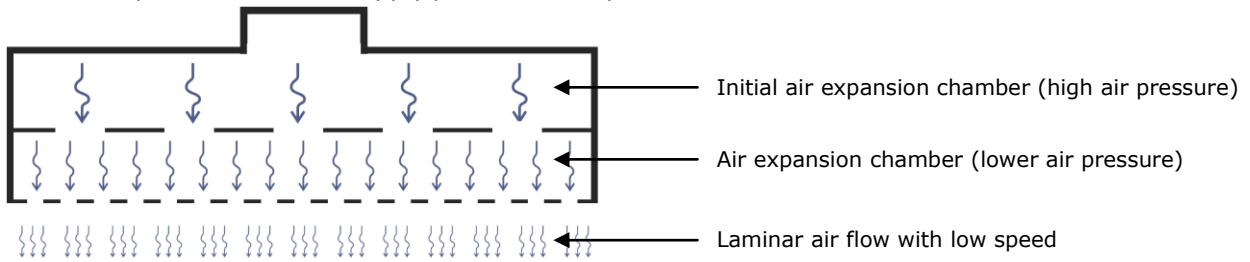
The demonstration area of an air conditioned room is approximately 45 m<sup>2</sup>.



**Fig. 3** – Pictures presenting the components of an air conditioned room



Means of operation of an air supply plenum (steady laminar air flow):



**Fig. 4** – Design and functioning of an air expansion supply box