Lindab **Regula room control system**

VAV & DCV Solutions

Lindab®

Regula room control system

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Regula room control system

Introduction

This manual is divided into Supply, Extract and complete solution. The supply solution is further more divided after flow regulation type. Each of the solutions found in this manual has a short description.

Designing a VAV/DCV ventilation system.

Variable Air Volume & Demand Controlled Ventilation.

VAV/DCV is about only using the necessary airflow and energy to ventilate buildings.

When designing a VAV/DCV ventilation system, there are several ways of doing it.

First the use and indoor climate requests of the room must be determined. This is important before the regulation parameter(s) can be chosen. The most common regulation parameters are:

- Temperature
- CO_2
- Presence/occupancy
- Humidity

A temperature regulation is often enough in most of the rooms, because the indoor climate is mostly influenced by solar gains, people and equipment. On the other hand though, sometimes other sensors would be more relevant than a temperature sensor: CO_2 sensor (for rooms with high occupancy index), presence sensor (for rooms with discountinuous occupancy), humidity sensors (for rooms with high evaporation or high latent load).

How to ensure the correct airflow to each room ?

One of the biggest issues with VAV/DCV is the distribution of the air. To make sure that all rooms gets the correct airflow it is a good idea to have VAV airflow regulators to each room.

General information on VAV

VAV is acronym for ”Variable Air Volume”. VAV is a demand controlled ventilation, to be used when the loads in a building vary. On the other hand, in rooms with a changing number of people, an airflow regulation based on CO_2 concentration (a good air quality indicator) would give a more satisfactory indoor comfort. It is however often the thermal load, such as people, computers and sun, that is dimensioning the ventilation need in a room. These thermal loads will almost always vary throughout the day and the night. By maintaining a constant supply air temperature, lower than the room temperature and instead regulate the air flow in ratio to the desired room temperature, the demand controlled ventilation will compensate the heat load.

The variation of the airflow in the system is controlled by duct dampers.
A VAV system is suitable for both displacement ventilation systems, mixed ventilation systems and active chilled beams systems.

Description of regulation types

In VAV systems, it is a pre-requisite that the fans in the air handling unit(AHU) can be speed-controlled.
Furthermore the VAV-unit must be divided into zones/sections, typically one zone for each distribution air duct. These zones can be identified from two different principles: The airflow regulation or pressure regulation.

Airflow regulation

According the airflow regulation principle, the air flow is measured and regulated across the whole air duct system. The airflow is set to be able to vary between a preprogrammed minimum and maximum airflow. An electronic signal from a sensor (temperature, CO_2, presence) or BMS regulates the airflow within the set minimum and maximum airflow limits.

In airflow regulation, the right airflow will be achieved even when the pressure conditions in the air duct are changing, since the airflow regulator is independent of the pressure (and only requires a minimum pre-pressure).

This type of regulation is usually used for zone-regulation in connection with diffusers without dampers in mixed- or displacement systems. In case of a mixed ventilation system with terminals without damper, and a temperature difference above -8K between supply air and room temperature, there is a risk to get draughts due to the too cold air from the diffusers.

The airflow regulators have a minimum limit for the measuring of the airflow. The minimum airflow must not be set lower than the measurement limit for the velocity of approx. 0.7 m/s. Airflow regulation can be used in the distribution air duct both for supply air and extract, either with a parallel signal from a sensor or BMS or with a Master/Slave function. If for example an over- or under pressure in a room is desired, with respect to the surroundings, a Master/Slave function is advisable.

Regula room control system

Pressure regulation of air ducts

Pressure regulation in ducts can be used within an area where it is required to maintain a stable duct pressure or in areas where air pressure has to be kept under a certain limit.

Normally, it is the distribution air duct on the supply air side which is regulated for pressure. A pressure regulation entails that a constant static pressure is maintained in the air duct. The static pressure is measured by a probe mounted inside the air duct. The probe is connected by a pipe to an electronic unit (pressure regulator) which registers the static pressure in the air duct with a membrane sensor unit.

A pressure regulation in the air duct will ensure stable pressure conditions in the zone, and therefore good conditions for controlling air duct dampers.

No matter the unit type however, the pressure loss in the zones air duct has to be taken into consideration, in order to obtain a similar if not identical pressure at all branches to the connection ducts. As a general rule, the pressure loss in the air duct from the first branch to the last branch should not exceed approx. 40% of total static pressure.

Mixed ventilation

In mixed ventilation the air is supplied with a relatively high velocity outside the occupied zone, usually from the ceiling or the wall. The high velocity of the supplied air means, that a considerable amount of room-air is circulated as well.
The velocity of the supplied air should be kept at a level which ensures that the mixing is effective, but at the same time ensures that the air velocity has fallen to the required level by the time it reaches the occupied zone. This makes demands on the efficiency of the units used as regards to velocity and mixing capacity.
An increase in the supplied air velocity will cause an increase in the sound level. Requirements for a low sound level consequently means a limit on the diffusers efficiency.
The temperature and the contamination concentration is roughly the same throughout the room, for both isothermal and cold air.
Mixed ventilation is mostly unaffected by outside influences and can be used for both heating and cooling needs.

Supply of cold air

As the cold air is heavier than the warm air, in case of high thermal loads there could be an excessive air velocity in the occupied zone. The higher the load, the bigger the risk. The air jets from diffusers (normally horizontal) and the convection streams from the heating sources (people, lighting, machines) result in a velocity in the occupied zone, which in addition to the supplied air velocity from the diffuser, depends on the removed effect per square meter (W/m^2), the distribution on the individual diffusers and the diffusers jet pattern.

The supply of both hot air (heating phase) and cold air (cooling phase) in the same diffuser, from the ceiling can normally not fulfil all requirements for temperature gradient, ventilation efficiency and velocity in the occupied zone at the same time.

Connecting the solution

When the design for the rooms have been made, then it is time to consider a control system. The proposed solutions in this manual are all fitted to either stand-alone or be part of a larger control system.

Stand-alone
A stand-alone solution consists of an individual room controller in each room. For this type of VAV system it is recommended to control the AHU fans with pressure control.

BMS
Lindabs room controllers and many of the actuators can communicate via bus communication. The solutions showed can therefore be integrated in a larger BMS system with MODbus, BACnet or KNX as standard.

Lindab Pascal system management
At Lindab we have designed our own DCV system fitted to create a simple and successful system solution. Read more about Lindab Pascal system management here:

Link to PASCAL SYSTEM MANAGEMENT

AHU fan control

In the past it has been customary to build VAV-system with a constant pressure AHU fan control. This is no longer adviceable, due to unnecessarry pressure in duct when air demands are low.

To ensure a low energy consumption in the AHU fans, it is recommended to optimize the fan speed. Combined with airflow regulators in each room it is possiple to optimize the airflow from the fans to meet the exact demand in the building.
It is advisable to vary the fan speed between a fixed minimum and maximum main duct pressure. This ensures full control of the main duct pressure and minimizes the pressure losses.

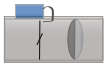
Fan optimization is a standard function in Lindab Pascal system management.

Regula room control system

Symbol and cable overview

Regula room controller

FTCU
Airflow regulator and temperature measuring (Ultralink)



VRU/VRA
Airflow regulator

MBV with ceiling diffuser
Plenum box, airflow regulator, air distribution
-CT: Regula Control card
-CT-RC: Control card with integrated Regula
Combi-CN: Regula Connect card

MB with ceiling diffuser
Plenum box, airflow regulator, air distribution
- B = Linear cone damper
- C = Blade damper supply
- E = Blade damper extract

LCFV
Free hanging diffuser

DBV
Straight through airflow regulator

ACB
Active Chilled Beam

FTMU
Airflow & temperature measuring (Ultralink)

Diffuser
With built in temperature/presence sensor

Silencer
Sound attenuator

OLR
Pressure control valve

Water actuator

Supply fan
Extract fan

Extract airflow
Supply airflow

Presence sensor

Humidity sensor

CO_2 sensor

Temperature sensor (extern)

2-10 V flow signal

RJ45 Signal cable

Regula room control system

Supply Solutions

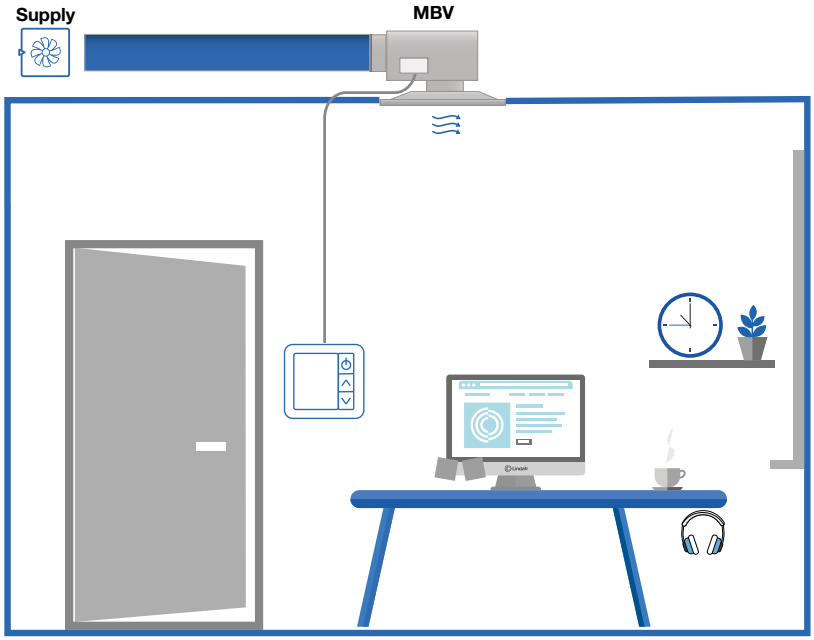
1. MBV supply solutions

Using MBV as the supply volume flow regulator unit.
MBV is a plenum box with integrated volume flow regulator used for VAV regulation of supply air diffusers LCP, LKP and LCC. MBV is equipped with a unique linear cone damper technology which makes it possible to regulate up to 200 Pa with low sound level. Using MBV in the Pascal system, the MBV is controlled by a Regula Combi room controller and it doesn't require specific settings from the factory nor specific labelling.
MBV is recommended as the regulating unit in rooms where flexibility and indoor climate are in focus. It is ideal in both small and large offices and in meeting rooms.

- Used in combination with LCP/LKP/LCC.
- Possible integrated Regula Combi, for all wiring above ceiling.
- Possible to add CO_2, RH and/or Presence sensor, according to needs.
- Possible to add heating actuator for radiators/panels, to be controlled with same setpoint.

1A MBV, Room controller wall mounted

Single office and small room solution.
Room controller with temperature regulation, where the supplied airflow is controlled with a MBV.
Recommended add-on option: Presence sensor, to optimize the energy consumption. Radiator actuator, to control heating in the room with same room controller.

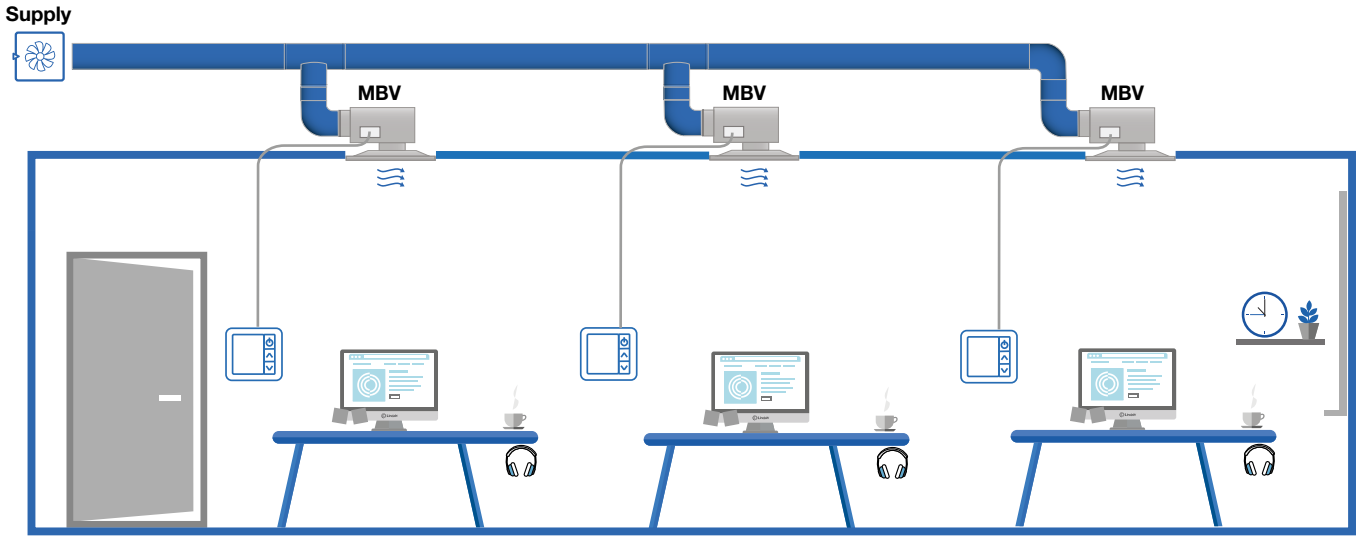


Flexibility: Simple solution for simple VAV application.
Indoor climate: Regulating according to individual need, with temperature as primary regulation parameter.

Regula room control system

1B. MBV, multiple room zones, RC's wall mounted

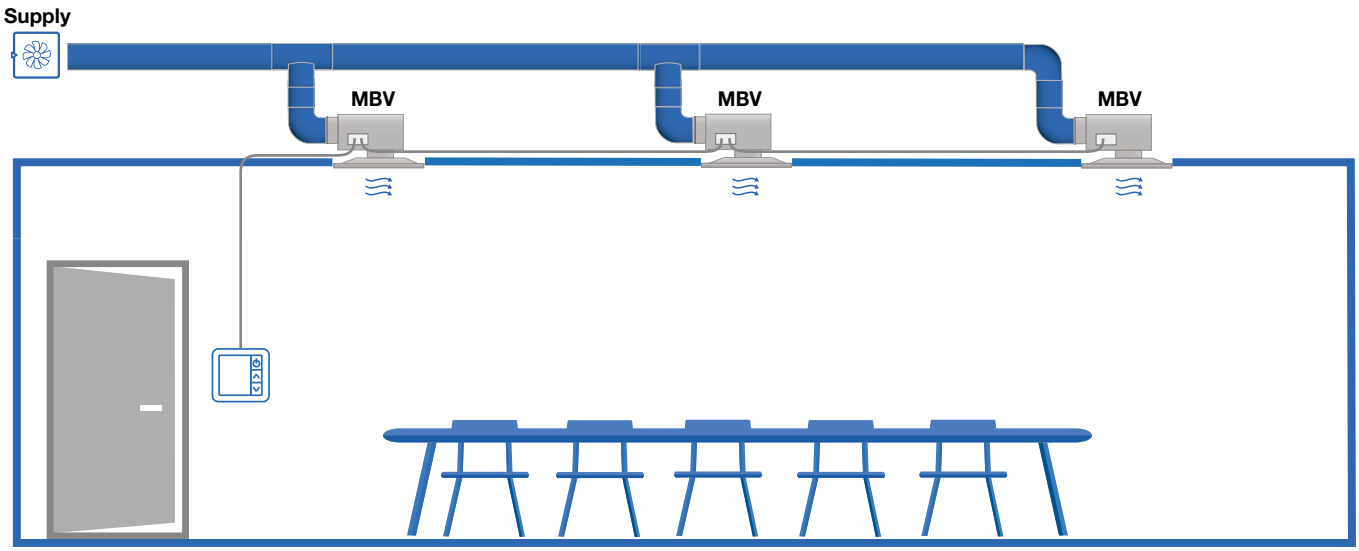
Landscape office and large room solution.
Several room controllers with temperature regulation, where the supplied airflow is controlled with a MBV for each room controller for individual temperature zones to handle different needs and loads. Recommended add-on option: Presence sensor, to optimize the energy consumption. Radiator actuator, to control heating in the room with same room controller.



Flexibility: small temperature zones gives the flexibility to change the room design, but the placement of the room controller needs to be taken in consideration do to wiring.
Indoor climate: Regulating according to individual need, with temperature as primary regulation parameter.

1C. MBV, large room zone, RC wall mounted

Landscape office and large room solution.
A single room controller with temperature regulation, where the supplied airflow is controlled with several MBVs. For rooms with an even need and load.
Recommended add-on option: Presence sensor, to optimize the energy consumption.
If used in meeting rooms, then add CO_2 sensor as well.

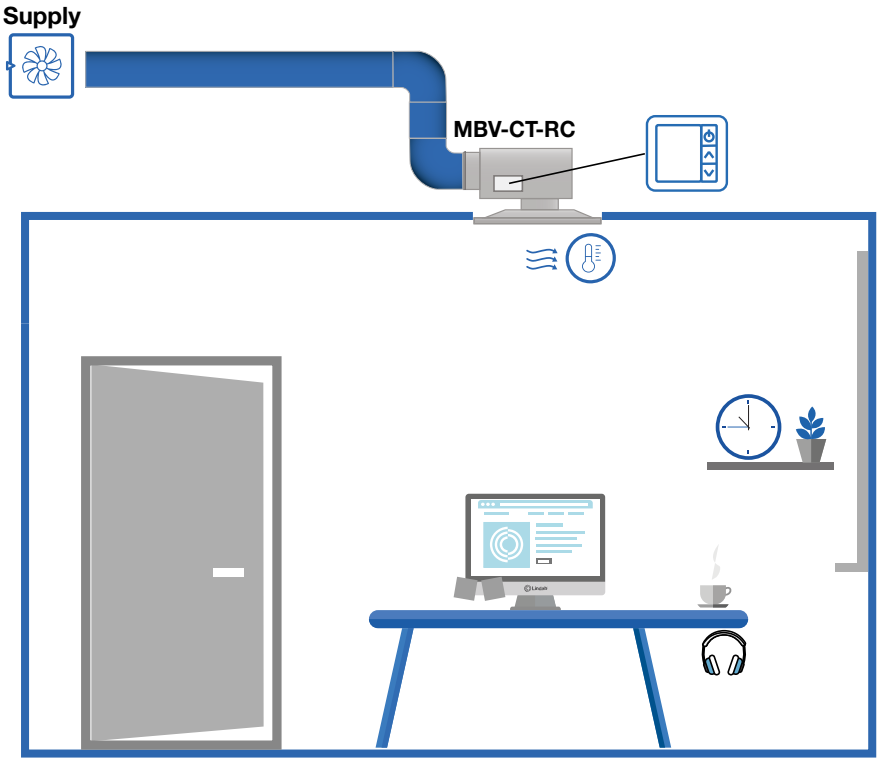


Flexibility: A redesign of the room will require new room controller for the related MBV, without changes in the ductwork.
Indoor climate: The large zone will be handled as one, therefore with only one temperature set point for the entire room.

Regula room control system

1D. MBV, RC above ceiling

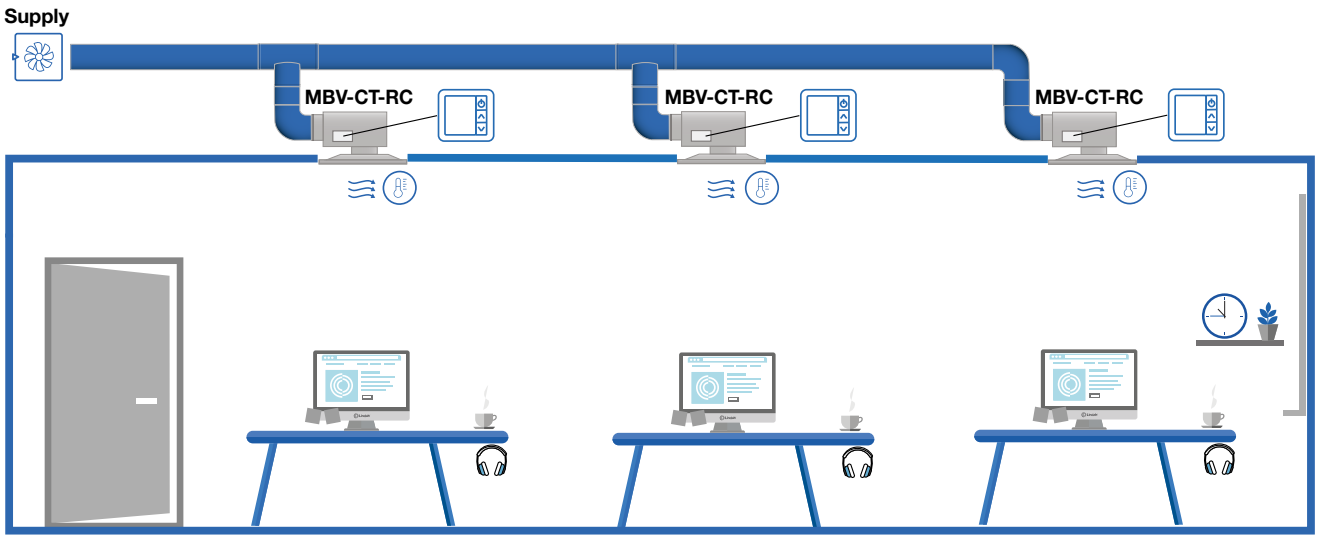
Single office and small room solution.
Room controller with temperature regulation from sensor in diffuser, where the supplied airflow is controlled with a MBV.
Recommended add-on option: Presence sensor integrated in diffuser, to optimize the energy consumption.



Flexibility: No sensors or controllers on the wall gives full flexibility to change the room design or merge
Indoor climate: Regulating according to individual need, with temperature as primary regulation parameter.

1E. MBV, multiple room zones, RC's above ceiling

Landscape office and large room solution.
Several room controllers mounted above ceiling with temperature sensor in diffuser. Where the supplied airflow is controlled with a MBV for each room controller for individual temperature zones to handle different needs and loads.
Recommended add-on option: Presence sensor integrated in diffuser, to optimize the energy consumption.

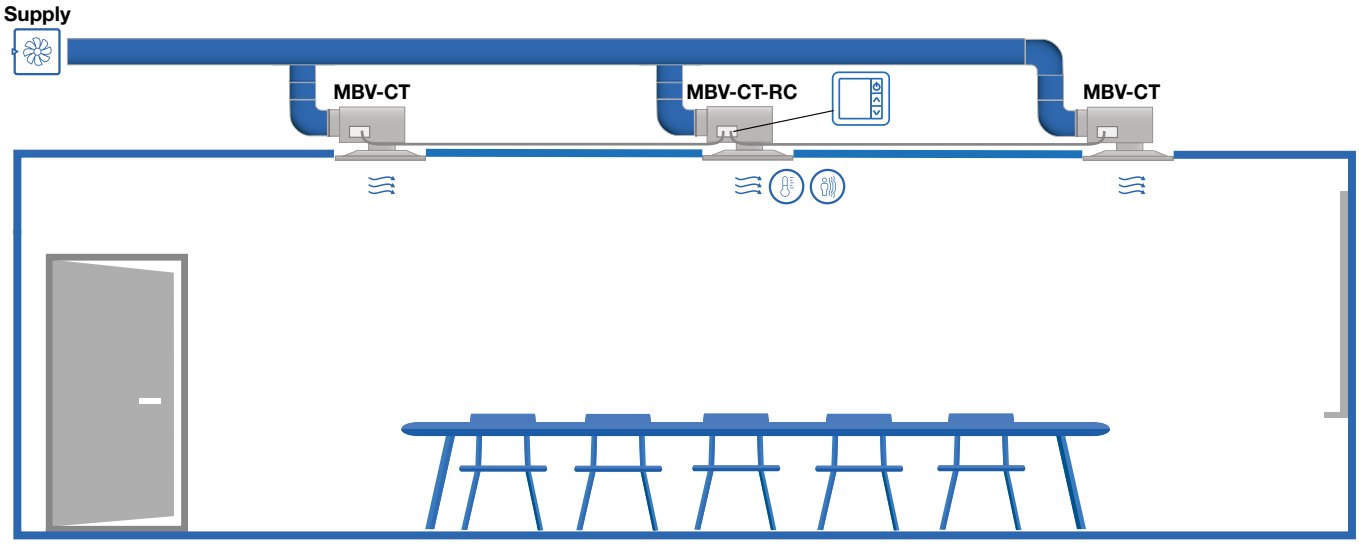


Flexibility: No sensors or controllers on the wall gives full flexibility to change the room design or split
Indoor climate: Regulating according to individual needs, with temperature as primary regulation parameter.

Regula room control system

1F. MBV, large room zone, RC's above ceiling

Landscape office and large room solution.
A single room controller mounted above ceiling with temperature regulation and presence sensor built into the diffuser. Where the supplied airflow is controlled with several MBVs on same signal. For rooms with an even need and load.
Recommended add-on option: Presence sensor, to optimize the energy consumption.
If used in meeting rooms, then add CO_2 sensor as well.



Flexibility: No sensors or controllers on the wall gives full flexibility to change the room design or split.
Indoor climate: The large zone will be handled as one, therefore with only one temperature set point for the entire room.

Regula room control system

Supply Solutions

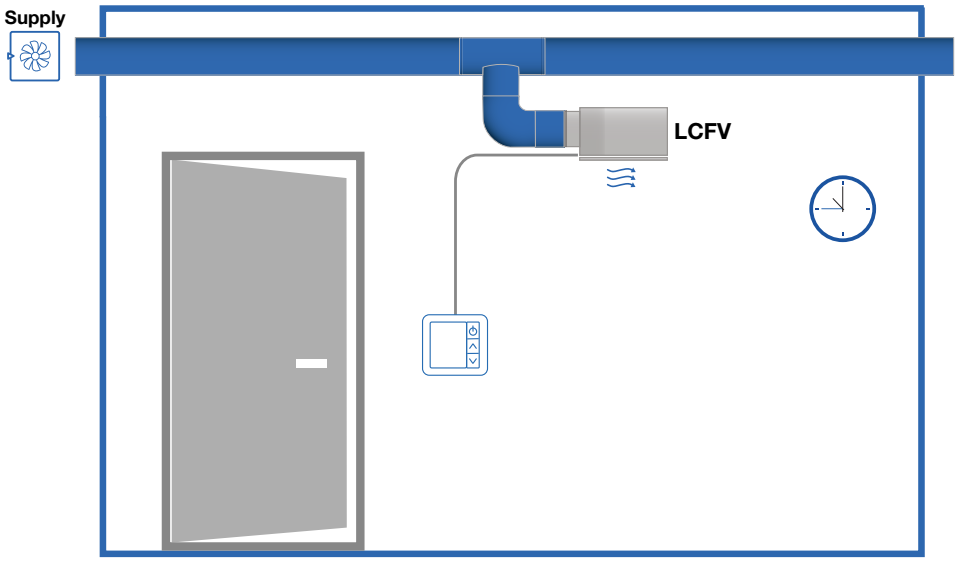
2. LCFV supply solution

Using LCFV as the supply volume flow regulator unit
LCFV is a VAV diffuser unit for supply air with circular unperforated face plate for free hanging installations. LCFV includes a unique linear cone damper with integrated volume flow regulator used for VAV regulation directly in the unit. The built-in VAV actuator is delivered pre-programmed with damper characteristic and in combination with a stable flow measurement over the damper, it makes the VAV regulation very accurate and reliable. The VAV-actuator can come with MP, MODbus or BACnet.

- Free hanging VAV unit with integrated volume flow regulator.
- Suitable in full variable airflow range with high under temperature.
- Unique linear cone damper.
- Up to 200 Pa with low sound level.
- Accurate and reliable VAV regulation.

2A. LCFV, RC wall mounted

Small room with high ceiling or free hanging installation.
Room controller with temperature regulation, where the supplied airflow is controlled with a LCFV.
Recommended add-on option: Presence sensor integrated in front plate of the LCFV. To optimize the energy consumption.

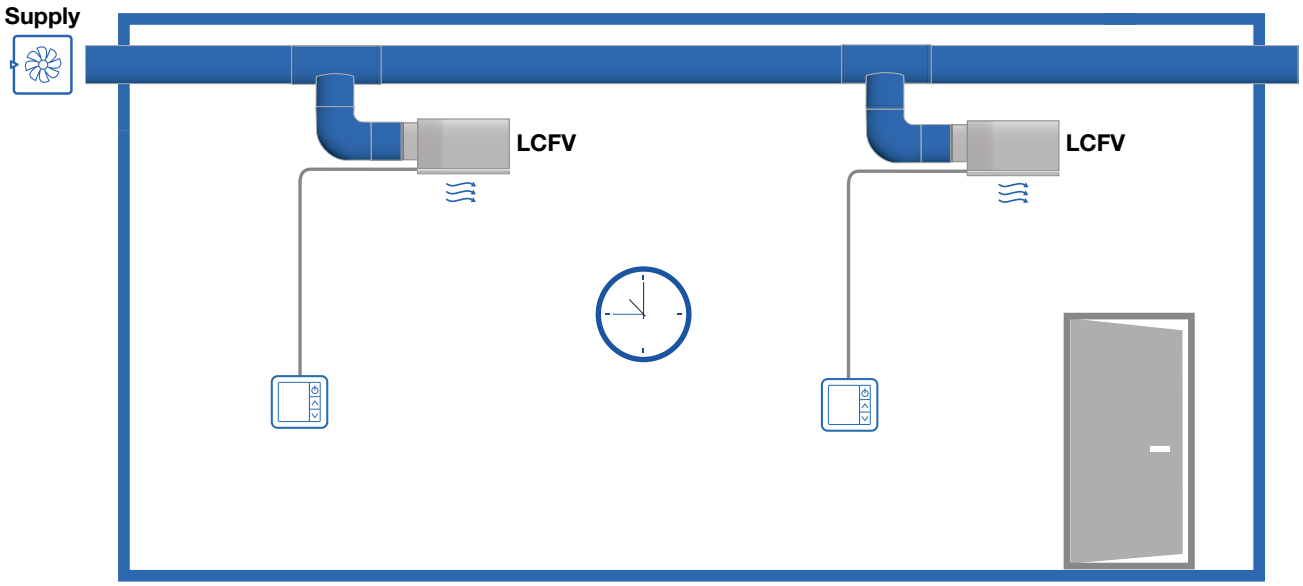


Flexibility: Simple solution for simple VAV application.
Indoor climate: Regulating according to individual need, with temperature as primary regulation parameter.

Regula room control system

2B. LCFV, multiple room zones, RC's wall mounted

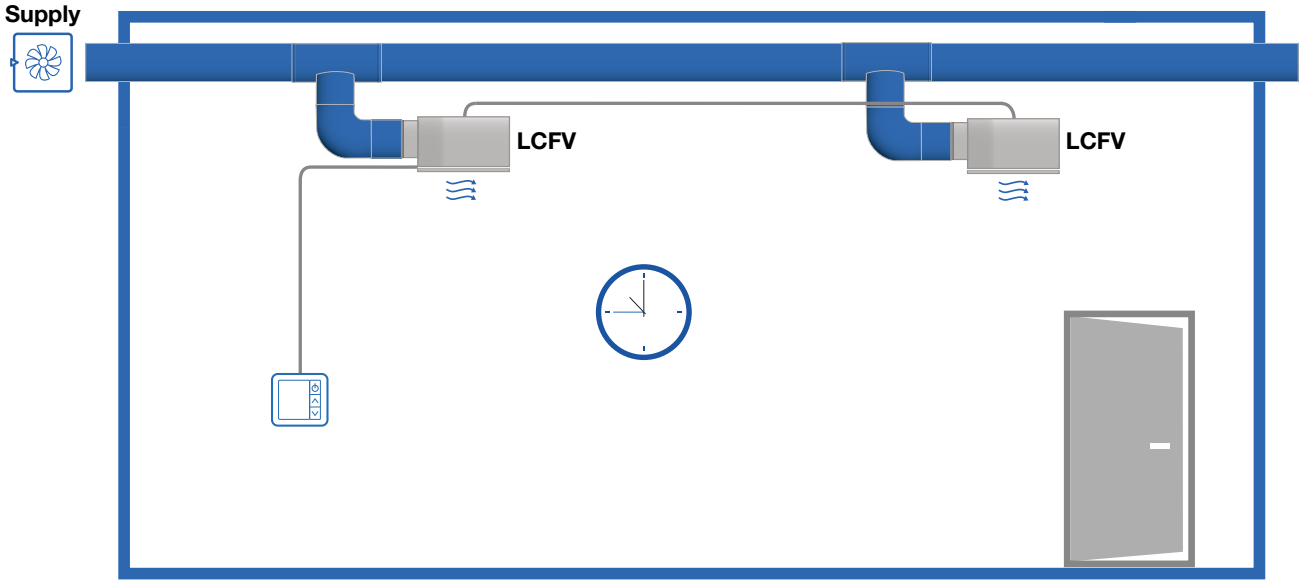
Large room with high ceiling or free hanging installation.
Room controller with temperature regulation, where the supplied airflow is controlled with a LCFV. Each Room controller is connected to one LCFV.
Recommended add-on option: Presence sensor integrated in front plate of the LCFV. To optimize the energy consumption.



Flexibility: small temperature zones give the flexibility to change the room design, but the placement of the room controller needs to be taken in consideration do to wiring.
Indoor climate: Regulating according to individual needs, with temperature as primary regulation parameter.

2C. LCFV, large room zone, RC wall mounted

Large room with high ceiling or free hanging installation.
Room controller with temperature regulation, where the supplied airflow is controlled with a LCFV. The Room controller is connected to several LCFV's for a larger temperature zone.
Recommended add-on option: Presence sensor integrated in front plate of the LCFV. To optimize the energy consumption.

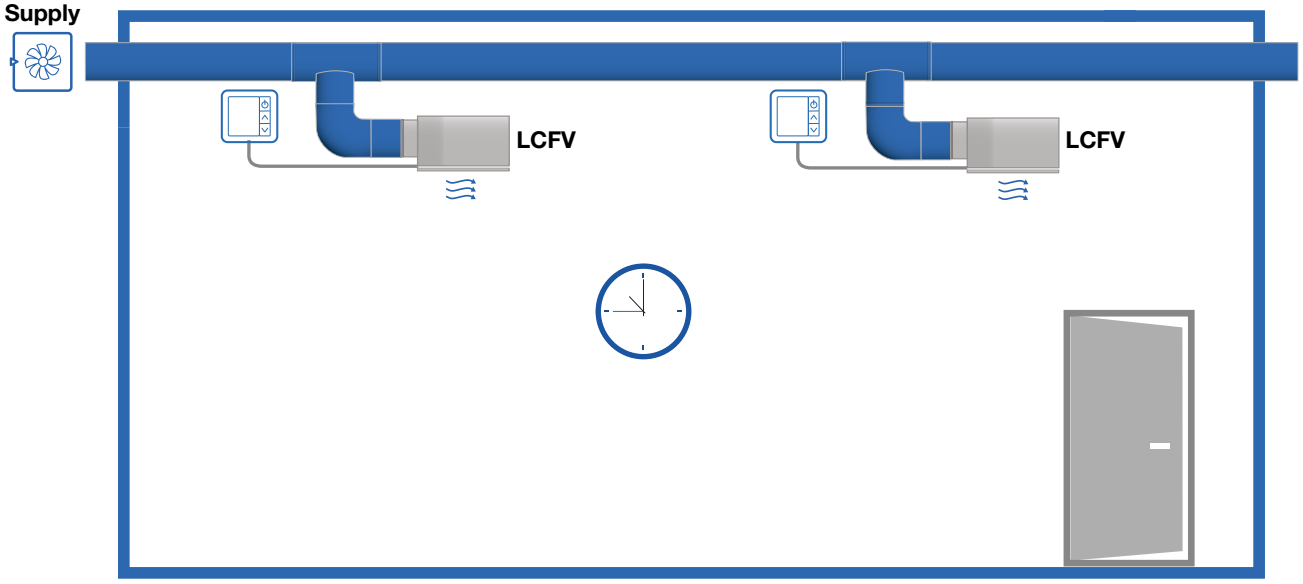


Flexibility: A redesign of the room will require new room controller for the related MBV, without changes in the ductwork.
Indoor climate: The large zone will be handled as one, therefore with only one temperature set point for the entire room.

Regula room control system

2D. LCFV, multiple room zones, RC's hidden

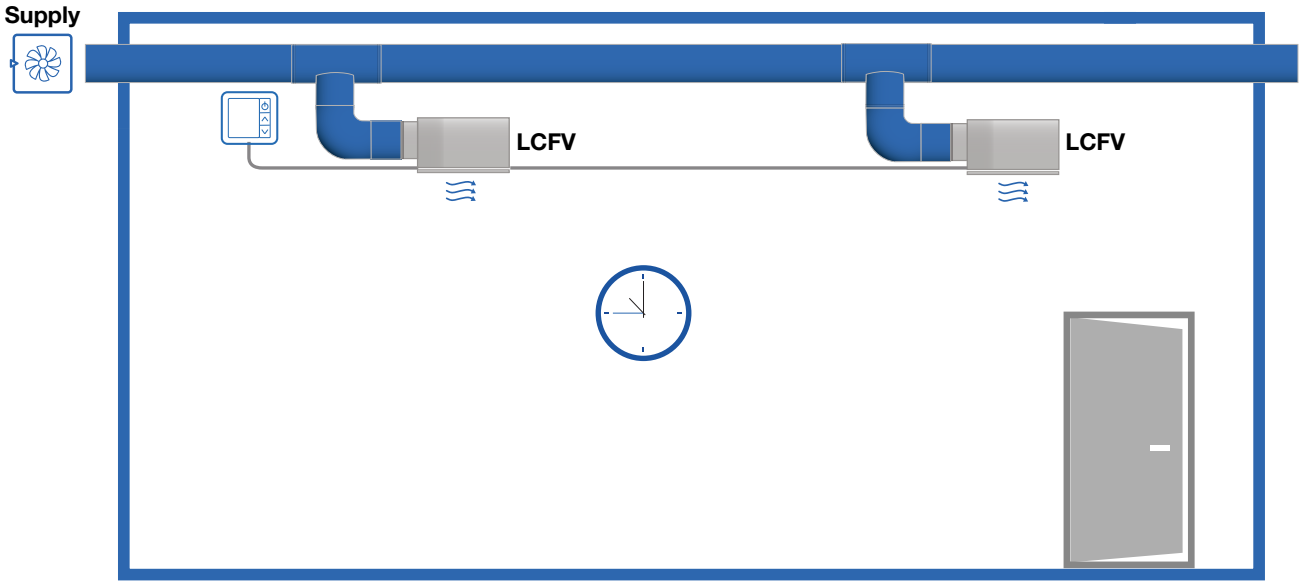
Large room with high ceiling or free hanging installation.
Room controller with temperature regulation, where the supplied airflow is controlled with a LCFV. The Room controller is mounted hidden connected to several LCFV's for a larger temperature zone.
Recommended add-on option: A temperature sensor in extract duct for regulation.
Presence sensor integrated in front plate of the LCFV. To optimize the energy consumption.



Flexibility: Depending on the placement of the temperature sensor, this can have full flexibility. And no wires in walls.
Indoor climate: Depending on the placement and numbers of the temperature or other sensors.

2E. LCFV, large room zone, RC hidden

Large room with high ceiling or free hanging installation.
Room controller with temperature regulation, where the supplied airflow is controlled with a LCFV. The Room controller is mounted hidden connected to several LCFV's for a larger temperature zone.
Recommended add-on option: A temperature sensor in extract duct for regulation.
Presence sensor integrated in front plate of the LCFV. To optimize the energy consumption.



Flexibility: Depending on the placement of the temperature sensor, this can have full flexibility. And no wires in walls.
Indoor climate: Depending on the placement and numbers of the temperature or other sensors.

Regula room control system

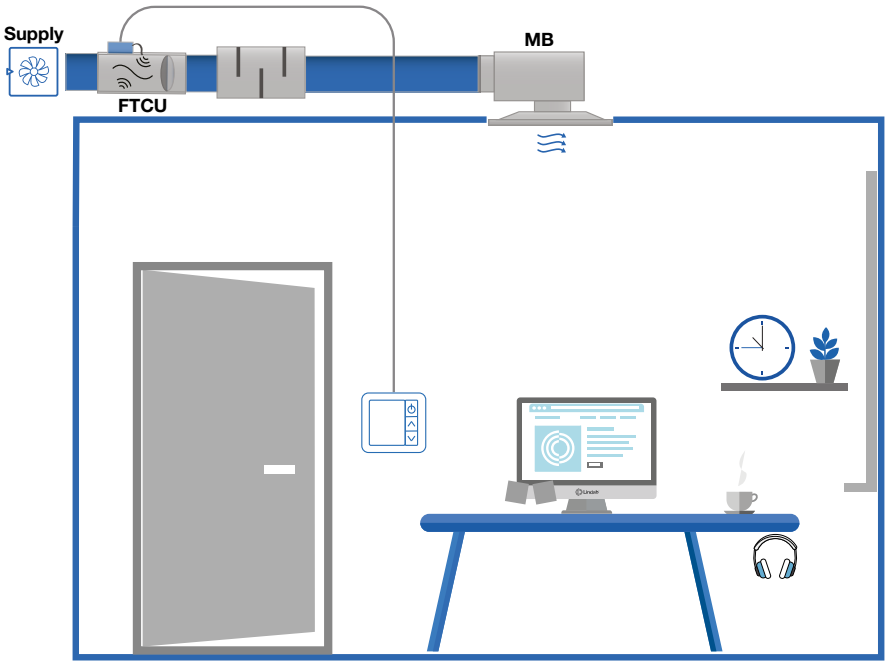
Supply Solutions

3 FTCU supply solution

Using FTCU as the supply volume flow regulator unit.
The Controller is suitable for measuring and controlling air flow and measuring temperature. Communication is established via analog signals and/or digital signal using Modbus. The Controller can also be commissioned via Bluetooth. The OneLink app is the perfect tool to monitor and adjust the airflow directly via a mobile device, which speeds up installation and commissioning.

3A. FTCU, RC wall mounted

Single office and small room solution.
Room controller with temperature regulation, where the supplied airflow is controlled with a FTCU.
Recommended add-on option: Presence sensor, to optimize the energy consumption. Radiator actuator, to control heating in the room with same room controller.

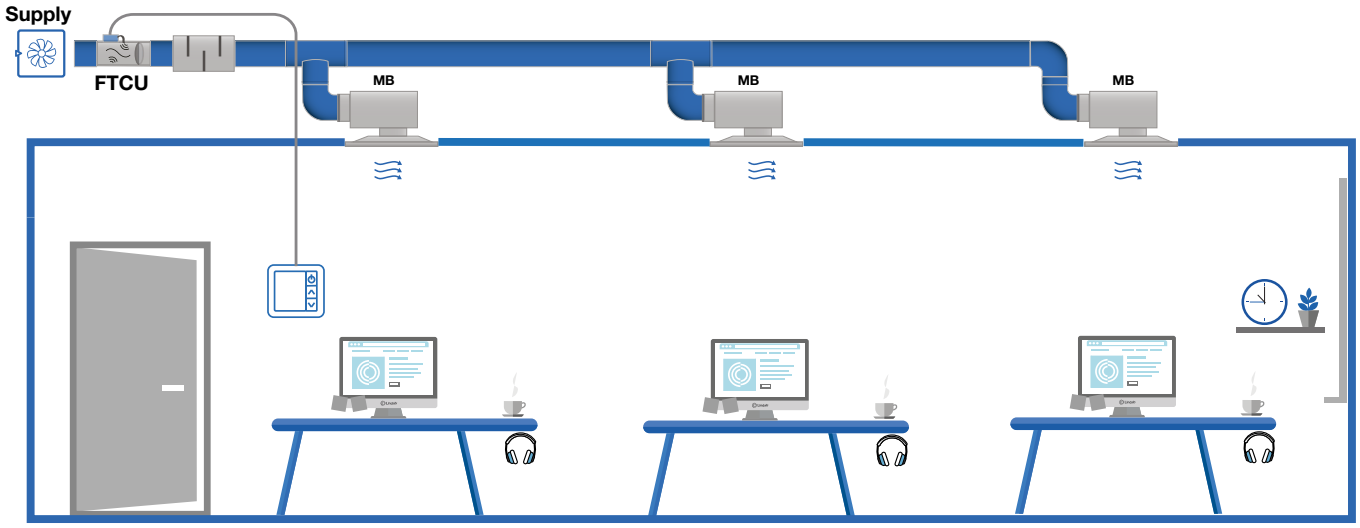


Flexibility: Simple solution for simple VAV application.
Indoor climate: Regulating according to individual need, with temperature as primary regulation parameter.

Regula room control system

3B. FTCU, large room zone, RC wall mounted

Landscape office and large room solution.
Room controller with temperature regulation, where the supplied airflow is controlled with a single FTCU.
Recommended add-on option: Presence sensor, to optimize the energy consumption. Radiator actuator, to control heating in the room with same room controller.



Flexibility: Simple solution for simple VAV application.
Indoor climate: Regulating according to individual need, with temperature as primary regulation parameter.

Regula room control system

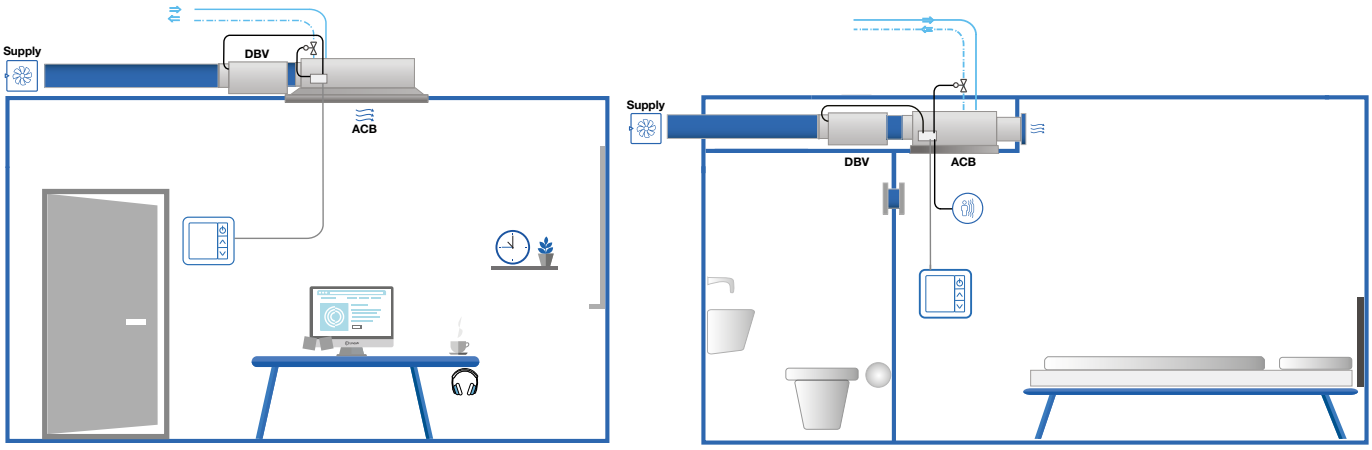
Supply Solutions

4 DBV supply solution

Using DBV as the supply volume flow regulator unit
DBV is a volume flow regulator used for VAV regulation of the supply air in a terminal duct for an active chilled beam. Also suitable together with eg. wall diffusers. DBV is equipped with a unique linear cone damper technology, which makes it possible to regulate up to 200 Pa with low sound level. The built-in VAV actuator is delivered pre-programmed with damper characteristic and in combination with a stable flow measurement over the damper, it makes the VAV regulation very accurate and reliable. DBV can be installed directly in a terminal duct in front of the active chilled beam. DBV can be delivered with MP, MODnet or BACnet communication. DBV is not suited for exhaust air.

4A. DBV & ACB, RC wall mounted

Single office and small room solution.
Room controller with temperature regulation, where the supplied airflow is controlled with a DBV and waterflow controlled with valve in ACB.
Recommended add-on option: heating actuator for radiators, so to have the same controller for heating, cooling and VAV. Presence detection in a hotel room can be made with a switch or cardholder, in connection with lights.

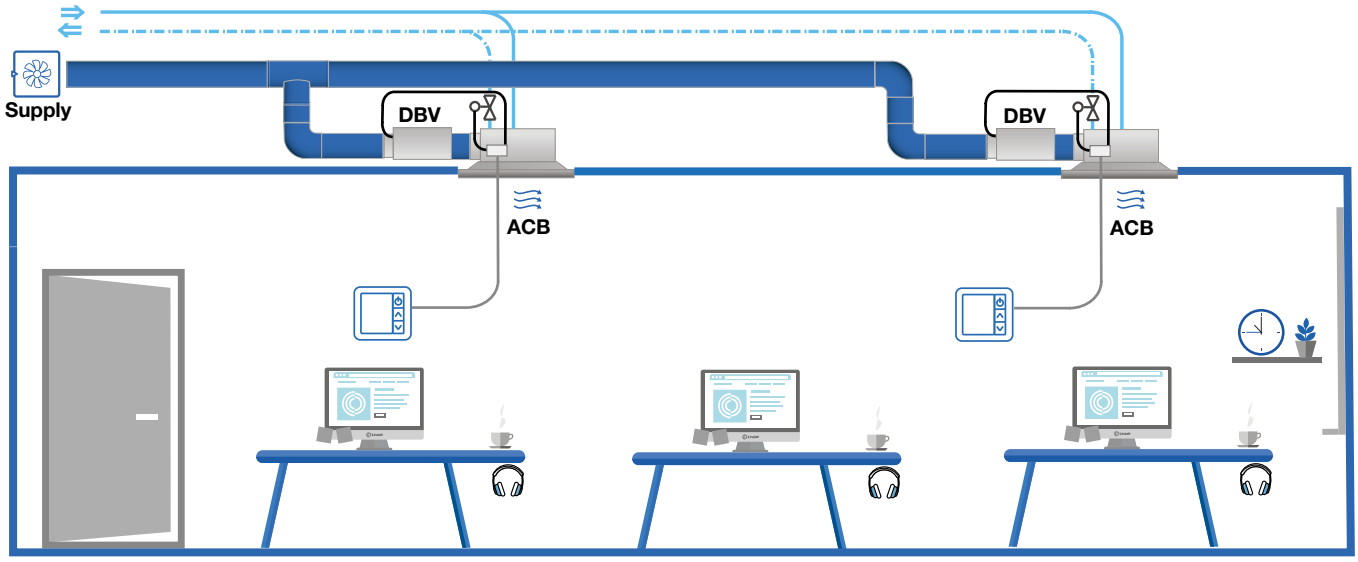


Flexibility: Simple solution for simple VAV application.
Indoor climate: Regulating cooling and VAV according to individual need, with temperature as primary regulation parameter.

Regula room control system

4B. DBV, multiple room zones, RC's wall mounted

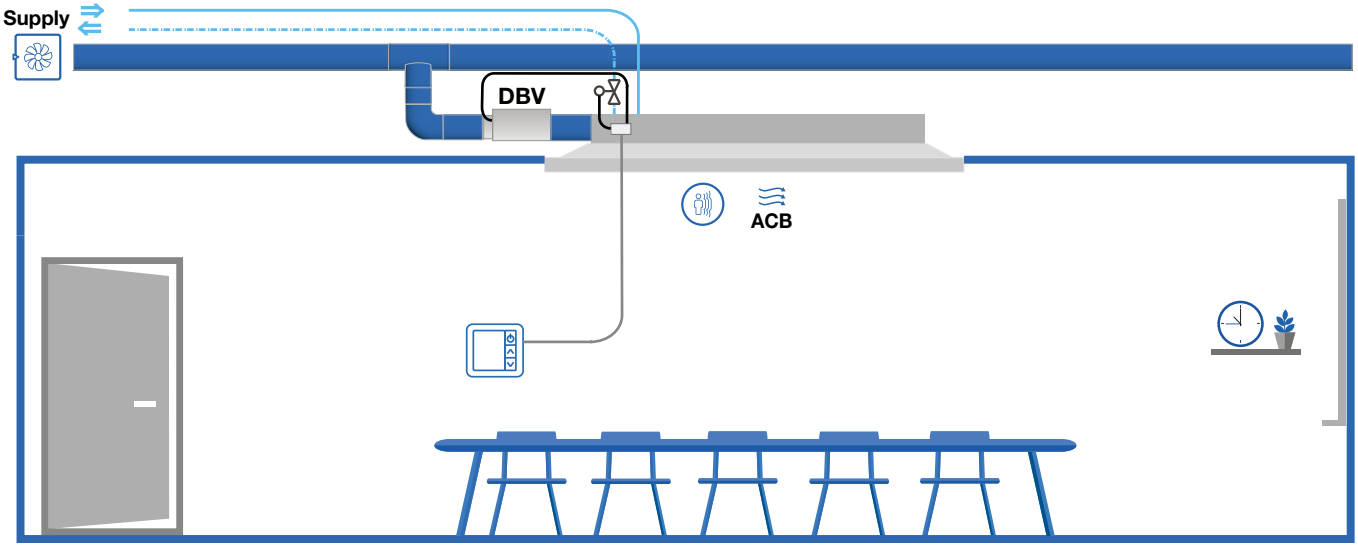
Room controller with temperature regulation. Controlling air- and waterflows with active chilled beams and DBVs.



Flexibility: Small temperature zones gives the flexibility to change the room design, but the placement of the room controller needs to be taken in consideration due to the wiring.
Indoor climate: Regulating cooling and VAV according to individual need, with temperature as primary regulation parameter.

4C. DBV, large room zone, RC wall mounted

Large meeting room.
Room controller with temperature regulation, where the supplied airflow is controlled with a DBV and the waterflow controlled with valve in ACB.
Recommended add-on option: Actuator for radiator heating to have same controller for both cooling, VAV and heating.



Flexibility: Small temperature zones gives the flexibility to change the room design, but the placement of the room controller needs to be taken in consideration due to the wiring.
Indoor climate: Regulating cooling and VAV according to individual need, with temperature as primary regulation parameter.

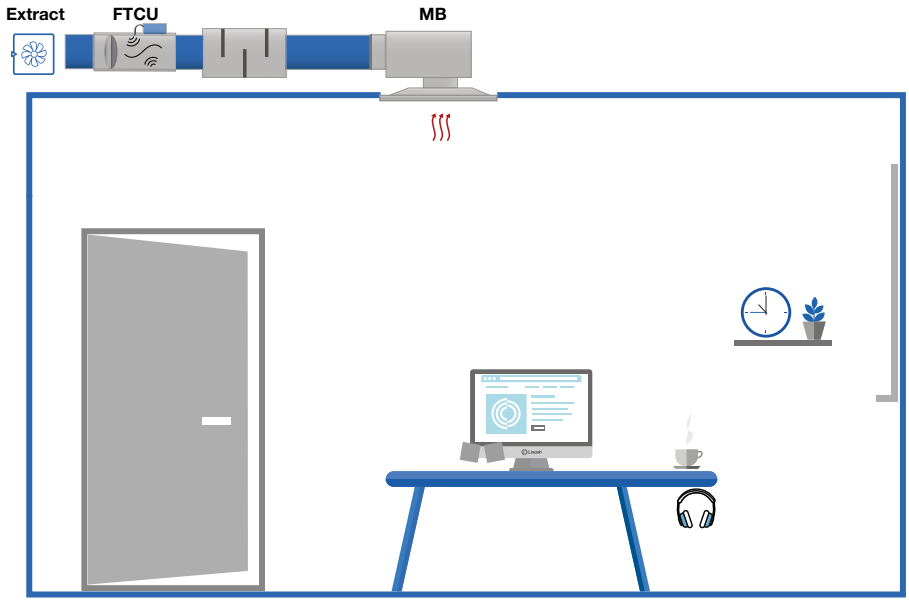
Regula room control system

Extract Solutions

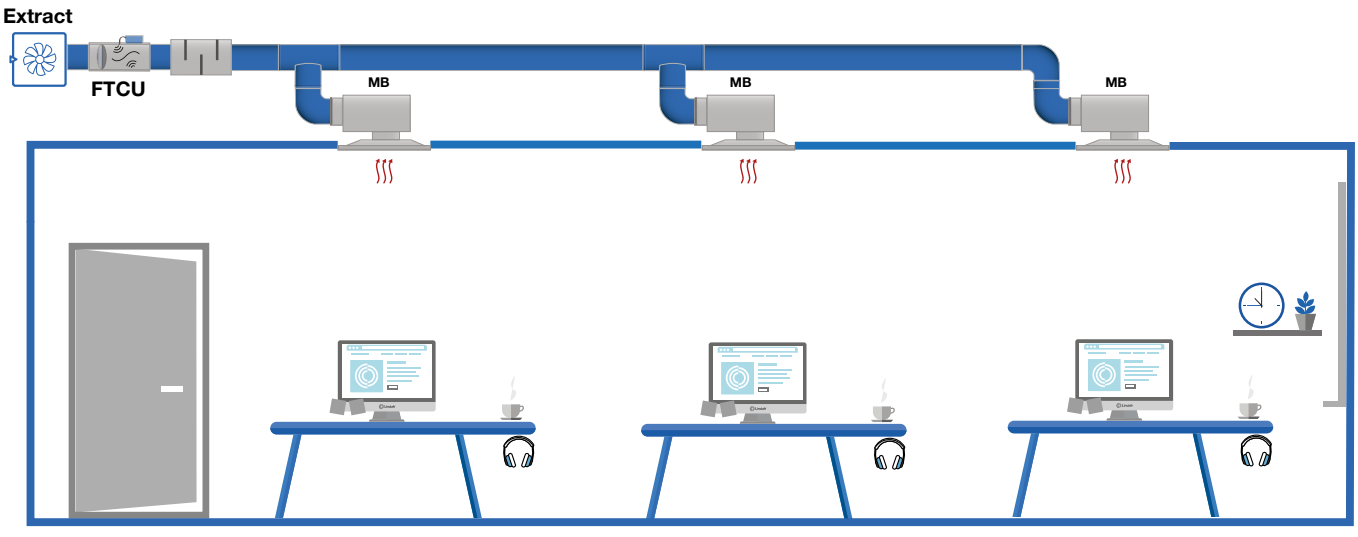
Balanced extract

A balanced ventilation solution on room level, will make sure that there is direct air balance in all rooms. No air transition between rooms. For this solution it is possible to use the extract duct air as an indoor climate indicator for the room, measured with a duct sensor e.g temperature og CO_2. The extract air flow demand can be set directly from the room controller or through a system master or from an overall BMS.

Small room with own extract unit.
Air flow controlled with FTCU. Demand from supply air flow, individual in each room. This solution can be combined with all above small room supply solutions.



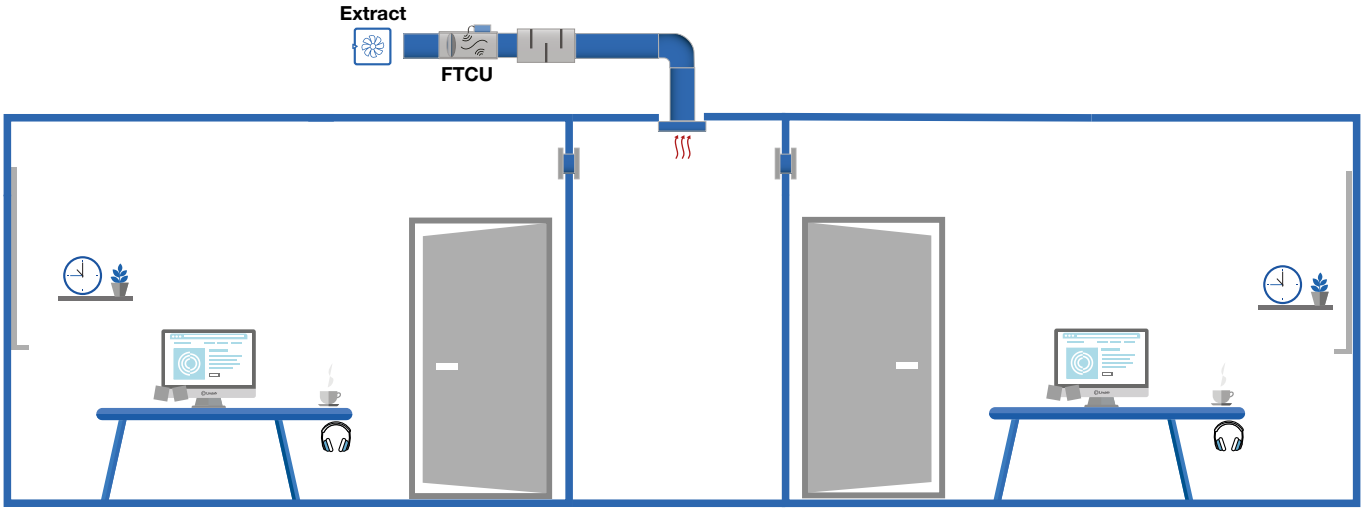
Large room with common extract.
Demand from supply air flow from entire room, supply strategy can be both individual and common.
This solution Can be combined with all above larger room supply solutions. The amount and size of extract points can vary from the supply points. As long as the air flow is in balance.



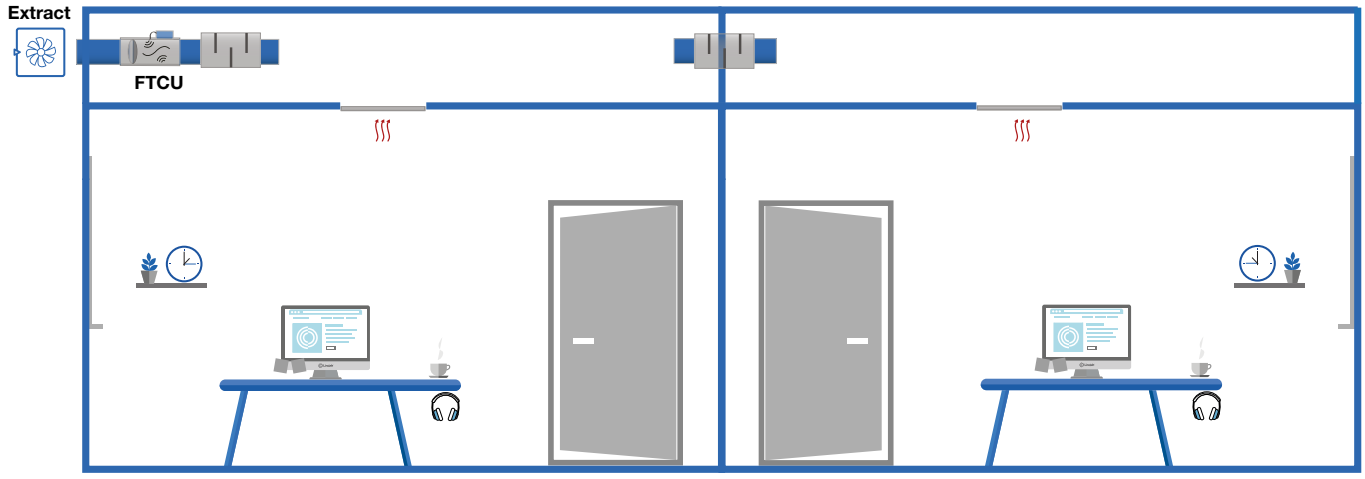
Regula room control system

Centralized extract

Centralized extract at floor/area level.
The extract air is collected in central points at floor/area level, where the air is moving across the rooms via overpressure valve.



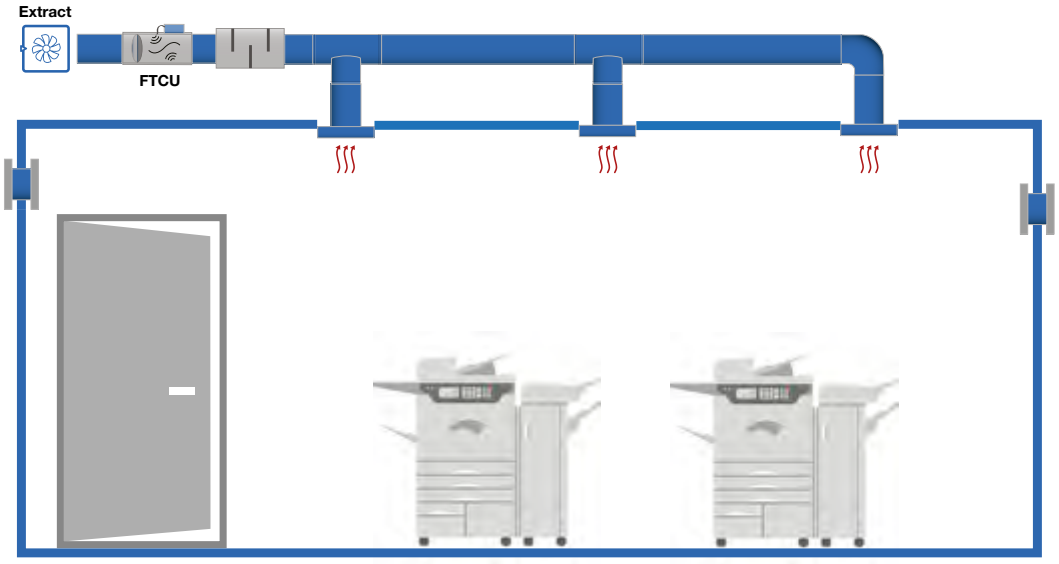
Centralized extract above suspended ceilings.
The air circulation happens above the suspended ceiling.



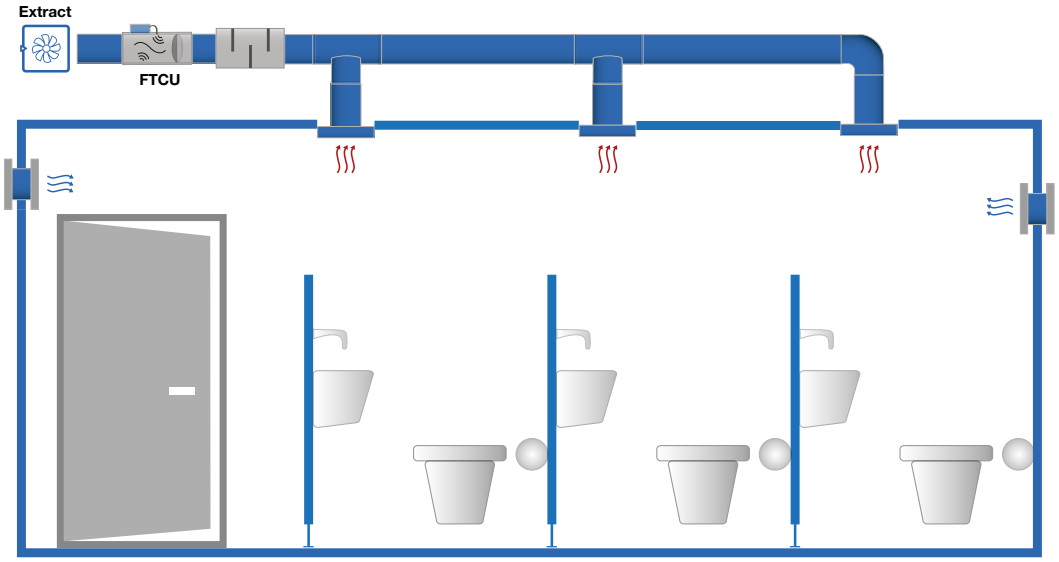
Regula room control system

Localize extract

Localize extract at room level
Some rooms have a special need for extract. this can be constant or accordning to process work. The room can be provide with the need supply air from naboring rooms, as an under pressure will be created.



Constant extract
Some areas require constant extract flow do to the use of the room, eg. toilets.
For toilets, the extract could be on a seperate AHU to avoid odours to spred through the main AHU. If this is the case, a flow meassuring unit as FTMU would be suitable. to be able to make air balance i the building.

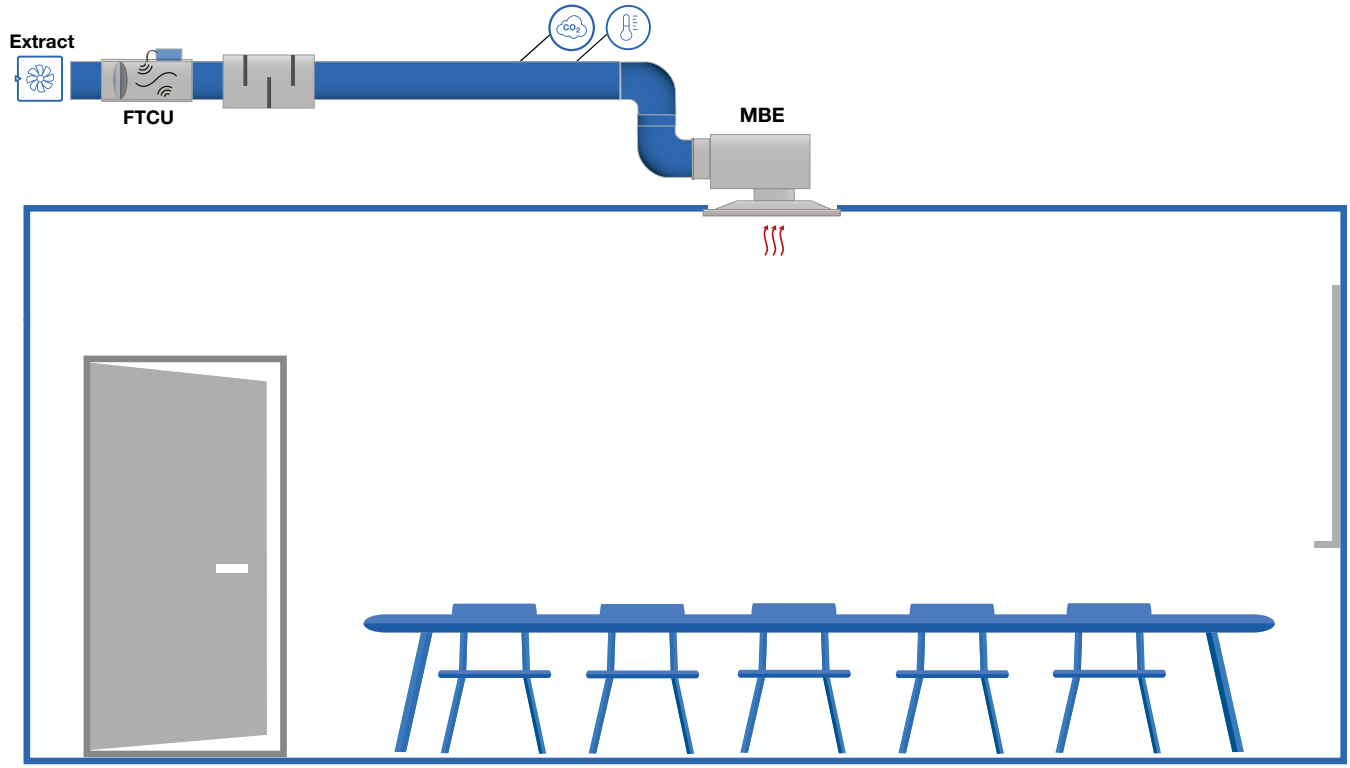


Regula room control system

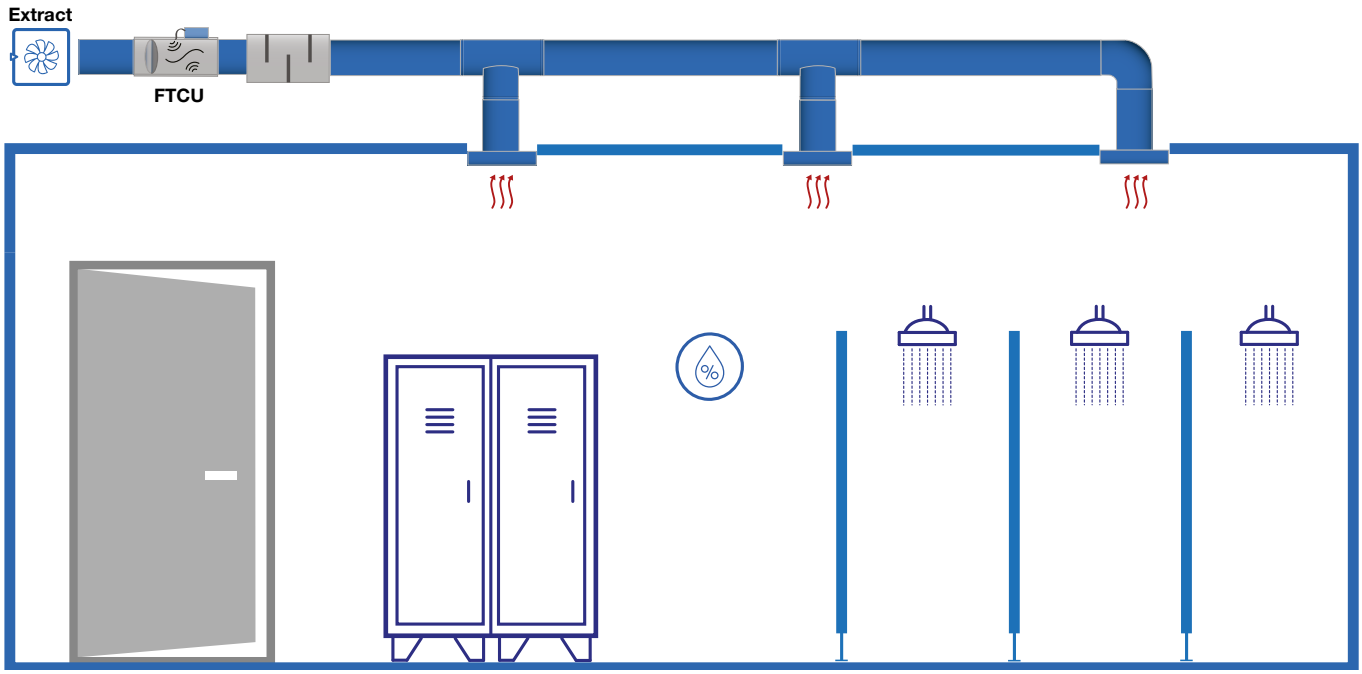
Direct control

A sensor controls the extract airflow based on the RH or the CO_2 level in room. The sensor can be wall mounted or installed in the duct.

CO_2-level based extract in a room occupation.



RH-level based extract in a room with high humidity risk, like a shower or kitchen.



Regula room control system

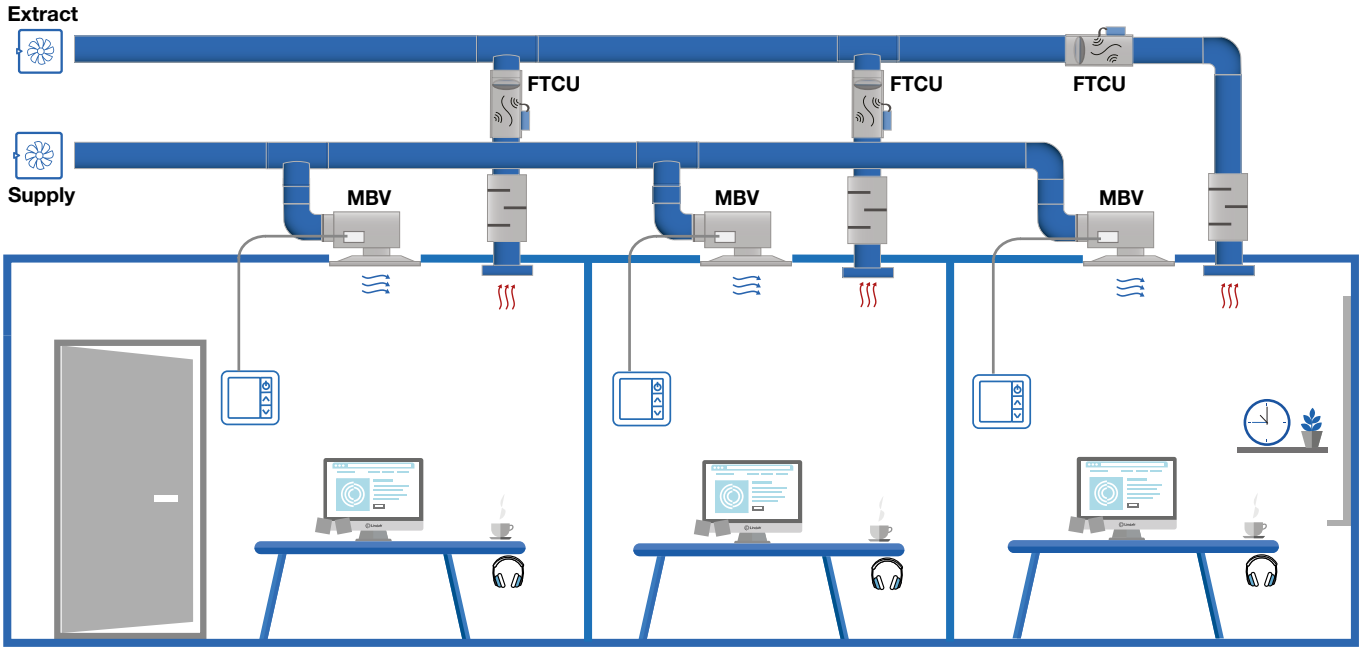
Combined solution

In this chaptor suggestion for complete room solutions is displayed. Thees are at combination of a suply solution and a extract solution, there are endless of combination that can be made. Reach out to the local Lindab sales office for for futher guidens to designing a good VAV/DCV building solution, that will handle the actual needs in that building.

Balanced small room solution with MBV and FTCU.

A modern classic way to create good indoor climate climate with individual needs in small offices, with a supply terminal and extract terminal in the same room.

Supply: 1A MBV, room controller wall mounted.
Extract: Balanced, small rooms.

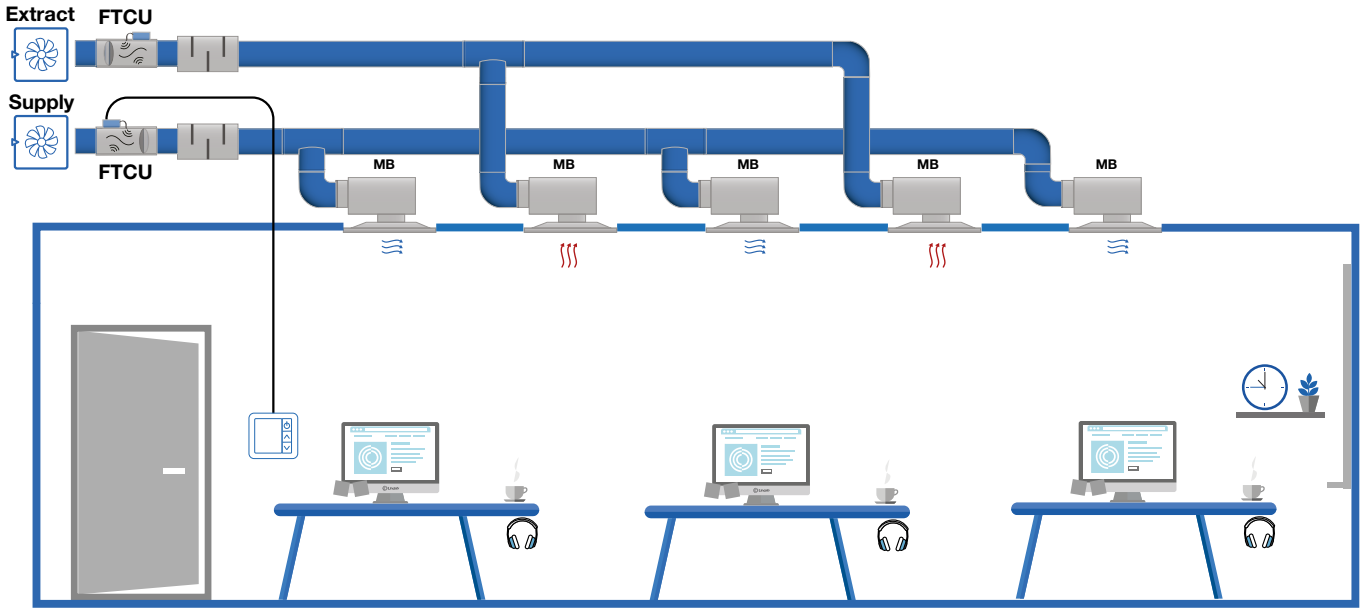


Regula room control system

Balanced large room solution with FTCU

FTCU in large room, single zone.
The simple and economical solution. A single FTCU to control the supply and a single FTCU for extract air.

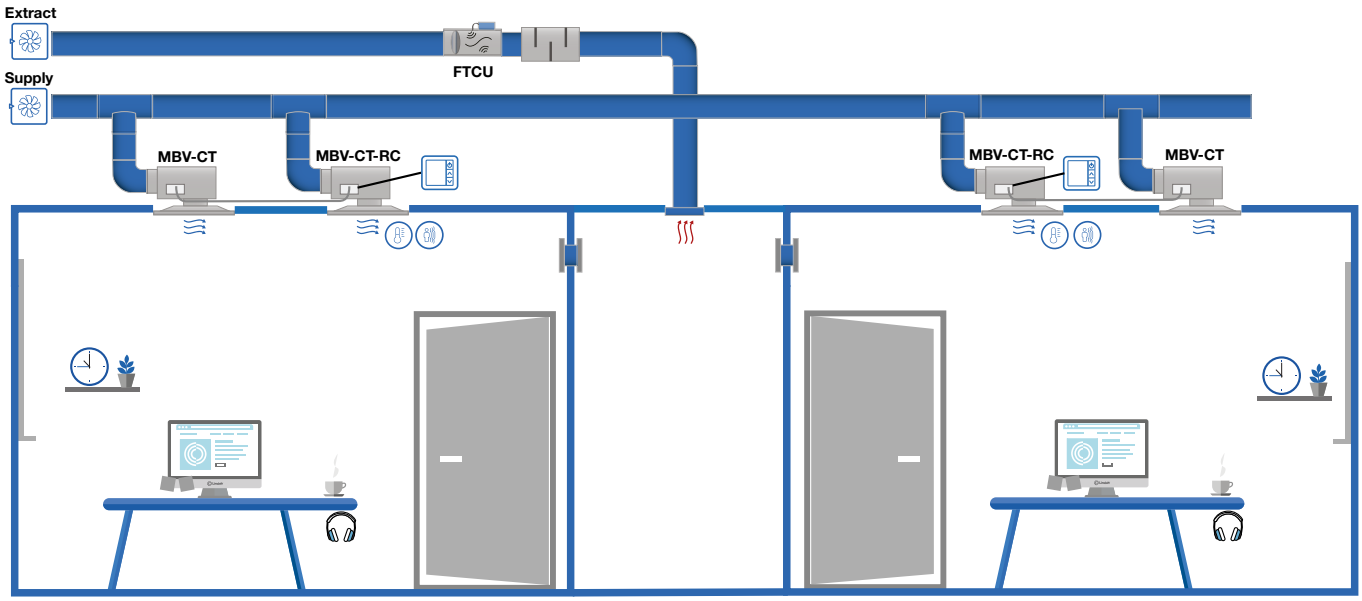
Supply: 3B, large regulation zone, RC wall mounted.
Extract: Balance with FTCU. Large room with common extract.



Regula room control system

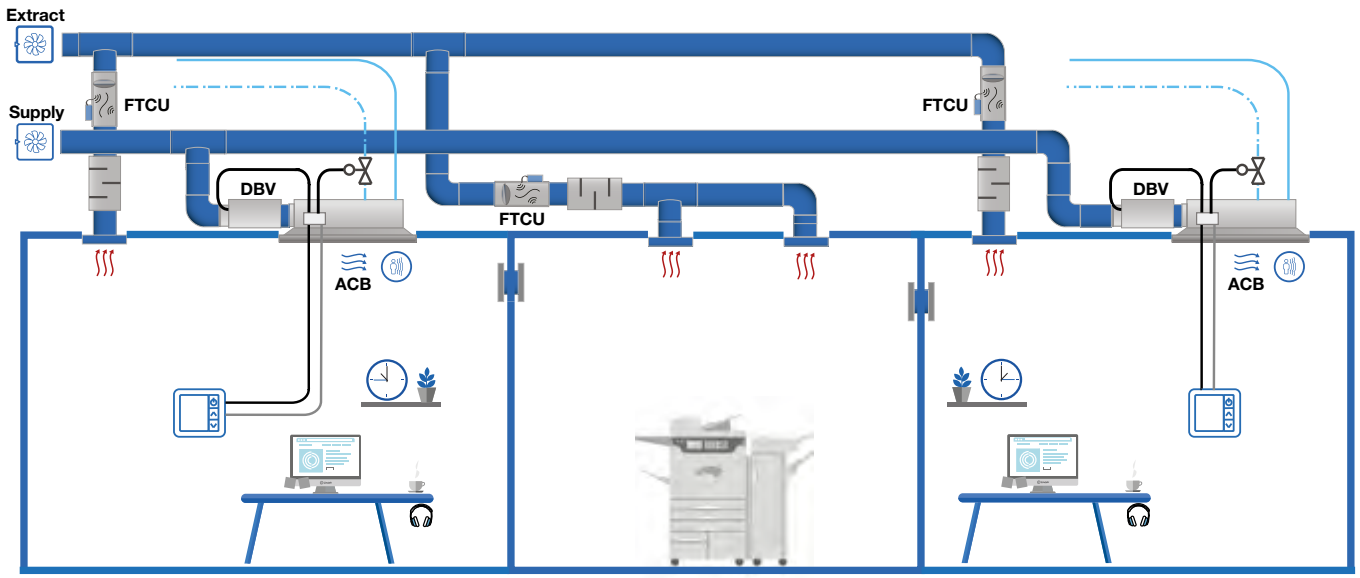
Centralized extract at floor level

Supply solution: 1F. MBV, large room zone, RC's above ceiling.
Extract: Central from hallway.



Localize extract at room level

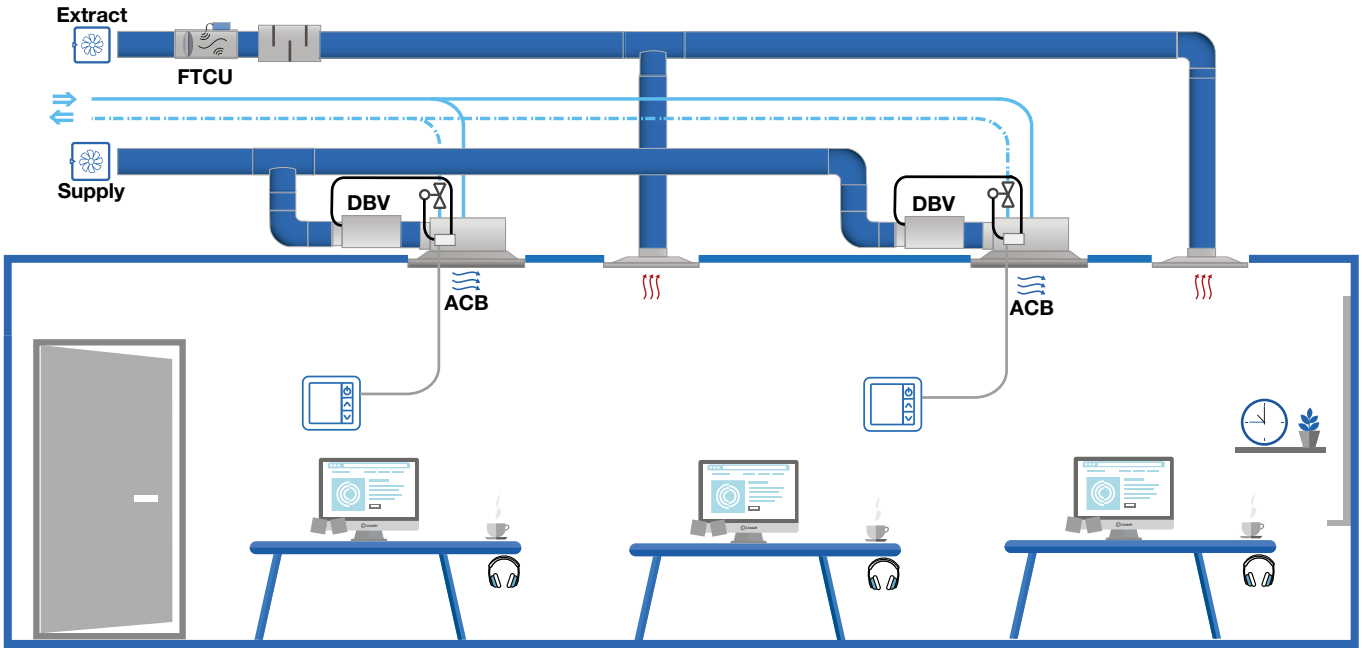
Supply solution: 4A. DBV and ACB with presence sensor, RC's wall mounted.
Extract: Compensated and balanced with rooms.



Regula room control system

VAV chilled beam system with individual supply and extract

Supply: 4A. DBV & ACB, RC wall mounted, induvidual regulation zones.
Extract: balanced common extract, large room solution with FTCU.



Most of us spend the majority of our time indoors. Indoor climate is crucial to how we feel, how productive we are and if we stay healthy.

We at Lindab have therefore made it our most important objective to contribute to an indoor climate that improves people's lives. We do this by developing energy-efficient ventilation solutions and durable building products. We also aim to contribute to a better climate for our planet by working in a way that is sustainable for both people and the environment.

Lindab | For a better climate