

Halton Workplace Climate Plus Solution description

Contents

1	Introduction	4
1.1	About this document	4
1.2	Copyright and disclaimers	4
1.3	Summary of changes	4
1.4	Contact information	4
2	Solution description	5
2.1	Overview	5
2.2	Operating principle	6
2.3	Halton Workplace Climate Plus solution	8
2.4	Halton Workplace services	8
2.5	System components	10
2.5.1	Halton Workplace air-water with active chilled beams	10
2.5.2	Halton Workplace air-water with diffusers and radiant panels	11
2.5.3	Halton Workplace all-air with diffusers	12
2.5.4	Halton Workplace common components	14
2.5.5	Halton Workplace zone and central level components	16
2.6	Scope of delivery and project responsibilities	17
2.6.1	Materials and installation	17
2.6.2	Preconditions for Halton Workplace commissioning support and start-up process	21
2.6.3	Halton Workplace commissioning support and start-up process	22
3	Design examples	25
3.1	Halton Workplace air-water system with Halton Rex Integrated VAV (R6O) and Halton Rex Exposed VAV (REO) active chilled beams	25
3.1.1	System description and performance	25
3.1.2	Room automation: Halton Rex Integrated VAV (R6O) active chilled beams controlled with Halton Workplace WRA room automation controllers	31
3.1.3	Components and order code examples for the system	34
3.2	Halton Workplace air-water system with Halton Rex Exposed (REE), Halton Rex 600 (RE6), and Halton Rex Expander (RXP) active chilled beams	35
3.2.1	System description and performance	35
3.2.2	Room automation: Halton Rex Exposed (REE) active chilled beams with HAQ control and Halton PTS damper, controlled with Halton Workplace WRA room automation controllers	39
3.2.3	Components and order code examples for the system	42
3.3	Halton Workplace all-air system with Halton Jaz Conical VAV (JDS) active diffusers	43
3.3.1	System description and performance	43
3.3.2	Room automation: Halton Jaz Conical VAV (JDS) active diffusers controlled with Halton Workplace WRA room automation controllers	48
3.3.3	Components and order code examples for the system	50

3.4 Halton Workplace air-water system with Halton Jaz JDA static diffusers and Halton Max Ultra Circular (MUC) VAV damper combined with Halton Ava Individual (AIN) radiant panels	51
3.4.1 System description and performance	51
3.4.2 Room automation: Halton Jaz JDA static diffuser, Halton Max Ultra Circular (MUC) VAV damper, and Halton Ava Individual (AIN) radiant panels, controlled with a Halton Workplace WRA room automation controller	57
3.4.3 Components and order code examples for the system	59
3.5 Halton Workplace zones	60
3.5.1 Example of a zone-level application	60
4 Reference data	62
4.1 Standards and guidelines	62
4.2 Typical design values for ventilation airflow rates specified in standards	63

1 Introduction

1.1 About this document

The purpose of this document is to describe the Halton Workplace Climate Plus solution for office buildings. The document also provides general design-related information, such as design examples. More detailed designs can be carried out using the Halton HIT Design tool, available for download at www.halton.com. The purpose of this document is to describe the gas and smoke extraction solution. The document also provides general design-related information, such as design examples.

Users of this guide are assumed to have basic heating, ventilation and air conditioning (HVAC) and automation design knowledge.

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1.3 Summary of changes

Release	Date	Description
2.0	31-May-2021	Radiant panels and diffusers added.
1.1	31-Dec-2021	Editorial changes.
1.0	18-Nov-2021	First release.

1.4 Contact information

For contact information, see www.halton.com.

2 Solution description

2.1 Overview



Fig. 1. An office with the Halton Workplace Climate Plus solution

The Halton Workplace Climate Plus solution is a complete demand-based indoor climate system for office buildings with services for ensuring a safe environment and well-functioning system operation during the building life cycle. The system optimises energy performance while maintaining occupant comfort and indoor air quality at all times.

Application areas

- Open-plan offices, single office rooms, and meeting rooms with ductwork zone design
- Office building floors with centralised exhaust, for example, in the lobby
- Rooms with individual exhaust units

Key features

- A complete solution from Halton, your experienced all-in-one partner
- Safe environment for all building users. Airflow rates continuously maintained to reduce the risk for airborne infection (REHVA covid-19 guidelines).
- Comfortable thermal conditions and good indoor air quality for enhancing the productivity of people working in the building

- A-class indoor environmental quality compatible with international standards (ISO EN 7730, EN 16798, CR 1752)
- Enables a fully flexible layout for changing needs in office environments, consequently lower churn costs. An office can be converted into a meeting room or vice versa in 15 minutes or less.
- Up to 50% reduction of energy consumption when compared to conventional air conditioning systems due to fully demand-based operation taking into account varying occupancy in office buildings and due to sustainable system characteristics.

2.2 Operating principle

In the Halton Workplace system, the control is divided into four levels: user, room, zone, and central.

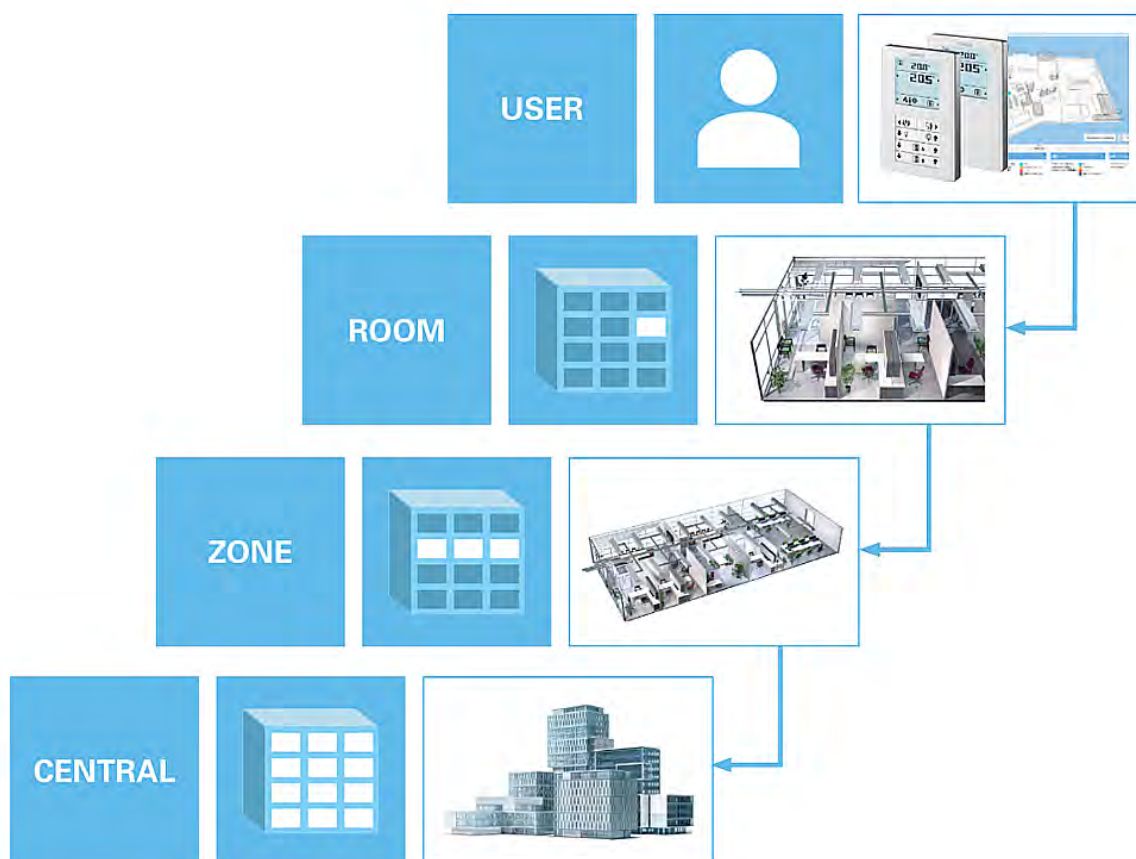


Fig. 2. Control levels of the Halton Workplace system

Users

With the wall panels of the Halton Workplace WRA room automation package, users can adjust the room temperature or boost the ventilation. Also, automatic adjustments can be programmed from the Building Management System (BMS). With Halton Connect, additional third-party functions such as Haltian Emphatic Building can be connected to the Halton Workplace system to provide smart office functions for users.

Rooms

Spaces are monitored using indoor air quality sensors such as occupancy, temperature and carbon dioxide (CO₂). Based on the defined office hours, the ventilation can be turned from unoccupied (minimum) to standby (medium) mode. In some cases, the ventilation can be shut off during night-time. During office hours, based on the

occupancy data, the ventilation can be turned from standby (medium) to occupied (normal) mode. Based on the temperature and CO₂ monitoring, the ventilation can be boosted when needed. This ensures safe and comfortable conditions and minimises energy consumption, for example, in meeting rooms.

Active room units, equipped with integrated dampers and control units, enable variable airflows while continuously maintaining comfortable conditions without the risk of draught.

The room automation controller in the Halton Workplace WRA room automation package ensures perfect conditions and saves energy when spaces are unoccupied.



Fig. 3. Room air conditioning operating modes based on occupancy and the time of the day

The following room air conditioning applications are available:

- Halton Workplace air-water with active chilled beams
- Halton Workplace air-water with diffusers and radiant panels
- Halton Workplace all-air with diffusers

For information on the room air conditioning applications and the related components, see chapter [System components](#). For design examples, see chapter *Design examples*.

Zones

The Halton Workplace system is divided into ventilation zones to ensure flexibility and controllability. This, in turn, ensures energy-efficient and sustainable operation. With zones, it is possible to control the ventilation rates efficiently and reduce unnecessary pressure in the system. Zones with a flexible design maximise the layout flexibility while keeping commissioning, maintenance, and adjustments simple.

The ventilation zones are controlled by airflow control dampers that maintain constant static pressure in the ductwork. Constant pressure enables variable airflows in spaces with different needs. For example, a meeting room can move from unoccupied mode to boost mode without affecting the open-plan office space in the same duct branch.

The controllers integrated into zone control dampers control the central system that operates the air handling unit (AHU). By optimising the performance of the AHU and the cooling or heating of rooms based on demand, energy savings of up to 50% can be reached.

Central level

On the central level, the Halton Workplace WSO system optimiser monitors the performance of the ventilation system. It minimises energy consumption by keeping the lowest possible pressure level in the ductwork.

2.3 Halton Workplace Climate Plus solution

The Halton Workplace system is part of the Halton Workplace Climate Plus solution that integrates elements into a wholesome indoor environment experience from design to building use.

Halton Workplace Climate Plus delivers a demand-based indoor climate solution that ensures a safe environment with excellent indoor air quality, occupant comfort, and adaptable performance in activity-based spaces.

The advanced control system maintains excellent air quality and thermal comfort conditions in areas where people spend time. Dynamic system adaptation ensures flexible space use, flexible layout changes and sustainable performance by reducing energy consumption with up to 50%.

As part of the delivery, Halton validates the designs during the planning phase as well as the actual conditions on site. If needed, adjustments can be made on site.

- Safe environment with a demand-based system
- Verified indoor climate conditions
- Fully flexible layout design
- Energy efficient operation

2.4 Halton Workplace services

The Halton Workplace Climate Plus solution is a complete demand-based indoor climate system for office buildings with services for ensuring well-functioning system operation during the building life cycle. These Halton services include support for the overall Halton Workplace system project management, design support, commissioning support, and life-cycle support service.

Halton project management support

This service from Halton contains support from a Halton sales representative and project management team. They propose the most suitable Halton Workplace solution options for your customer project and act as a contact point and link between the customer representatives and the Halton supply chain. The goal is to ensure a smooth system delivery from the first negotiations at the pre-design stage of the building project up until the start-up and actual usage of the Halton Workplace system during the first years of building operations.

Halton Design Studio

The target of this service is to ensure a correct Halton Workplace system design. It provides an additional checkpoint for the design done by a Halton specialist or an approved consultant. The extent of the service can be adjusted, but it is advisable to include at least a short overall checkpoint in all projects. The following stages are included:

- Checking the operation of ductwork zones with designed variable airflow rates. This includes checking the design of airflow management dampers and measurement units in the ductwork starting from the air handling unit and investigating the ductwork designs (including ring ductworks).
- Checking the design of the room supply and exhaust units in the Halton Workplace system. The target of this service is to ensure operation as part of the variable airflow system. This support service can be extended

with the verification of the indoor climate design by measurements done at the Halton Innovation Hub or by CFD simulation services.

Halton Tune

This service is done for ensuring a smooth Halton Workplace system start-up. This service differs from the general building commissioning process, but supports and improves it. It is done by a Halton specialist working remotely through Halton Connect and a local Halton partner working on site. For more detailed information, see chapter [Scope of delivery and project responsibilities](#).

Halton Life Cycle

- Maintenance
Halton offers a maintenance agreement for the installed systems. As part of this service, the Halton service team or service partner monitors, tests, and possibly readjusts the components and sensors of the Halton Workplace system to ensure a continuous functionality of the spaces and working conditions. This maintenance agreement can include Halton Survey that provides a method for guaranteeing individual comfort in the building after the occupants have moved in, by mapping perceived satisfaction. This way, individual needs are taken into account in different parts of the building
- Halton Connect remote monitoring (as part of a maintenance agreement)
Halton Connect is an IoT platform with an advanced cloud-based portal accessible with Halton Edge. It enables 24/7 remote monitoring of the solutions designed by Halton. It provides vital information to Halton engineers so they can remotely and safely control all systems and their settings when required.



2.5 System components

For an overview of the components of each Halton Workplace room air conditioning application, see the sections below.


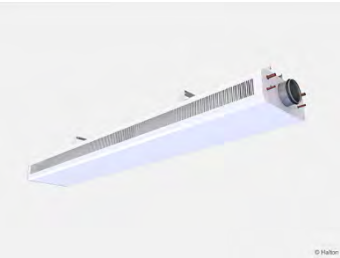

For further information on the Halton Workplace system, see www.halton.com or Halton HIT Design, or contact Halton sales.

2.5.1 Halton Workplace air-water with active chilled beams


Active chilled beams with a built-in variable supply airflow damper

Component	Description
<p>Halton Rex Integrated VAV (R6O) chilled beam</p>  <p>The image shows a long, rectangular, white integrated VAV chilled beam. It has a central circular damper and two yellow-handled adjustment knobs on the right side. The beam is shown from a perspective view, highlighting its slim profile.</p>	<p>An active VAV chilled beam for suspended ceilings. Used for demand-based ventilation with constant static pressure ductwork.</p>
<p>Halton Rex Exposed VAV (REO) chilled beam</p>  <p>The image shows a long, rectangular, white exposed VAV chilled beam. It has a central circular damper and a red-handled adjustment knob on the right side. The beam is shown from a perspective view, highlighting its slim profile.</p>	<p>An active VAV chilled beam for exposed installation. Used for demand-based ventilation with constant static pressure ductwork.</p>

Active chilled beams with a built-in boost airflow damper and an optional minimum airflow damper

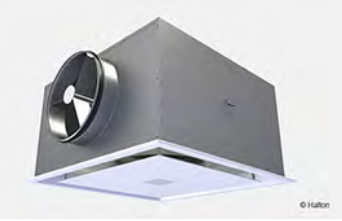
Component	Description
<p>Halton Rex 600 (RE6) chilled beam</p> 	<p>An adaptable active chilled beam for suspended ceilings.</p>
<p>Halton Rex Exposed (REE) chilled beam</p> 	<p>An adaptable active chilled beam for exposed installation.</p>
<p>Halton Rex Expander (RXP) chilled beam</p> 	<p>An active CAV/VAV chilled beam with 4-way air distribution for suspended ceilings.</p>

2.5.2 Halton Workplace air-water with diffusers and radiant panels**Radiant panel for exposed installation and suspended ceilings**

Component	Description
<p>Halton Ava Individual (AIN) radiant panel</p> 	<p>A radiant panel with low pressure drop and high capacity also with small water flows. Fully recyclable materials.</p> <p>Product models with solid or perforated front panels and insulation for room sound attenuation. Customised models available.</p> <p>To be combined with supply air diffusers (see Halton Workplace all-air with diffusers).</p>






2.5.3 Halton Workplace all-air with diffusers

Active ceiling diffuser with a built-in variable supply airflow damper and sound attenuation

Component	Description
<p>Halton Jaz Conical VAV (JDS) diffuser</p> 	<p>An active ceiling diffuser for supply air in systems with constant static pressure ductwork.</p> <p>Stable throw length with variable airflow rates. Integrated balancing plenum with measurement and adjustment functions and effective sound attenuation.</p>



Static diffusers with an external variable supply airflow damper and an optional sound attenuator


Note: Also other types of static supply air diffusers and plenums can be used in the system (for example, any ceiling diffusers, wall diffusers, or displacement units).

Component	Description
<p>Halton Max One Circular (MOC) VAV damper</p> 	<p>A circular airflow management damper for room supply air installations with the Halton Workplace WRA room automation package and with an optional sound attenuator.</p> <p>Airflow measurement based on the cross-tube pressure difference.</p> <p>To be used with any static supply air diffusers.</p>
<p>Halton Max Ultra Circular (MUC) VAV damper</p> 	<p>A circular airflow management damper for room supply air installations with the Halton Workplace WRA room automation package and with an optional sound attenuator.</p> <p>Airflow measurement with ultrasound sensors.</p> <p>To be used with any static supply air diffusers.</p>
<p>Halton Jaz JDA diffuser</p> 	<p>A square ceiling diffuser with a side slot. Suitable for supply and exhaust. A balancing plenum can be selected as an accessory.</p>
<p>Halton Jaz JDB diffuser</p> 	<p>A circular ceiling diffuser with a side slot. Suitable for supply and exhaust. A balancing plenum can be selected as an accessory.</p>
<p>Halton Jaz JSC diffuser</p> 	<p>A multi-nozzle ceiling diffuser with an adjustable supply air pattern. A balancing plenum can be selected as an accessory.</p>




2.5.4 Halton Workplace common components

Components common to room air conditioning applications

Component	Description
<p>Halton Workplace WRA room automation package</p> 	<p>The Halton Workplace WRA room automation package consists of a controller and optional components depending on customer needs: a wall panel and sensors for temperature, CO₂, occupancy, pressure, and condensation.</p>
<p>Halton Max One Circular (MOC) VAV damper</p> 	<p>A circular airflow management damper for a wide variety of standard VAV applications, with an optional sound attenuator.</p> <p>Airflow measurement based on the cross-tube pressure difference.</p> <p>Suitable for room supply and exhaust air installations. For more information, see Static diffusers with an external variable supply airflow damper and an optional sound attenuator.</p>
<p>Halton Max Ultra Circular (MUC) VAV damper</p> 	<p>A circular airflow management damper for VAV and CAV applications, with an optional sound attenuator.</p> <p>Airflow measurement with ultrasound sensors.</p> <p>Suitable for room supply and exhaust air installations. For more information, see Static diffusers with an external variable supply airflow damper and an optional sound attenuator.</p>
<p>Halton PTS/A single-blade airflow management damper</p> 	<p>A circular single-blade shut-off, adjustment, and balancing damper with a gasket. Used with the Halton Workplace air-water with active chilled beams application as an optional minimum airflow damper.</p>

Component	Description
<p>Halton AGC exhaust grille with Halton PRL plenum</p>  <p>© Halton</p> <p>© Halton</p>	<p>A detachable exhaust grille with a large free area. Even high airflow rates with minimal pressure drop.</p> <p>A balancing plenum for connecting supply or exhaust grilles to ductwork. Effective sound attenuation.</p> <p>Also other types of exhaust air grilles and valves can be used in the system.</p>

2.5.5 Halton Workplace zone and central level components

Component	Description
<p>Halton Max MDC zone control damper</p>  <p>A circular, cylindrical metal damper with a control box on top and blue wiring. It has a large circular opening on the front.</p>	<p>A circular pressure-independent variable airflow control damper, with an optional sound attenuator.</p>
<p>Halton MSS static pressure measurement unit</p>  <p>A cylindrical metal unit with a black control box on the side and yellow and blue wires extending from the bottom.</p>	<p>Used for measuring the static pressure in zone ducts. Consists of a measurement element and a pressure transmitter with an LCD display.</p>
<p>Halton Workplace WSO system optimiser</p>  <p>A white metal rack-mounted unit with a black control panel on the front and various components visible inside.</p>	<p>Includes two optional modules:</p> <ul style="list-style-type: none"> - Halton Workplace WSO system optimiser is a controller for monitoring the performance of the ventilation system. Minimises energy consumption by keeping the lowest possible pressure level in the ductwork. - Halton Edge remote control is used to access the Halton Connect cloud-based portal, to remotely perform the system start-up and commissioning, and to collect data for maintenance. It is always needed for a standard Halton Workplace system delivery as well as an efficient start-up and commissioning support process.

2.6 Scope of delivery and project responsibilities

2.6.1 Materials and installation

Components: room units

Room units	Supplier	Installer	Cabling	Connections
Room units with integrated airflow control dampers	Halton	HVAC	Halton*	MAC
Halton Workplace WSO system optimiser	Halton	MAC	EC	MAC
Routers and Ethernet switches	MAC	MAC	MAC	MAC
Temperature sensors	Halton	Halton/EC*	Halton/EC*	MAC
CO ₂ sensors	Halton	Halton/EC*	Halton/EC*	MAC
Occupancy sensors	Halton	Halton/EC*	Halton/EC*	MAC
Condensation sensors	Halton	Halton/EC*	Halton/EC*	MAC
Window switches	MAC	MAC	EC	MAC
Wall panels	Halton	EC	EC	MAC
Heating valves	Halton	Halton/EC*	Halton/EC*	MAC
Heating valve actuators	Halton	Halton/EC*	Halton/EC*	MAC
Cooling valves	Halton	Halton/EC*	Halton/EC*	MAC
Cooling valve actuators	Halton	Halton/EC*	Halton/EC*	MAC

Table 1. Parties responsible for the components related to room units

Components: zone units

Zone units	Supplier	Installer	Cabling	Connections
Airflow control dampers	Halton	HVAC	EC	MAC
Static pressure measurement units	Halton	HVAC	EC	MAC

Table 2. Parties responsible for the components related to zone units

Cables

Cable	Supplier	Cabling	Connections	Cable type
Power supply 230 V	EC	EC	EC	3 x 1.5 mm ²
Network	EC	EC	MAC	CAT 5 Ethernet, max. length 100 m
Controllers and actuators	EC	EC	MAC	Shielded twisted pair, min. size 0.5 mm ²
KNX device	EC	EC	MAC	KNX certified cable

Table 3. Parties responsible for the cables

Key:

- Supplier = Party responsible for supplying the component
- Installer = Party responsible for installing the component
- Cabling = Party responsible for supplying and installing the cables between components
- Connections = Party responsible for connecting the wires to the components
- Halton/EC* = Component in question is installed to a room unit at the factory, or if provided separately, installed by an EC on site (see project-specific documentation)
- HVAC = HVAC contractor
- MAC = Main automation contractor
- EC = Electrical contractor

For detailed information on the components and wiring, see the project-specific documentation.

Components excluded from the Halton scope of delivery and provided by the installer

See tables [Parties responsible for the components related to room units](#), [Parties responsible for the components related to zone units](#) and [Parties responsible for the cables](#). For detailed information, see the project-specific wiring diagrams.

Installations and configurations performed at the Halton factory prior to system delivery

- Installation of components to room units.
 - For a list of factory-installed components for active chilled beams, active diffusers, and radiant panels, see table [Factory-installed components for room units](#).
 - The all-air room air conditioning application with static diffusers and an external Halton Max Ultra Circular (MUC) or Halton Max One Circular (MOC) VAV damper requires the Halton Workplace WRA room automation controller and the related components to be installed on site. A transformer is installed to the controller at the factory.
 - The Halton Ava Individual (AIN) radiant panel requires the water valves to be installed on site. Only water valve actuators are included in the Halton Workplace WRA room automation package.
- Room unit internal cabling
- Downloading of system software to controllers
- Configuration and verification of predetermined operational parameter settings in controllers:
 - Pre-requisite: A table of the operational parameters and setpoint data must be delivered to Halton in advance.
- Testing of factory-installed components
- Pre-commissioning phase BACnet addressing
 - Pre-requisite: the addressing instructions for all components must be delivered to Halton in advance

Component	Halton Rex Integrated VAV (R6O) chilled beam	Halton Rex Exposed VAV (REO) chilled beam	Halton Rex 600 (RE6) chilled beam	Halton Rex Expander (RXP) chilled beam	Halton Rex Exposed (REE) chilled beam	Halton Jaz Conical VAV (JDS) active diffuser
Halton Workplace WRA room automation controller	F	F	F	F	F	F
Supply air control damper	F	F	F	F	F	F
▪ Halton PTS damper	-	-	S	S	S	-
Room exhaust air control damper	S	S	S	S	S	S
Transformer	F	F	F	F	F	F
Temperature sensor	F	F	F	F	F	F
CO ₂ sensor	F	F	F	F	F	F
Occupancy sensor	S	F	S	S	F	F
Condensation sensor	F	F	F	F	F	-
Window switch	S	S	S	S	S	-
Wall panel	S	S	S	S	S	S
Pressure sensor	F	F	F	F	F	F

Component	Halton Rex Integrated VAV (R6O) chilled beam	Halton Rex Exposed VAV (REO) chilled beam	Halton Rex 600 (RE6) chilled beam	Halton Rex Expander (RXP) chilled beam	Halton Rex Exposed (REE) chilled beam	Halton Ava Individual (AIN) radiant panel
Cooling water valves and actuators:						
▪ Danfoss	F*	F*	F*	F*	F*	S
▪ Siemens	S	F*	S	S	F*	S
Heating water valves and actuators:						
▪ Danfoss	F*	F*	F*	F*	F*	S
▪ Siemens	S	F*	S	S	F*	S
▪ Radiator	S	S	S	S	S	S

Table 4. Factory-installed components for room units

Key:

- F = Factory-installed
- S = Installed on site
- F*= Factory-installed, with the exception of primary and secondary units being installed on site

2.6.2 Preconditions for Halton Workplace commissioning support and start-up process

The following preconditions for the Halton Workplace commissioning support and start-up service are not included in the Halton scope of delivery and must be completed before the start-up process can be started:

- Copies of all drawings and documentation listed below must be delivered to Halton
 - Ventilation plan drawings
 - Electrical and automation operation and wiring diagrams
 - Automation operation descriptions (specification in case descriptions are not included in the operation diagrams)
- Operational parameters and setpoint data must be provided in the excel format (an excel file template is provided by Halton in advance)
- Installation details of any externally installed sensors or field devices, such as heating and cooling valves, must be compatible with Halton systems

- Installation responsibility and location
- Additional sensor or wall panel mounting brackets
- Communication network design
- Labelling of active components

Installation, cabling, and connections of all Halton Workplace system components must be completed according to project and component-specific installation instructions. This includes but is not limited to the following:

- Room units
- Airflow control dampers
- Static pressure measurement units
- Halton Workplace WSO system optimiser cabinet
- Field devices
- Automation cabling done from the Halton Workplace WRA room automation controller to BMS
- Connecting Halton Workplace WSO system optimiser units to BMS sub-stations

The following tasks must be completed and verified before the start-up process can be started and are not included in the Halton scope of delivery:

- Power supply for the controllers and controller network in the Halton Workplace system completed and in operation.
- The air handling units, ductwork, and ventilation units (supply and exhaust) installed and in operation, stabilised, and available for adjustments by Halton.
- The preliminary balancing of the ductwork completed (main ducts for ductwork zones).
- The water piping for cooling and heating connected and completed. The pre-setting of valves completed.
- The performance and functionality testing and verification of all systems and components affecting the Halton Workplace system operation completed.
- No leakage points in the construction of rooms or ductwork (referring to local regulations and/or Halton recommendations), other than planned in the specifications.
- Access above the false ceiling and access hatches ensured in all spaces.

A person in charge of the project site must be available for assistance to Halton during normal working hours for the entire project duration.

2.6.3 Halton Workplace commissioning support and start-up process

The start-up process of the Halton Workplace system reviews and tests the functionality of the system components for the building commissioning process. The start-up process consists of remote work (a Halton specialist working remotely through Halton Connect) and/or local work on site (a local Halton partner working on site) specified below.

Review of room unit installations on site (local work on site)

- Reviewing all aspects (air, water, and electrical connections, installation, locations, etc.) of the initial installation of 10% of the Halton chilled beams and diffusers at the construction stage.

Review of controller network connections (remote work)

- Making sure that Halton Edge is powered up and online

- Making sure that all controllers are online
- Checking the data connections between devices

Testing of field devices (remote work)

- Room-level temperature sensors (factory-tested - remote check)
- Room-level CO₂ sensors (factory-tested - remote check)
- Room-level occupancy sensors (factory-tested - remote check)
- Room-level occupancy sensors (remote work, if not factory-tested)
- Room-level condensation sensors (factory-tested - remote check)
- Room-level wall panels

Testing of field devices (local work on site)

- Room-level window switches
- Airflow control dampers not integrated into room units
- Room-level water valves
- Zone-level airflow control dampers

Airflow measurements (responsible local contractor for airflow measurement; with support of local work on site and remote work)

Airflow measurements based on room unit pressure levels with airflow rate calculation (unoccupied, standby, occupied, boost) and comparison with the airflow measurement from the zone control dampers.

Testing of Halton Workplace WSO system optimiser functionality (remote work)

After the installation and start-up phases of the room and zone levels have been completed, the functionality of the Halton Workplace WSO system optimiser is tested as follows:

- Testing and adjusting the operation of the Halton Workplace WSO system optimiser
- Testing the WSO and BMS sub-station operation according to project-specific documentation
- Checking the WSO system operation during the first weeks of building operation and making adjustments if needed.

Finalisation of ductwork balancing at the end of the start-up process

Note: The finalisation of the ductwork balancing is part of the building commissioning process and not included in the Halton commissioning support and start-up process.

Training (remote work)

Customer or user training, including detailed user instructions, is provided by Halton. The half-day training is meant for all people delegated by the customer and covers the system characteristics, performance, operation principles (automation system), and proper maintenance of potential faults. The specific use of Halton Velocity Control (HVC) and airflow control dampers integrated into room units is explained.

Documentation

- Room units, airflow control dampers, controllers, sensors, wall panels, valves when applicable
- Device addresses
- Controller documentation including the parameter list

- Software names and versions downloaded to the components
 - Configuration and application settings
- Project-specific wiring diagrams
- Report of all reviewed items and necessary recommendations
 - List of functionality tests implemented on site
- Instructions for building users

3 Design examples

3.1 Halton Workplace air-water system with Halton Rex Integrated VAV (R6O) and Halton Rex Exposed VAV (REO) active chilled beams

3.1.1 System description and performance

System description

The designed Halton Workplace system with Halton Rex Integrated VAV (R6O) and Halton Rex Exposed VAV (REO) chilled beams can be used flexibly in office rooms, landscape offices, and meeting rooms with medium to high cooling needs.

The system is divided in central, zone and room levels. The room level consists of room supply and exhaust units and required sensors, controllers, and user interfaces to maintain and monitor the indoor climate on the room level.

Both chilled beams can be used for cooling, heating, or combined cooling and heating. They are well suited for demand-based ventilation with a constant static pressure ductwork.

The Halton Operation Mode Damper (OMD) integrated into the chilled beams allows flexibility by enabling the following:

- Adaptability for different operating modes
- Adjustable supply airflow rate

System design criteria

The room area is 21 m², and the room height is 2.8 m. The assumed maximum number of people is eight in the meeting room and two in the cellular office room.

The design criteria for the indoor environment were selected according to the EN16798-1 standard, assuming category II for low polluting building. The CO₂ levels in the room with different ventilation airflow rates and different numbers of occupants are also calculated, to keep the airborne infection risk below an acceptable level.

Performance data

The product selections were done with the Halton HIT Design software.

Normal Cooling		R60/A-2400-C-2100		2018.03
Room:		Supply air flow rate:	2 x 15 l/s	
Room size:	5.3 x 4.0 x 2.8 m		1.4 l/(sm ²)	
Occupied zone:	h=1.8 m / dw=0.5 m	Supply air temperature:	18.0 °C	
Room air:	24.0 °C / 50 %	Static / OMD pressure:	▲p _{st} =83 ▲p _{omd} =83 Pa	
Heat gain:	-	Total pressure drop:	83 Pa	
Installation height:	2.80 m	Chamber 1 pressure:	82 Pa	
Inlet water temperature:	15.0 °C	Chamber 2 pressure:	-	
Outlet water temperature:	17.0 °C	Total sound pressure level:	< 20 dB(A)	
Water flow rate:	0.120 kg/s (2 x 0.060 kg/s)	Primary air capacity:	218 W (2 x 109 W)	
Coil capacity:	985 W (2 x 493 W) 224 W/m	Total cooling capacity:	1203 W (2 x 602 W) 273 W/m, 57 W/m ²	
Water pressure drop:	3.1 kPa	Dew point temperature:	12.9 °C	
		Velocity control:	side=2, middle=1	
		OMD opening:	50.0	
		L _d :	1.0 m	
Velocity point	v3			
Nozzle jet	~0.20 m/s			
Nozzle jet, isothermal	~0.05 m/s			
dt (nozzle jet-room air)	-0.6 °C			
Heat sources and their location may influence the velocity and direction of the jet				
v _{lim} = 0.20 m/s				

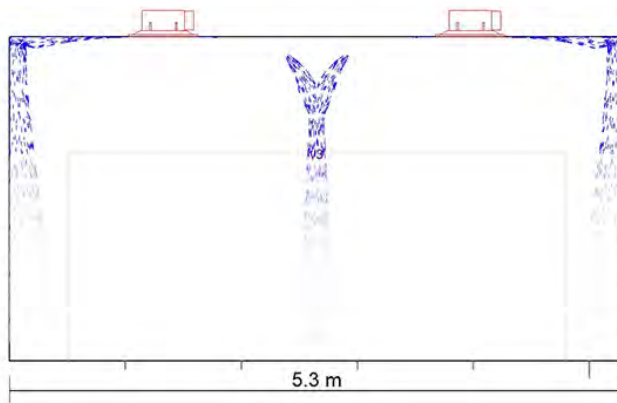


Fig. 4. Occupied (normal) operating mode for Halton Rex Integrated VAV (R60) chilled beam, designed to provide cooling and ventilation in a room used either as an office room or a meeting room, with two persons in the room.

Boost Cooling		R60/A-2400-C-2100		2018.03	
Room:		Supply air flow rate:	2 x (15+25 l/s)		
Room size:	5.3 x 4.0 x 2.8 m		3.8 l/(sm ²)		
Occupied zone:	h=1.8 m / dw=0.5 m	Supply air temperature:	18.0 °C		
Room air:	24.0 °C / 50 %	Static / OMD pressure:	▲p _{st} =83 ▲p _{omd} =83 Pa		
Heat gain:	-	Total pressure drop:	85 Pa		
Installation height:	2.80 m	Chamber 1 pressure:	82 Pa		
Inlet water temperature:	15.0 °C	Chamber 2 pressure:	71 Pa		
Outlet water temperature:	17.7 °C	Total sound pressure level:	29 dB(A)		
Water flow rate:	0.120 kg/s (2 x 0.060 kg/s)	Primary air capacity:	584 W (2 x 292 W)		
Coil capacity:	1337 W (2 x 669 W)	Total cooling capacity:	1921 W (2 x 961 W)		
	304 W/m		437 W/m, 91 W/m ²		
Water pressure drop:	3.1 kPa	Dew point temperature:	12.9 °C		
		Velocity control:	side=2, middle=1		
		OMD opening:	100.0		
		L _d :	-		
Velocity point	v1	v3			
Nozzle jet	~0.05 m/s	~0.20 m/s			
Nozzle jet, isothermal	~0.05 m/s	~0.15 m/s			
dt (nozzle jet-room air)	-0.0 °C	-0.2 °C			
Heat sources and their location may influence the velocity and direction of the jet					
vlim = 0.20 m/s					

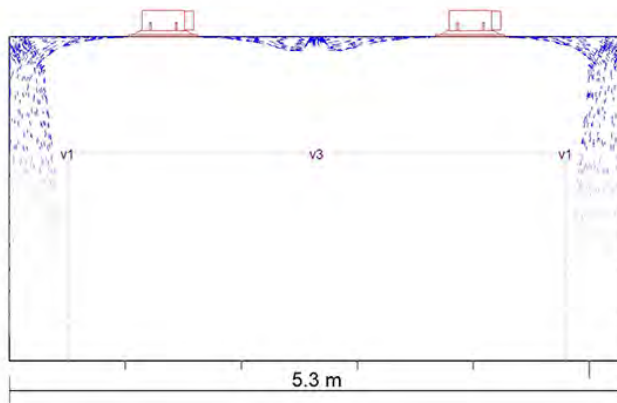


Fig. 5. Boost (maximum) operating mode for Halton Rex Integrated VAV (R60) chilled beam, designed to provide cooling and ventilation in a room used as a meeting room, with max. eight persons in the room.

Min Cooling		R60/A-2400-C-2100		2018.03
Room:		Supply air flow rate:	2 x 6 l/s	
Room size:	5.3 x 4.0 x 2.8 m		0.6 l/(sm ²)	
Occupied zone:	h=1.8 m / dw=0.5 m	Supply air temperature:	18.0 °C	
Room air:	24.0 °C / 50 %	Static / OMD pressure:	▲p _{st} =83 ▲p _{omd} =83 Pa	
Heat gain:	-	Total pressure drop:	83 Pa	
Installation height:	2.80 m	Chamber 1 pressure:	14 Pa	
Inlet water temperature:	15.0 °C	Chamber 2 pressure:	-	
Outlet water temperature:	16.3 °C	Total sound pressure level:	< 20 dB(A)	
Water flow rate:	0.120 kg/s (2 x 0.060 kg/s)	Primary air capacity:	89 W (2 x 45 W)	
Coil capacity:	637 W (2 x 319 W)	Total cooling capacity:	727 W (2 x 363 W)	
	145 W/m		165 W/m, 34 W/m ²	
Water pressure drop:	3.1 kPa	Dew point temperature:	12.9 °C	
		Velocity control:	side=2, middle=1	
		OMD opening:	7.1	
		L _d :	0.8 m	
Velocity point	v3			
Nozzle jet	-0.30 m/s			
Nozzle jet, isothermal	<0.05 m/s			
dt (nozzle jet-room air)	-0.4 °C			
Heat sources and their location may influence the velocity and direction of the jet				
v _{lim} = 0.20 m/s				

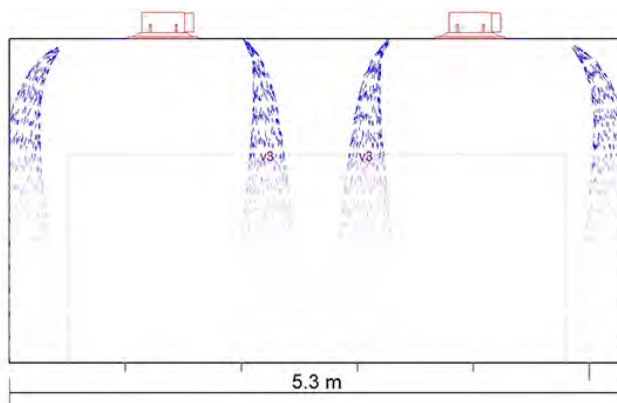


Fig. 6. Standby operating mode for Halton Rex Integrated VAV (R60) chilled beam, designed to provide ventilation to compensate for building material emissions and to provide cooling in an unoccupied room during office hours

Note: In the Halton HIT Design software, you can design three operating modes: minimum, normal, boost. Typically, the minimum operating mode corresponds to the standby (medium) situation. It is also possible to use the minimum operating mode for designing an unoccupied mode for outside office hours.

Note: The heating design can be done in the same way.

The product selection for the room exhaust VAV damper is shown in the figure below. The minimum and maximum airflow rates are marked with vertical lines. The duct velocities need to be in the valid range. The operating point in different modes between these lines depends on the exhaust ductwork pressure condition that can be modelled on an HVAC CAD design platform. It is recommended that a sound attenuator is installed between the exhaust unit and the VAV damper as indicated in the sound levels below. Sound attenuators are included in the following ventilation design schemes.

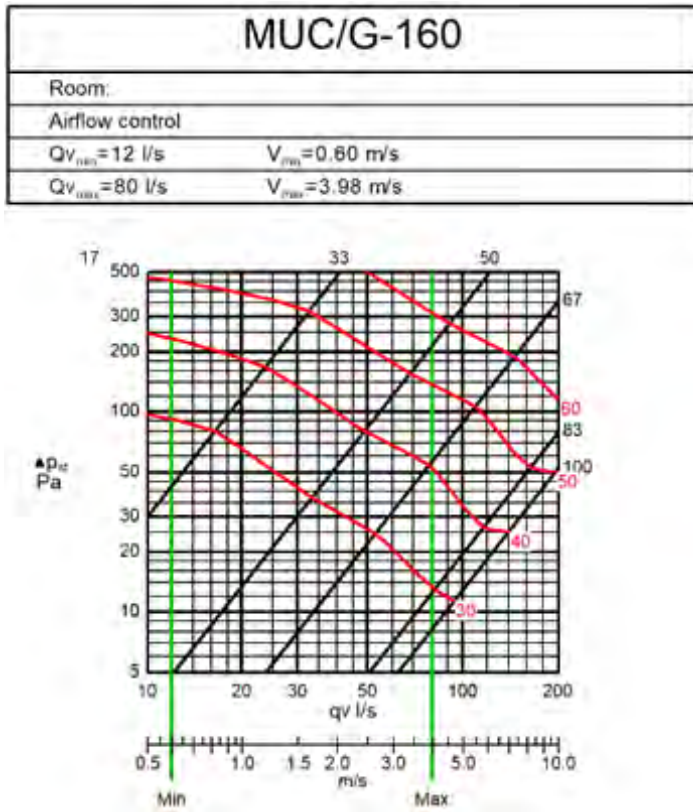


Fig. 7. Exhaust VAV airflow damper (Halton Max Ultra Circular, MUC). The vertical line on the left: min. airflow. The vertical line on the right: max. airflow.

Ventilation design scheme



Fig. 8. Meeting room situation (boost operating mode design for a max. number of people)

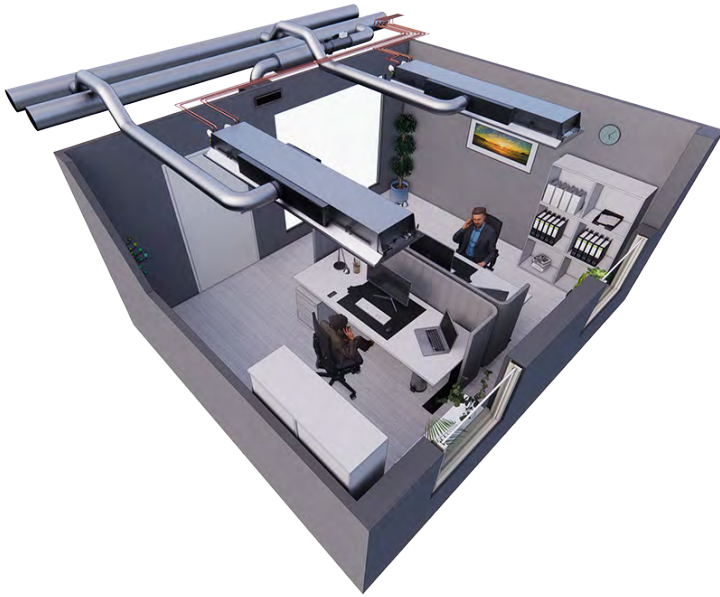


Fig. 9. Office room situation (occupied operating mode design for a selected number of people)

This design is fully flexible, in other words, you can use the room as a meeting room, when needed. When the room is used as a cellular office room, the system operates in the occupied operating mode. When the room is used as a meeting room, the system switches to the boost operating mode when the number of people in the room or the heat gain increases.

3.1.2 Room automation: Halton Rex Integrated VAV (R6O) active chilled beams controlled with Halton Workplace WRA room automation controllers

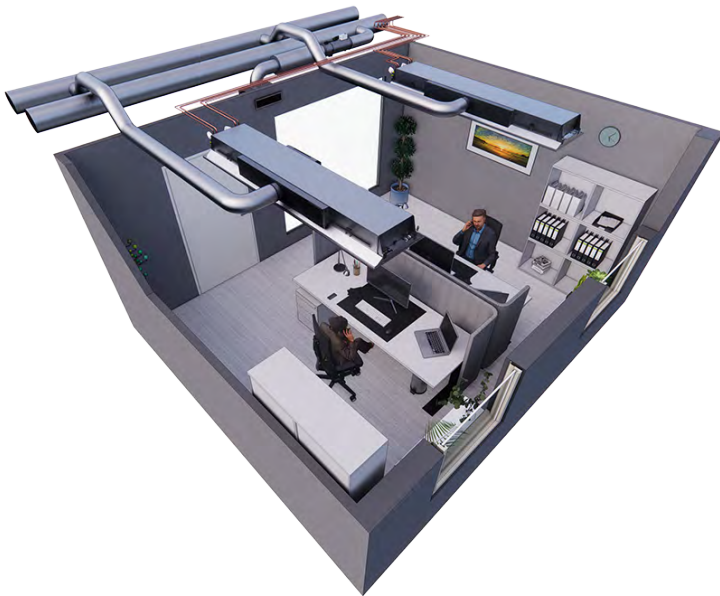


Fig. 10. Halton Rex Integrated VAV (R6O) chilled beams controlled with Halton Workplace WRA room automation controllers in a double office room

Room automation description

In this configuration, two Halton Workplace WRA room automation controllers (type DXR2.E12P-102A) control two Halton Rex Integrated VAV (R6O) active chilled beams. Each chilled beam has heating and cooling valves, a motorised Operation Mode Damper (OMD) control, and integrated CO₂ and condensation sensors. A pressure sensor is integrated into the Halton Workplace WRA room automation controller. The system also includes an exhaust VAV damper and a wall panel (type QMX3.P37) with temperature sensor and display. One Halton Workplace WRA room automation controller can individually control up to four room units, and there can be several Halton Workplace WRA room automation controllers in the room.

Design criteria for room automation

- Chilled beam has heating and cooling valves
- Chilled beam has motorised OMD control
- Condensation sensor and CO₂ sensor integrated into chilled beam
- Exhaust airflow control
- Wall panel with temperature sensor and display
- Window switch control
- Pressure sensor integrated into Halton Workplace WRA room automation controller

Equipment list

Code	Equipment
RC	Controller
FG	Airflow damper actuator
FC	Airflow measurement
H	Water valve actuator
CS	Condensation sensor
OS	Occupancy sensor
PE	Pressure sensor
CO2	CO ₂ sensor
WP	Wall panel
TE	Temperature sensor
TI	Temperature display

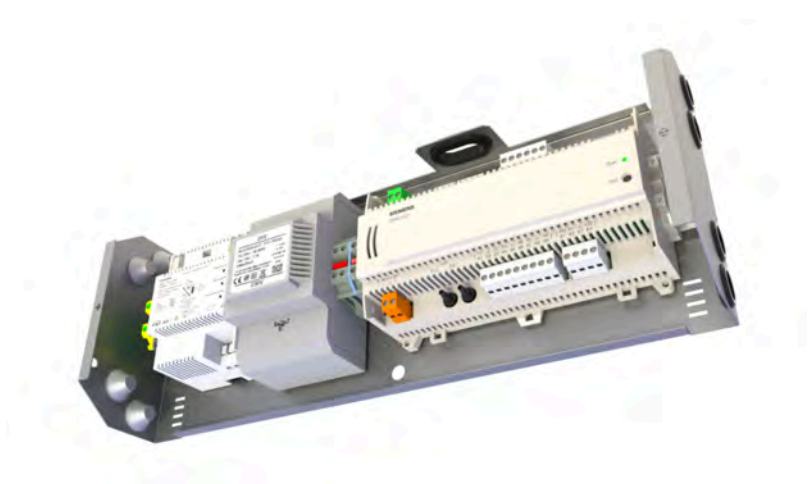


Fig. 12. Factory-installed Halton Workplace WRA room automation controller, type DXR2.E12P-102A

3.1.3 Components and order code examples for the system

- 2 x Active chilled beam: Halton Rex Integrated VAV (R6O)
R6O/A-2400-C-2100, SP=Y, LD=R3, TC=H, CO=SW, ZT=N
- 1 x Exhaust unit: Halton AGC Exhaust grille + Halton PRL Plenum for grilles
AGC/N-400-100 FS=CL, ME=A, FI=PN, CO=W, ZT=N + PRL/F-400-100-160
- 1 x VAV damper: Halton Max Ultra Circular (MUC) or Halton Max One Circular (MOC)
MUC/G-160, MA=CS
- Automation package: 2 x Halton Workplace WRA room automation controller with related components
WRA/R6O-E21-OM-EX4, WP=37, LC=NA, CD=CS, SW=NA, ST=IC, SL=OE, PM=P2, TC=H, CV=SP5,
RV=NA, ZT=N

3.2 Halton Workplace air-water system with Halton Rex Exposed (REE), Halton Rex 600 (RE6), and Halton Rex Expander (RXP) active chilled beams

3.2.1 System description and performance

System description

The designed Halton Workplace system with Halton Rex Exposed (REE), Halton Rex 600 (RE6) and Halton Rex Expander (RXP) chilled beams can be used flexibly in office rooms, landscape offices, and meeting rooms with medium to high cooling needs.

The system is divided in central, zone and room levels. The room level consists of room supply and exhaust units and required sensors, controllers, and user interfaces to maintain and monitor the indoor climate on the room level.

The Halton Rex Exposed (REE), Halton Rex 600 (RE6), and Halton Rex Expander (RXP) chilled beams can be used for cooling, heating, or combined cooling and heating. They are well suited for demand-based ventilation with a constant static pressure ductwork.

The Halton Air Quality (HAQ) control integrated into the chilled beams allows flexibility by enabling the following:

- Adaptability for different operating modes
- Adjustable supply airflow rate

Note: Halton Air Quality (HAQ) control has two operating modes. To enable a third operating mode (standby), a Halton PTS damper is required.

To enable the standby operating mode, it is necessary to add a shut-off damper (PTS) that is controlled by the Halton Workplace WRA room automation controller to reduce the pressure level in the chilled beam chamber.

System design criteria

The room area is 21 m², and the room height is 2.8 m. The assumed maximum number of people is eight in the meeting room and two in the cellular office room.

The design criteria for the indoor environment were selected according to the EN16798-1 standard, assuming category II for low polluting building. The CO₂ levels in the room with different ventilation airflow rates and different numbers of occupants are also calculated, to keep the airborne infection risk below an acceptable level.

Performance data

The product selections were done with the Halton HIT Design software.

Cooling		REE/A-2800-2500+HAQ(0.0)		2018.10
Room:		Supply air flow rate	2 x 15 l/s / 2 x 15 l/s	
Room size:	5.3 x 4.1 x 2.8 m	total/nozzle(s):	1.4 l/(sm ²)	
Occupied zone:	h=1.8 m / dw=0.5 m	Supply air temperature:	18.0 °C	
Room air:	24.0 °C / 50 %	Static chamber pressure:	71 Pa	
Heat gain:	-	Total pressure drop:	72 Pa	
Installation height:	2.70 m	Total sound pressure level:	<20 dB(A)	
Inlet water temperature:	15.0 °C	Primary air capacity:	218 W (2 x 109 W)	
Outlet water temperature:	18.0 °C	Total cooling capacity:	1249 W (2 x 625 W)	
Water flow rate:	0.082 kg/s (2 x 0.041 kg/s)		250 W/m, 57 W/m ²	
Coil capacity:	1031 W (2 x 515 W)	Dew point temperature:	12.9 °C	
	206 W/m	Velocity control:	side=2, middle=2	
Water pressure drop:	1.7 kPa	Flow damper opening:	-	
		L _d :	-	
Velocity point	v3			
Nozzle jet	~0.20 m/s			
Nozzle jet, isothermal	~0.10 m/s			
dt (nozzle jet-room air)	-1.4 °C			
Heat sources and their location may influence the velocity and direction of the jet				
v _{lim} = 0.20 m/s				

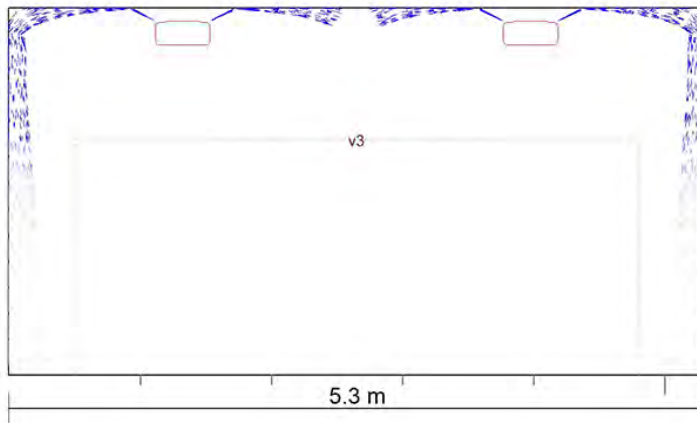


Fig. 13. Occupied (normal) operating mode designed to provide cooling and ventilation in a room used either as a cellular office room or a meeting room, with two persons in the room

Cooling		REE/A-2800-2500+HAQ(17.8)		2018.10
Room:		Supply air flow rate	2 x 40 l/s / 2 x 15 l/s	
Room size:	5.3 x 4.1 x 2.8 m	total/nozzle(s):	3.7 l/(sm ²)	
Occupied zone:	h=1.8 m / dw=0.5 m	Supply air temperature:	18.0 °C	
Room air:	24.0 °C / 50 %	Static chamber pressure:	71 Pa	
Heat gain:	-	Total pressure drop:	77 Pa	
Installation height:	2.70 m	Total sound pressure level:	30 dB(A)	
Inlet water temperature:	15.0 °C	Primary air capacity:	583 W (2 x 291 W)	
Outlet water temperature:	18.0 °C	Total cooling capacity:	1609 W (2 x 804 W)	
Water flow rate:	0.082 kg/s (2 x 0.041 kg/s)		322 W/m, 74 W/m ²	
Coil capacity:	1026 W (2 x 513 W)	Dew point temperature:	12.9 °C	
	205 W/m	Velocity control:	side=2, middle=2	
Water pressure drop:	1.7 kPa	Flow damper opening:	-	
		L _d :	3.0 m	
Velocity point	v3			
Nozzle jet	~0.20 m/s			
HAQ diffuser jet	~0.15 m/s			
Nozzle jet, isothermal	~0.10 m/s			
dt (nozzle jet-room air)	-1.4 °C			
Heat sources and their location may influence the velocity and direction of the jet				
vlim = 0.20 m/s				

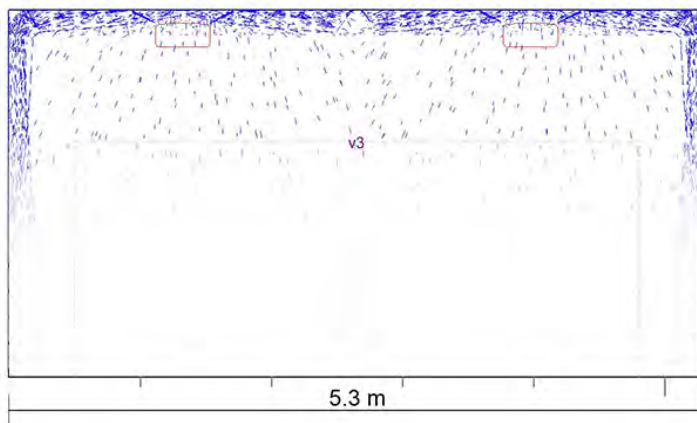


Fig. 14. Boost (maximum) operating mode designed to provide cooling and ventilation in a room used as a meeting room, with max. eight persons in the room

Note: It is also possible to define an unoccupied mode for outside office hours.

Note: The heating design can be done in the same way.

The product selection for the room exhaust VAV damper is described in example [Halton Workplace air-water system with Halton Rex Integrated VAV \(R6O\) and Halton Rex Exposed VAV \(REO\) active chilled beams](#).

Ventilation design scheme

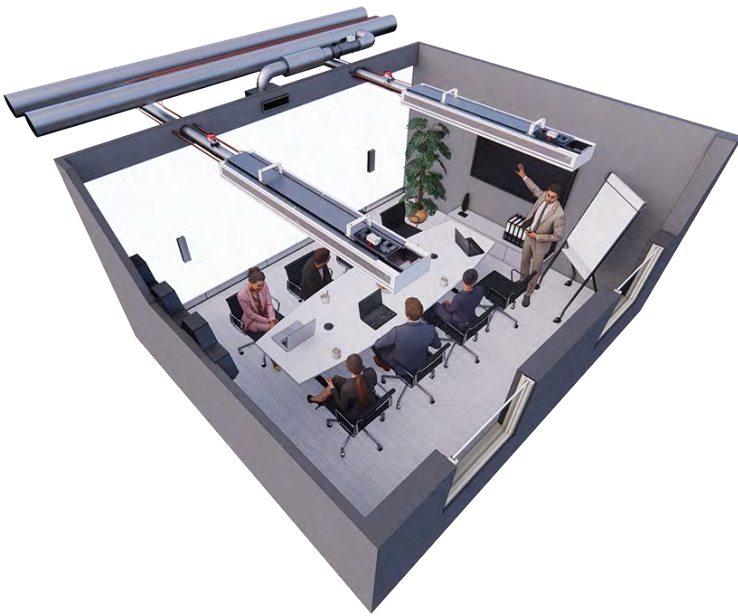


Fig. 15. Meeting room situation (boost operating mode design for a max. number of people)

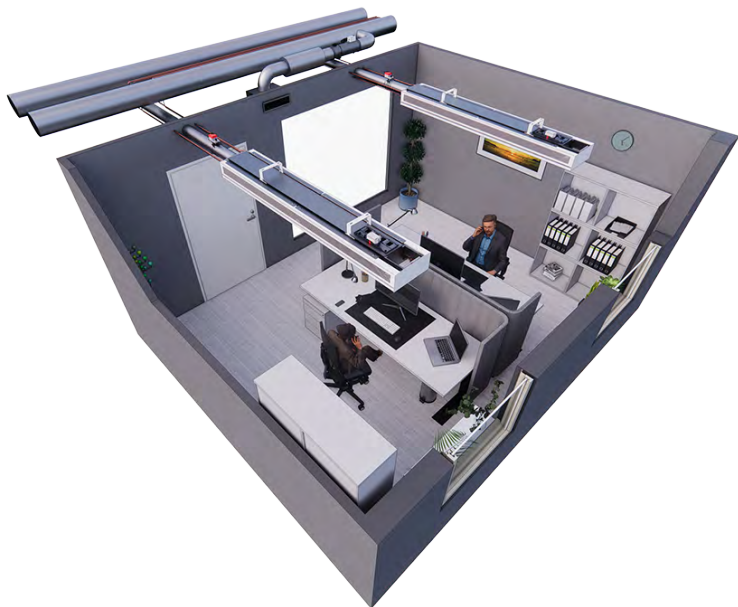


Fig. 16. Cellular office situation (occupied operating mode design for a selected number of people)

This design is fully flexible, in other words, you can use the room as a meeting room, when needed. When the room is used as a cellular office room, the system operates in the occupied operating mode. When the room is used as a meeting room, the system switches to the boost operating mode when the number of people in the room or the heat gain increases.

3.2.2 Room automation: Halton Rex Exposed (REE) active chilled beams with HAQ control and Halton PTS damper, controlled with Halton Workplace WRA room automation controllers

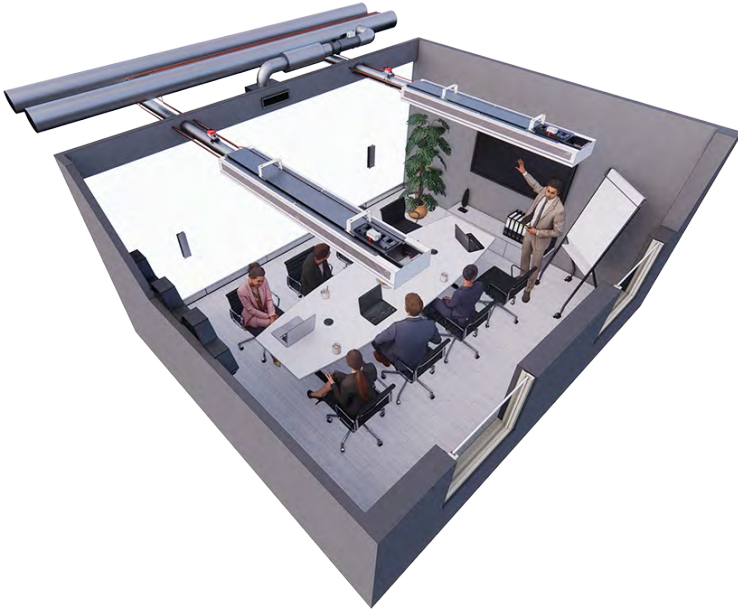


Fig. 17. Halton Rex Exposed (REE) active chilled beams with HAQ control and Halton PTS damper, controlled with Halton Workplace WRA room automation controllers in a meeting room

Room automation description

In this configuration, two Halton Workplace WRA room automation controllers (type DXR2.E18-102A) control two Halton Rex Exposed (REE) active chilled beams. Each chilled beam has heating and cooling valves, motorised Halton Air Quality (HAQ) control, as well as integrated CO₂, occupancy, pressure, and condensation sensors. A Halton PTS single-blade damper is used for controlling the minimum airflow rate in the standby and unoccupied operating modes. The system also includes an exhaust VAV damper, window switch control, and a wall panel (type QMX3.P37) with a temperature sensor and display. One Halton Workplace WRA room automation controller can individually control up to four room units, and there can be several Halton Workplace WRA room automation controllers in the room.

Design criteria for room automation

- Chilled beam has heating and cooling valves
- Chilled beam has motorised HAQ control
- Chilled beam has integrated CO₂, occupancy, pressure, and condensation sensors
- Wall panel with temperature sensor and display
- Window switch control
- PTS damper for controlling minimum airflow
- Exhaust airflow control

Schematic drawing

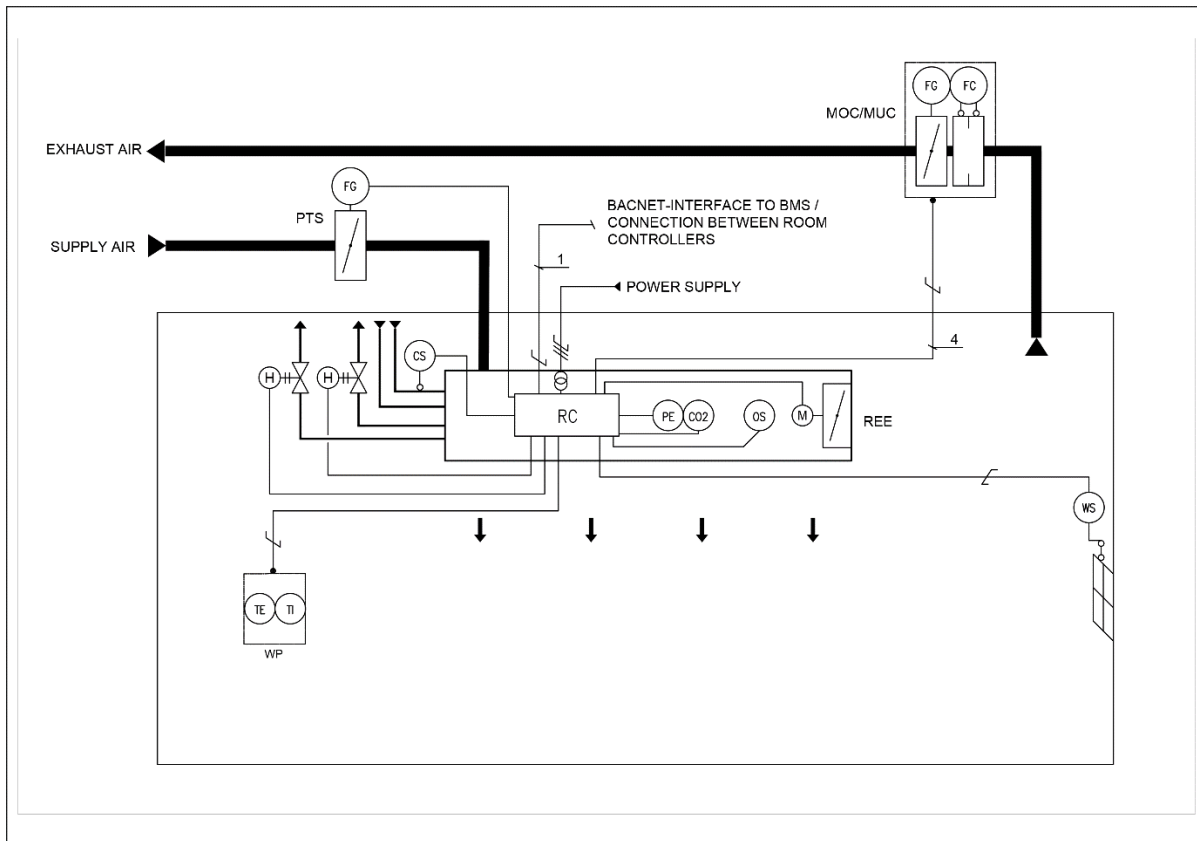


Fig. 18. Schematic drawing: Halton Rex Exposed (REE) chilled beam (4-pipe) controlled with Halton Workplace WRA room automation controller

Equipment list

Code	Equipment
RC	Controller
FG	Airflow damper actuator
FC	Airflow measurement
H	Water valve actuator
CS	Condensation sensor
OS	Occupancy sensor
PE	Pressure sensor
CO2	CO ₂ sensor
WP	Wall panel
TE	Temperature sensor
TI	Temperature display
WS	Window switch control

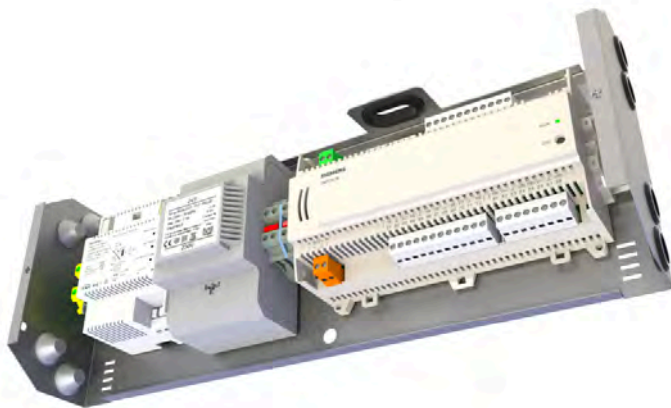


Fig. 19. Factory-installed Halton Workplace WRA room automation controller, type DXR2.E18-102A

3.2.3 Components and order code examples for the system

- 2 x Active chilled beam: Halton Rex Exposed (REE)
REE/A-2800-2500, TC=H, CT=S, AQ=MO, VA=RO, CO=SW, CV=NA, ZT=N
- 1 x Exhaust unit: Halton AGC Exhaust grille + Halton PRL Plenum for grilles
AGC/N-400-100 FS=CL, ME=A, FI=PN, CO=W, ZT=N + PRL/F-400-100-160
- 1 x VAV damper: Halton Max Ultra Circular (MUC) or Halton Max One Circular (MOC)
MUC/G-160, MA=CS
- 2 x standby, shut-off damper: Halton PTS
PTS/A-125, MA=CS, MO=B4, ZT=N
- Automation package: 2 x Halton Workplace WRA room automation controller with related components
WRA/REE-E81-H3-EX4, WP=37, LC=NA, CD=CS, SW=NC, ST=IC, SL=OI, PM=P1, TC=H, CV=SP6,
RV=NA, ZT=N

3.3 Halton Workplace all-air system with Halton Jaz Conical VAV (JDS) active diffusers

3.3.1 System description and performance

System description

The designed Halton Workplace system with Halton Jaz Conical VAV (JDS) active diffusers can be used flexibly in office rooms, landscape offices, and meeting rooms with small to medium cooling needs. When cooling by cold ventilation air for occupancy and indoor air quality does not cover design heat gains, additional water-based cooling from radiant panels with diffusers is often the most energy-efficient option to use.

The system is divided in central, zone and room levels. The room level consists of room supply and exhaust units and required sensors, controllers, and user interfaces to maintain and monitor the indoor climate on the room level.

Active diffusers are well suited for demand-based ventilation with a constant static pressure ductwork. They can be used for cooling. When heating is needed, it is recommended that you use radiant panels with diffusers.

The integrated airflow adjustment damper and sound attenuator in the Halton Jaz Conical VAV (JDS) active diffuser allow flexibility by enabling the following:

- Adaptability for different operating modes
- Adjustable supply airflow rate

System design criteria

The room area is 21 m², and the room height is 2.8 m. The assumed maximum number of people is eight in the meeting room and two in the cellular office room.

The design criteria for the indoor environment were selected according to the EN16798-1 standard, assuming category II for low polluting building. The CO₂ levels in the room with different ventilation airflow rates and different numbers of occupants are also calculated, to keep the airborne infection risk below an acceptable level.

Performance data

The product selections were done with the Halton HIT Design software.

Cooling		JDS/S-125 (15.0)		2014.06	
Room:		Supply air flow rate	14 l/s (2 x 7 l/s)		
Room size:	5.3 x 4.1 x 2.8 m		0.7 l/(sm ²)		
Occupied zone:	h=1.8 m / dw=0.5 m	Supply air temperature:	16.0 °C		
Room air:	24.0 °C / 50 %	Static pressure drop:	45 Pa		
Heat gain:	-	Total pressure drop:	45 Pa		
Installation height:	2.75 m	Total sound pressure level:	19 dB(A)		
		Total cooling capacity:	140 W (2 x 70 W)		
			6 W/m ²		
		L _d :	-		
		Airflow adjustment:	1.0		
Velocity point	v1	v3			
v	-0.10 m/s	~0.20 m/s			
ΔT	-0.0 °C	-0.0 °C			
v _{lim} = 0.20 m/s					

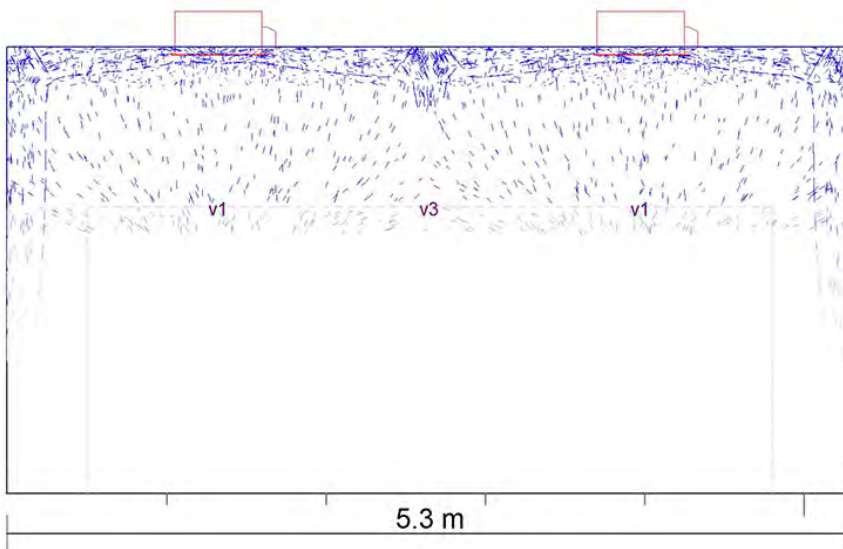


Fig. 20. Occupied (normal) operating mode for Halton Jaz Conical VAV (JDS) active diffuser, designed to provide cooling and ventilation in a room used either as an office room or a meeting room, with two persons in the room.

Cooling		JDS/S-125 (15.0)		2014.06	
Room:		Supply air flow rate		80 l/s (2 x 40 l/s)	
Room size: 5.3 x 4.1 x 2.8 m		Supply air temperature:		3.7 l/(sm ²)	
Occupied zone: h=1.8 m / dw=0.5 m		Static pressure drop:		45 Pa	
Room air: 24.0 °C / 50 %		Total pressure drop:		52 Pa	
Heat gain: -		Total sound pressure level:		27 dB(A)	
Installation height: 2.75 m		Total cooling capacity:		783 W (2 x 391 W)	
				36 W/m ²	
		L _d :		-	
		Airflow adjustment:		100.0	
Velocity point	v3				
v	-0.10 m/s				
ΔT	-0.2 °C				
v _{lim} = 0.20 m/s					

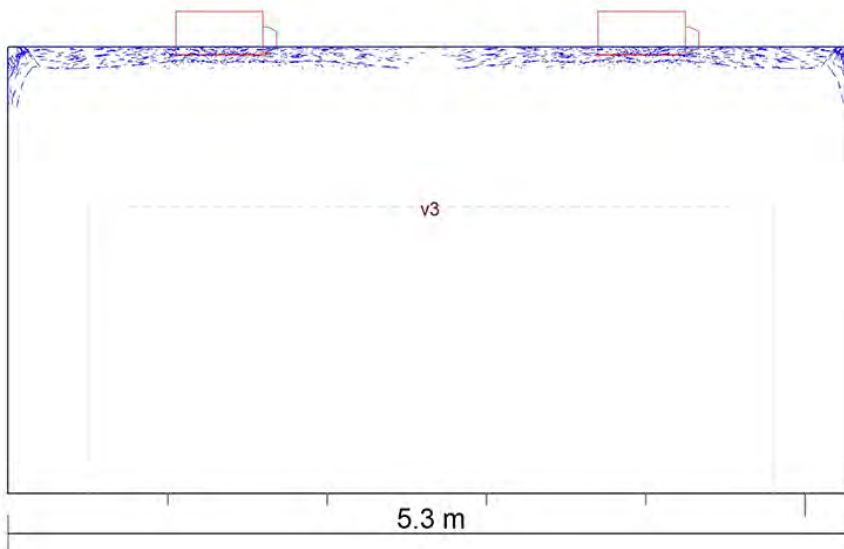


Fig. 21. Boost (maximum) operating mode for Halton Jaz Conical VAV (JDS) active diffuser, designed to provide cooling and ventilation in a room used as a meeting room, with max. eight persons in the room.

Cooling		JDS/S-125 (15.0)		2014.06	
Room:		Supply air flow rate	30 l/s (2 x 15 l/s)		
Room size:	5.3 x 4.1 x 2.8 m		1.4 l/(sm ²)		
Occupied zone:	h=1.8 m / dw=0.5 m	Supply air temperature:	16.0 °C		
Room air:	24.0 °C / 50 %	Static pressure drop:	45 Pa		
Heat gain:	-	Total pressure drop:	46 Pa		
Installation height:	2.75 m	Total sound pressure level:	22 dB(A)		
		Total cooling capacity:	293 W (2 x 147 W)		
			14 W/m ²		
		L _d :	-		
		Airflow adjustment:	15.0		
Velocity point	v3				
v	-0.10 m/s				
ΔT	-0.1 °C				
v _{lim} = 0.20 m/s					

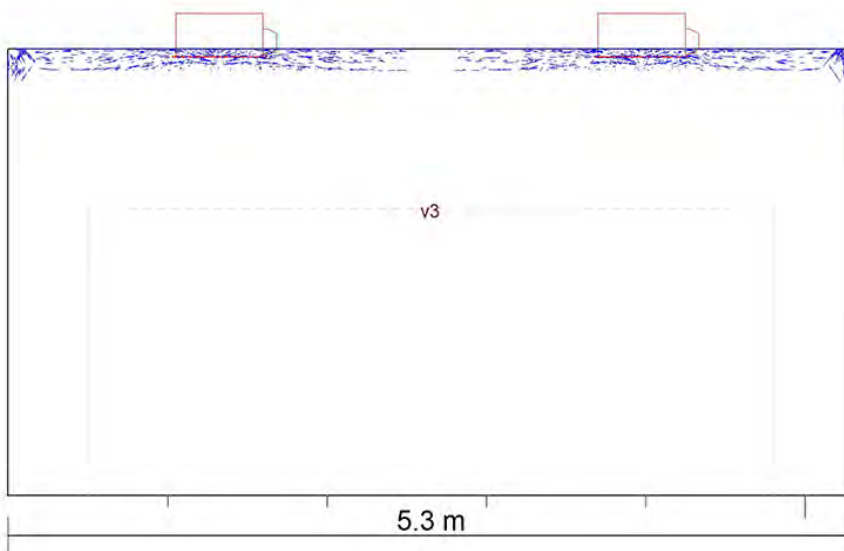


Fig. 22. Standby operating mode for Halton Jaz Conical VAV (JDS) active diffuser, designed to provide ventilation to compensate for building material emissions and to provide cooling in an unoccupied room during office hours

Note: In the Halton HIT Design software, you can design three operating modes: minimum, normal, boost. (Currently, the selection is done for the boost mode, and the minimum and normal modes can be verified when doing the selection.) Typically, the minimum operating mode corresponds to the standby (medium) situation. It is also possible to use the minimum operating mode for designing an unoccupied mode for outside office hours.

The product selection for the room exhaust VAV damper is shown in the figure below. The minimum and maximum airflow rates are marked with vertical lines. The duct velocities need to be in the valid range. The operating point in different modes between these lines depends on the exhaust ductwork pressure condition that can be modelled on an HVAC CAD design platform. It is recommended that a sound attenuator is installed between the exhaust unit and the VAV damper as indicated in the sound levels below. Sound attenuators are included in the following ventilation design schemes.

MUC/G-160	
Room:	
Airflow control	
$Q_{v_{min}}=14 \text{ l/s}$	$V_{min}=0,70 \text{ m/s}$
$Q_{v_{max}}=80 \text{ l/s}$	$V_{max}=3,98 \text{ m/s}$

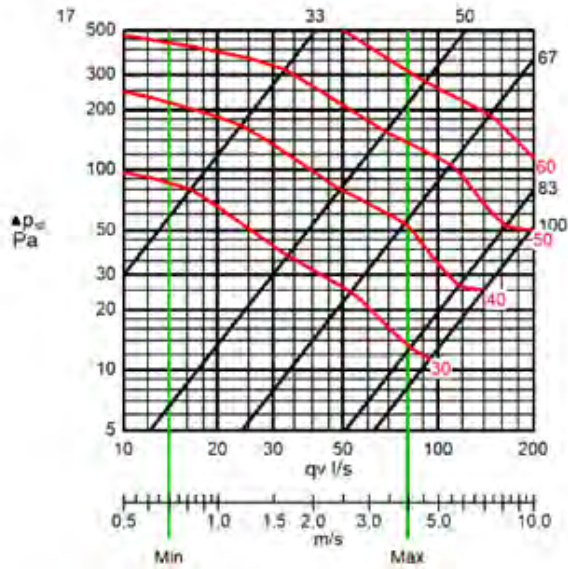


Fig. 23. Exhaust VAV airflow damper (Halton Max Ultra Circular, MUC). The vertical line on the left: min. airflow. The vertical line on the right: max. airflow.

Ventilation design scheme



Fig. 24. Meeting room situation (boost operating mode design for a max. number of people)

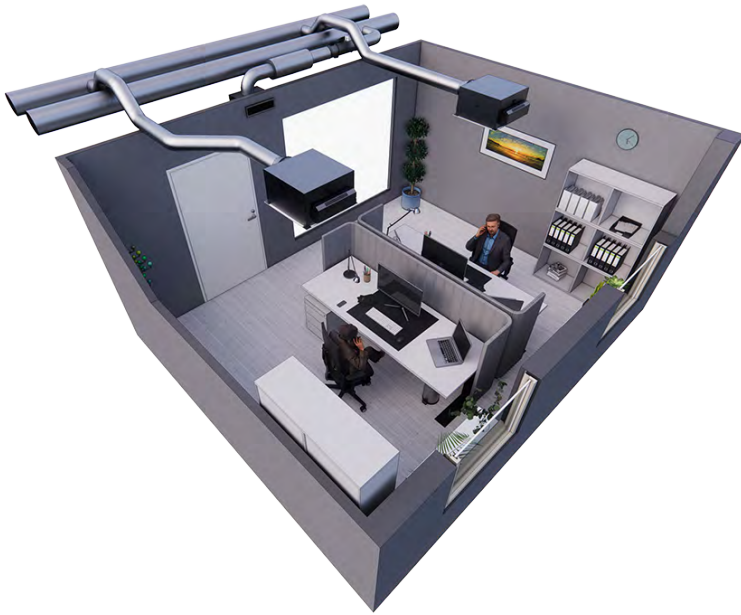


Fig. 25. Office room situation (occupied operating mode design for a selected number of people)

This design is fully flexible, in other words, you can use the room as a meeting room, when needed. When the room is used as a cellular office room, the system operates in the occupied operating mode. When the room is used as a meeting room, the system switches to the boost operating mode when the number of people in the room or the heat gain increases.

3.3.2 Room automation: Halton Jaz Conical VAV (JDS) active diffusers controlled with Halton Workplace WRA room automation controllers

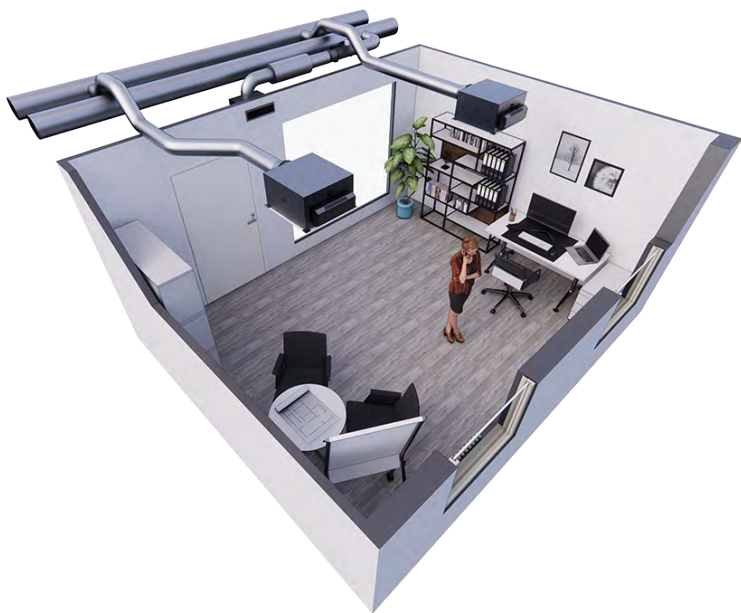


Fig. 26. Halton Jaz Conical VAV (JDS) active diffusers controlled with Halton Workplace WRA room automation controllers in a single office room

Room automation description

In this configuration, two Halton Workplace WRA room automation controllers (type DXR2.E12P-102A) control two Halton Jaz Conical VAV (JDS) active diffusers. Each active diffuser has integrated temperature, CO₂, and occupancy sensors. A pressure sensor is integrated into the Halton Workplace WRA room automation controller. The system also includes an exhaust VAV damper and control of radiator heating water valves. One Halton Workplace WRA room automation controller can individually control up to four room units, and there can be several Halton Workplace WRA room automation controllers in the room.

Design criteria for room automation

- Active diffuser has an integrated balancing plenum with measurement and adjustment functions
- Active diffuser has integrated CO₂, occupancy, and temperature sensors
- Pressure sensor integrated into Halton Workplace WRA room automation controller
- Control of radiator heating water valves
- Exhaust airflow control

Schematic drawing

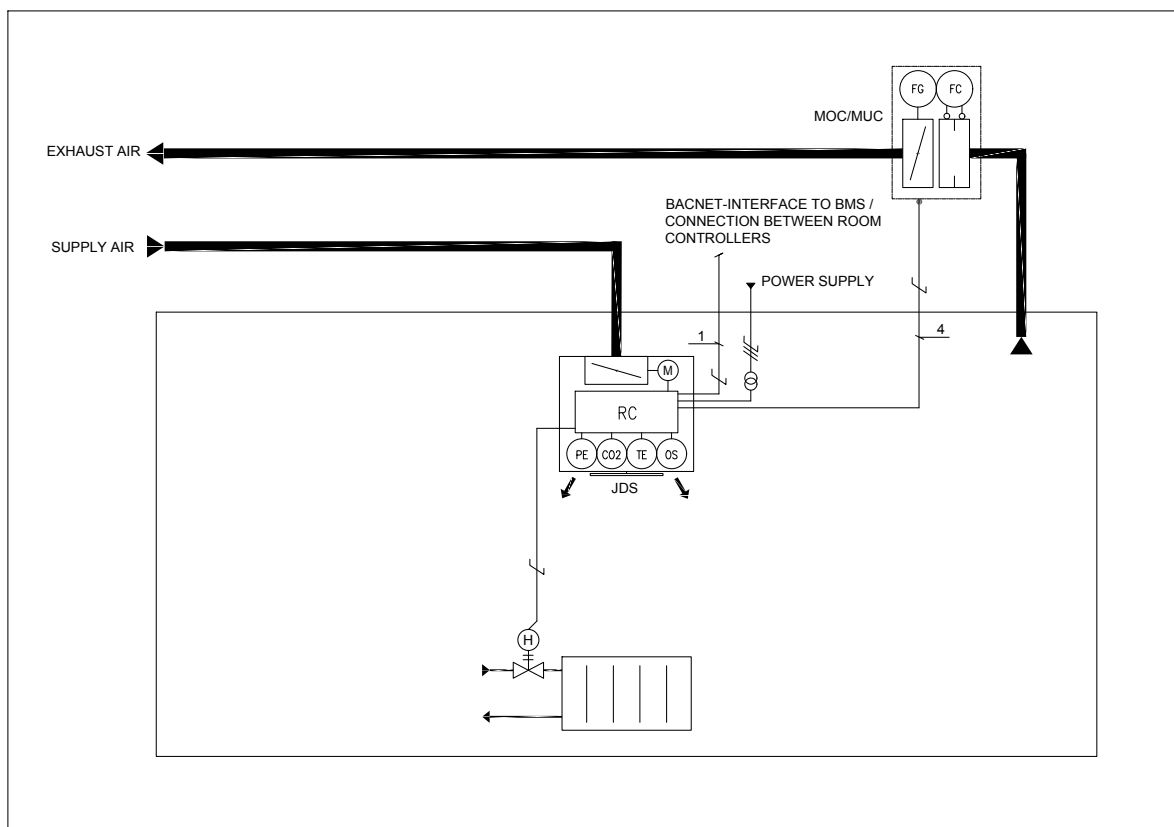


Fig. 27. Schematic drawing: Halton Jaz Conical VAV (JDS) active diffuser controlled with Halton Workplace WRA room automation controller

Equipment list

Code	Equipment
RC	Controller
FG	Airflow damper actuator
FC	Airflow measurement
H	Water valve actuator
OS	Occupancy sensor
PE	Pressure sensor
CO2	CO ₂ sensor
TE	Temperature sensor

3.3.3 Components and order code examples for the system

- 2 x Active diffuser: Halton Jaz Conical VAV (JDS)
JDS/S-125 CO=SW, IO=NA, RC=NA, SE=NA, ED=N, CP=NA, ZT=N
- 1 x Exhaust unit: Halton AGC Exhaust grille + Halton PRL Plenum for grilles
AGC/N-400-100 FS=CL, ME=A, FI=PN, CO=W, ZT=N + PRL/F-400-100-160
- 1 x VAV damper: Halton Max Ultra Circular (MUC) or Halton Max One Circular (MOC)
MUC/G-160, MA=CS
- Automation package: 2 x Halton Workplace WRA room automation controller with related components
WRA/JDS-E21-JD-EX4, WP=NA, LC=NA, CD=NA, SW=NA, ST=IA, SL=OI, PM=P2, TC=NA, CV=NA,
RV=RA, ZT=N

3.4 Halton Workplace air-water system with Halton Jaz JDA static diffusers and Halton Max Ultra Circular (MUC) VAV damper combined with Halton Ava Individual (AIN) radiant panels

3.4.1 System description and performance

System description

The designed Halton Workplace system with Halton Jaz JDA static diffusers and Halton Max Ultra Circular (MUC) VAV damper combined with Halton Ava Individual (AIN) radiant panels can be used flexibly in office rooms, landscape offices, and meeting rooms with medium cooling needs.

The system is divided in central, zone and room levels. The room level consists of room supply and exhaust units and required sensors, controllers, and user interfaces to maintain and monitor the indoor climate on the room level.

Static diffusers and a VAV damper with radiant panels can be used for cooling, heating, or combined cooling and heating. They are well suited for demand-based ventilation with a constant static pressure ductwork.

They allow flexibility by enabling the following:

- Adaptability for different operating modes
- Adjustable supply airflow rate

System design criteria

The room area is 21 m², and the room height is 2.8 m. The assumed maximum number of people is eight in the meeting room and two in the cellular office room.

The design criteria for the indoor environment were selected according to the EN16798-1 standard, assuming category II for low polluting building. The CO₂ levels in the room with different ventilation airflow rates and different numbers of occupants are also calculated, to keep the airborne infection risk below an acceptable level.

Performance data

The product selections were done with the Halton HIT Design software.

Cooling		JDA/S-125(R4) + TRI/S-100-125(N)		08.2016	
Room:		Supply air flow rate	30 l/s (2 x 15 l/s)		
Room size:	5.3 x 4.1 x 2.8 m		1.4 l/(sm ²)		
Occupied zone:	h=1.8 m / dw=0.5 m	Supply air temperature:	16.0 °C		
Room air:	24.0 °C / 50 %	Total pressure drop:	63 Pa		
Heat gain:	-	Total sound pressure level:	15 dB(A)		
Installation height:	2.80 m	Total cooling capacity:	293 W (2 x 147 W)		
			14 W/m ²		
		L _d :	2.0 m		
		Plenum adjustment:	1.1		
Velocity point	v3				
v	~0.10 m/s				
ΔT	-0.2 °C				
v _{lim} = 0.20 m/s					

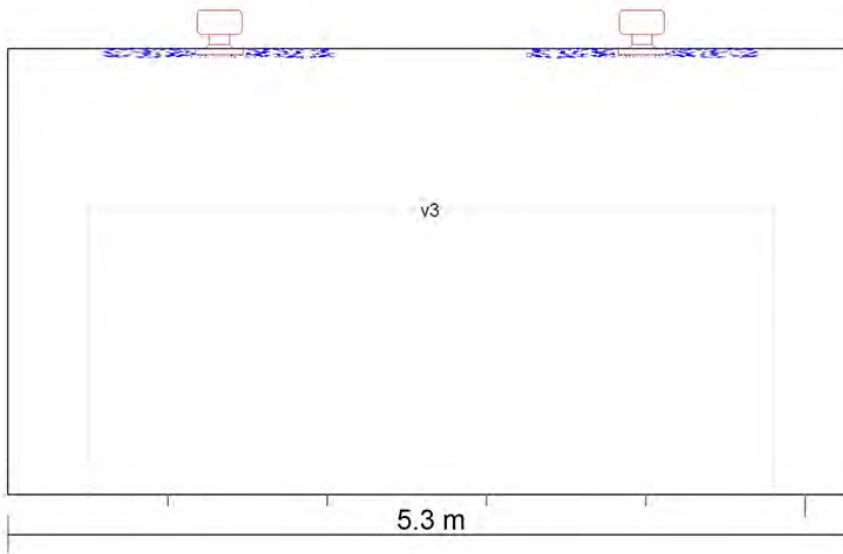


Fig. 28. Occupied (normal) operating mode for Halton Jaz JDA static diffuser, designed to provide cooling and ventilation in a room used either as an office room or a meeting room, with two persons in the room

Cooling		JDA/S-125(R4) + TRI/S-100-125(N)		08.2016
Room:		Supply air flow rate	80 l/s (2 x 40 l/s)	
Room size:	5.3 x 4.1 x 2.8 m		3.7 l/(sm ²)	
Occupied zone:	h=1.8 m / dw=0.5 m	Supply air temperature:	16.0 °C	
Room air:	24.0 °C / 50 %	Total pressure drop:	63 Pa	
Heat gain:	-	Total sound pressure level:	31 dB(A)	
Installation height:	2.80 m	Total cooling capacity:	783 W (2 x 391 W)	
			36 W/m ²	
		L _d :	-	
		Plenum adjustment:	30.0	
Velocity point	v3			
v	~0.15 m/s			
ΔT	-0.3 °C			
v _{lim} = 0.20 m/s				

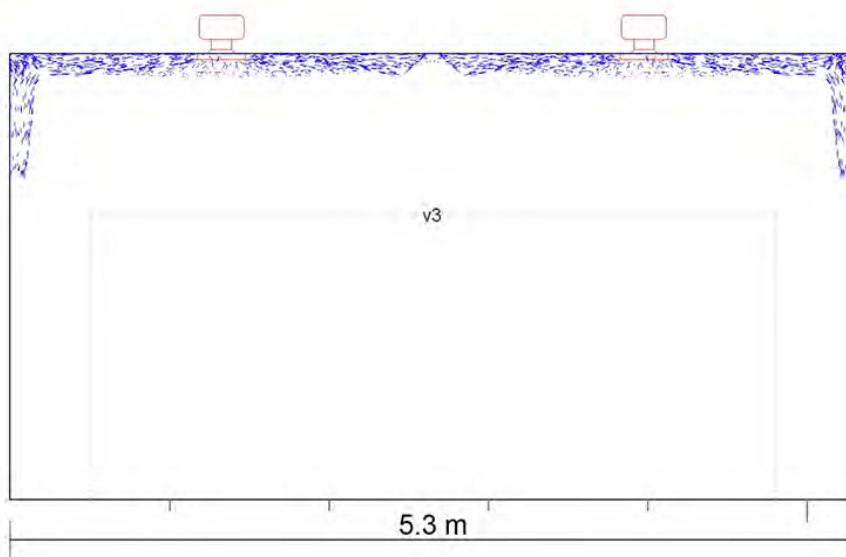


Fig. 29. Boost (maximum) operating mode for Halton Jaz JDA static diffuser, designed to provide cooling and ventilation in a room used as a meeting room, with max. eight persons in the room

Note: In the Halton HIT Design software, you can design two operating modes: normal and boost. (The selection is done for the boost mode, and the normal mode can be verified when doing the selection.) Typically, the airflow rate in the standby (medium) or unoccupied mode for outside office hours is so low that the supply airflow throw pattern cannot be visualised in Halton HIT Design.

The product selection for the room exhaust VAV damper is shown in the figure below. The minimum and maximum airflow rates are marked with vertical lines. The duct velocities need to be in the valid range. The operating point in different modes between these lines depends on the exhaust ductwork pressure condition that can be modelled on an HVAC CAD design platform. It is recommended that a sound attenuator is installed between the exhaust unit and the VAV damper as indicated in the sound levels below. Sound attenuators are included in the following ventilation design schemes.

MUC/G-125	
Room:	
Airflow control	
$Q_{v,min} = 7 \text{ l/s}$	$V_{min} = 0.57 \text{ m/s}$
$Q_{v,max} = 40 \text{ l/s}$	$V_{max} = 3.26 \text{ m/s}$

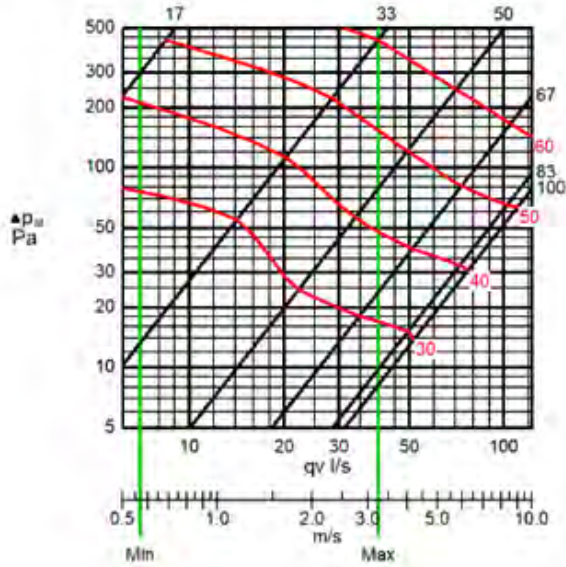


Fig. 30. Exhaust VAV airflow damper (Halton Max Ultra Circular, MUC). The vertical line on the left: min. airflow. The vertical line on the right: max. airflow.

The product selection for the Halton Ava Individual (AIN) radiant panels is shown below.

Cooling		AIN-1800-600-1-NA-NA		07.2019
Room:		Inlet water temperature:	15.0 °C	
Room size:	5.3 x 4.0 x 2.8 m	Outlet water temperature:	16.6 °C	
Occupied zone:	h=1.8 m / dw=0.5 m	Water flow rate:	0.060 kg/s	
Room air:	24.0 °C / 50 %	Panel capacity:	409 W (4 x 102 W avg.)	
Heat gain:	-		panel: 95 W/m ² , floor: 19 W/m ²	
Installation height:	2.70 m	Water pressure drop:	9.4 kPa	
	Exposed installation	Dew point temperature:	12.9 °C	
Eff. panel area / ceiling area: 0.19 (used in calculation)				

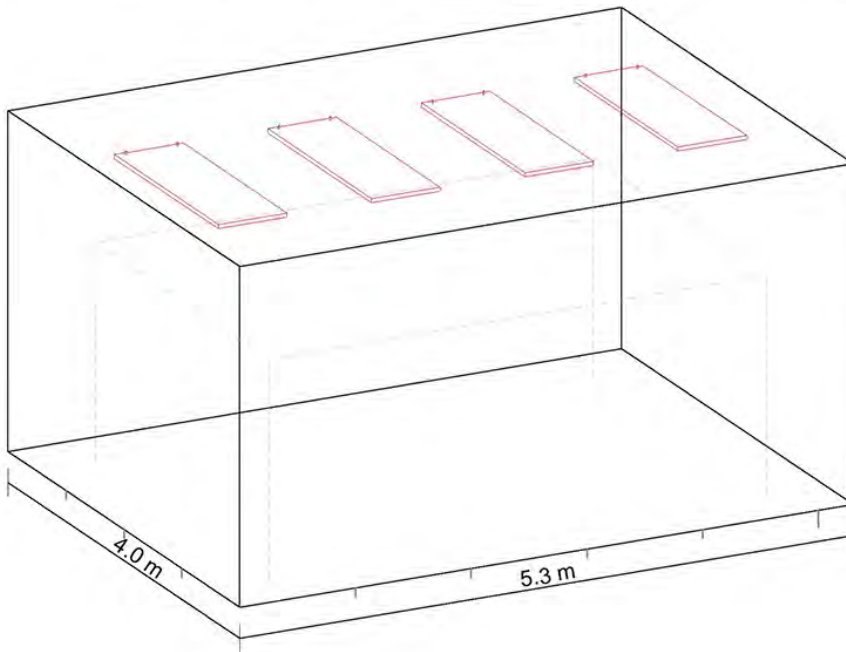


Fig. 31. Halton Ava Individual (AIN) radiant panels designed to provide cooling in a room used as an office or meeting room, with design heat gains in the room

The product selection for the room exhaust VAV damper is shown in the figure below. The minimum and maximum airflow rates are marked with vertical lines. The duct velocities need to be in the valid range. The operating point in different modes between these lines depends on the exhaust ductwork pressure condition that can be modelled on an HVAC CAD design platform. It is recommended that a sound attenuator is installed between the exhaust unit and the VAV damper as indicated in the sound levels below. Sound attenuators are included in the following ventilation design schemes.

MUC/G-160	
Room:	
Airflow control	
$Q_{v_{min}} = 14 \text{ l/s}$	$V_{min} = 0,70 \text{ m/s}$
$Q_{v_{max}} = 80 \text{ l/s}$	$V_{max} = 3,98 \text{ m/s}$

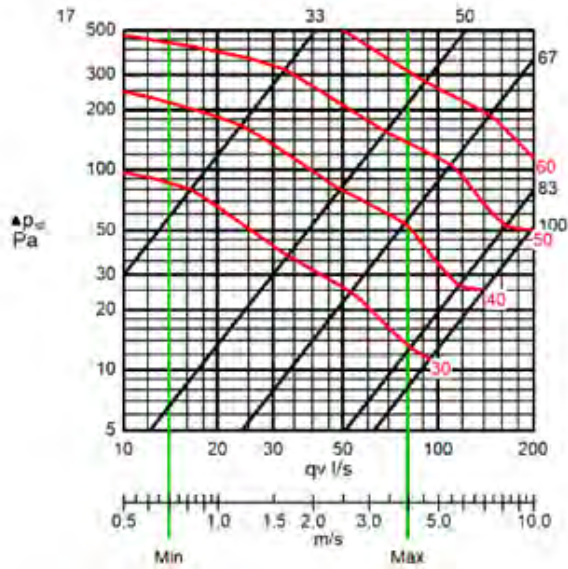


Fig. 32. Exhaust VAV airflow damper (Halton Max Ultra Circular, MUC). The vertical line on the left: min. airflow. The vertical line on the right: max. airflow.

Ventilation design scheme



Fig. 33. Meeting room situation (boost operating mode design for a max. number of people)

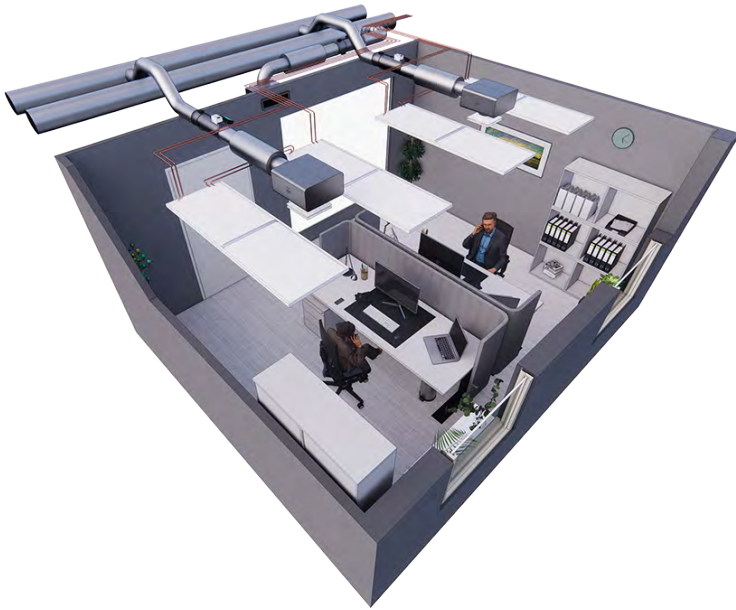


Fig. 34. Office room situation (occupied operating mode design for a selected number of people)

This design is fully flexible, in other words, you can use the room as a meeting room, when needed. When the room is used as a cellular office room, the system operates in the occupied operating mode. When the room is used as a meeting room, the system switches to the boost operating mode when the number of people in the room or the heat gain increases.

3.4.2 Room automation: Halton Jaz JDA static diffuser, Halton Max Ultra Circular (MUC) VAV damper, and Halton Ava Individual (AIN) radiant panels, controlled with a Halton Workplace WRA room automation controller



Fig. 35. Halton Jaz JDA static diffuser, Halton Max Ultra Circular (MUC) VAV damper, and Halton Ava Individual (AIN) radiant panels, controlled with a Halton Workplace WRA room automation controller in a

double office room

Room automation description

In this configuration, the Halton Workplace WRA room automation controller (type DXR2.E12P-102A) controls a Halton Max Ultra Circular (MUC) VAV damper that is combined with a Halton Jaz JDA static diffuser and Halton Ava Individual (AIN) radiant panels. An external occupancy sensor is installed in the room. Temperature, CO₂, and humidity sensors are integrated into the wall panel (type QMX3.P70). Each radiant panel has heating and cooling valves. The system also includes an exhaust VAV damper and condensation detection that is done with dew point calculation based on relative humidity and inlet water temperature. One Halton Workplace WRA room automation controller can individually control up to four VAV dampers, and there can be several Halton Workplace WRA room automation controllers in the room.

Design criteria for room automation

- Supply airflow control
- Exhaust airflow control
- External occupancy sensor
- Wall panel with temperature, CO₂, and humidity sensors
- Condensation detection is done with dew point calculation based on relative humidity and inlet water temperature measurement (requires a wall panel with a humidity sensor and also inlet water temperature measurement at the zone or building level)
- Control of radiant panel heating and cooling water valves

Schematic drawing

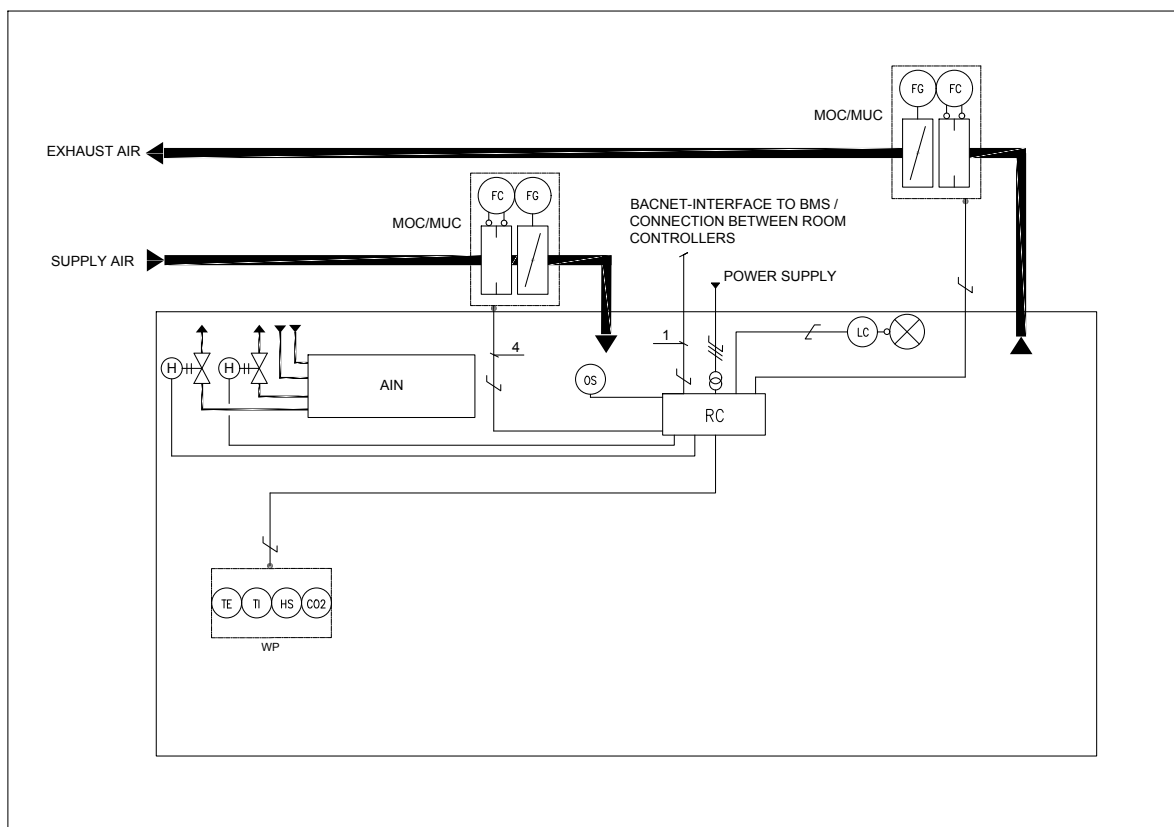


Fig. 36. Schematic drawing: Halton Jaz JDA static diffuser, Halton Max Ultra Circular (MUC) VAV damper,

and Halton Ava Individual (AIN) radiant panels, controlled with a Halton Workplace WRA room automation controller

Equipment list

Code	Equipment
RC	Controller
FG	Airflow damper actuator
FC	Airflow measurement
H	Water valve actuator
WP	Wall panel
OS	Occupancy sensor
CO2	CO ₂ sensor
TE	Temperature sensor
HS	Humidity sensor

3.4.3 Components and order code examples for the system

- 1 x Static diffuser: Halton Jaz JDA
JDA/S-125(R4) WS=NA, CO=W, ZT=N + TRI/S-125-125(N)
- 1 x VAV damper: Halton Max Ultra Circular (MUC) or Halton Max One Circular (MOC)
MUC/G-125, MA=CS
- 4 x Radiant panel: Halton Ava Individual (AIN)
AIN-1800-600 NL=2, IN=NA, PE=NA, CA=NA, CO=W, ZT=N
- 1 x Exhaust unit: Halton AGC Exhaust grille + Halton PRL Plenum for grilles
AGC/N-400-100 FS=CL, ME=A, FI=PN, CO=W, ZT=N + PRL/F-400-100-160
- 1 x VAV damper: Halton Max Ultra Circular (MUC) or Halton Max One Circular (MOC)
MUC/G-160, MA=CS
- Automation package: 1 x Halton Workplace WRA room automation controller with related components
WRA/MUC-E21-MU-EX4, WP=70, LC=NA, CD=DP, SW=NA, ST=NA, SL=OE, PM=NA, TC=H, CV=SP5,
RV=NA, ZT=N

3.5 Halton Workplace zones

3.5.1 Example of a zone-level application

Description

Halton Workplace zones are designed with static pressure ductwork. The zone level consists of multiple rooms and its main components are zone control dampers (Halton Max MDC) and the static pressure measurement unit (Halton MSS).

Design criteria

- Ring duct supply and central exhaust
- Separate supply line with a lower operating pressure for core meeting rooms and room-specific exhaust



Fig. 37. Ventilation design with ring duct supply and central exhaust

Zone-level control scheme

ZONE LEVEL - ACTIVE CHILLED BEAM COOLING AND RADIATOR HEATING
ROOM SPECIFIC EXHAUST WITH VAV DAMPER

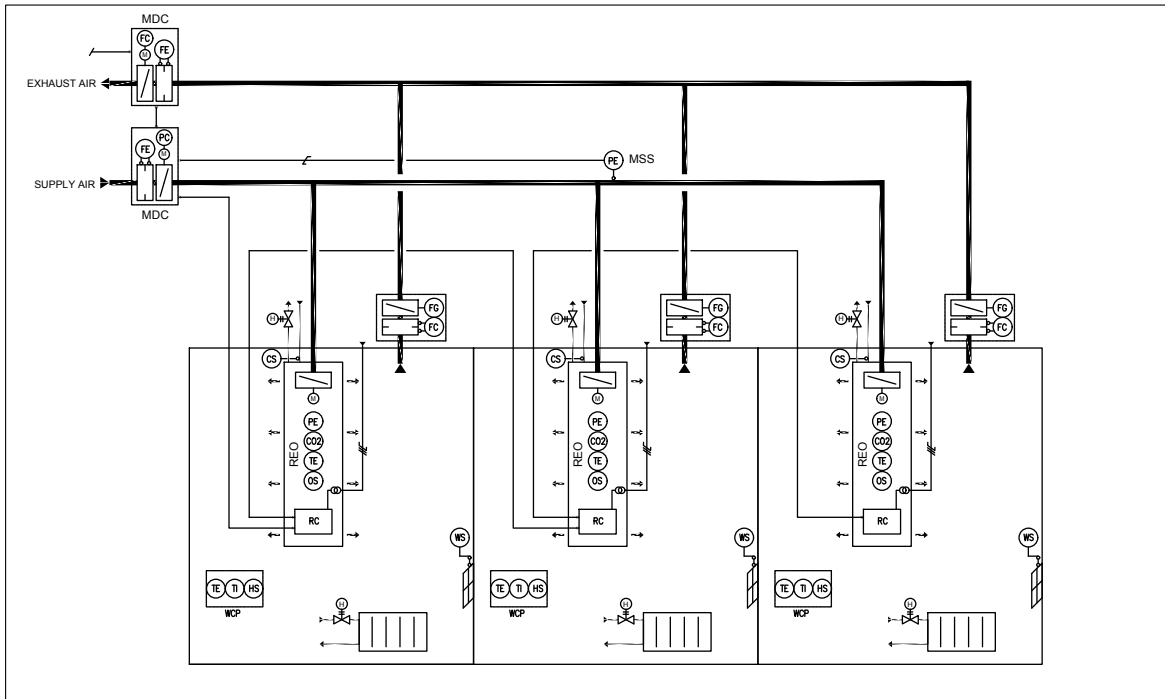


Fig. 38. Zone-level control scheme

Zone-level components and order code examples

Supply for the ring:

- 1 x Zone control damper (Halton Max MDC)
MDC/G-315 MA=CS, CU=BA2, CM=FC, ZT=N
- 1 x Zone duct static pressure measurement (Halton MSS)
MSS-400, ZT=N

General exhaust:

- 1 x Zone control damper (Halton Max MDC)
MDC/G-315 MA=CS, CU=BA2, CM=FC, ZT=N
- 1 x Zone duct static pressure measurement (Halton MSS)
MSS-400, ZT=N

4 Reference data

4.1 Standards and guidelines

National and international standards and guidelines are the basis for the Halton Workplace system design.

These standards do not constitute the law, but represent the state of the art and are the basis for expert opinions in case of damage.

Standards and guidelines that apply to indoor environment and cooling demand

- ISO 7730: 2005, Ergonomics of the Thermal Environment-Analytical Determination and Interpretation of Thermal Comfort Using Calculation of the PMV and PPD Indices and Local Thermal Comfort Criteria, International Organization for Standardization, Geneva, Switzerland.
- EN 15251: 2007, Indoor Environmental Input Parameters for Design and Assessment of Energy Performance of Buildings Addressing Indoor Air Quality, Thermal Environment, Lighting and Acoustics, European Committee for Standardization, B-1050 Brussels, Belgium.
- EN16798-1: 2019 (EN 15251 revised) Energy performance of buildings - Ventilation for buildings - Part 1: Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics, European Committee for Standardization, B-1050 Brussels, Belgium.
- WELL Building Standard
- Federation of European Heating, Ventilation and Air Conditioning Associations (REHVA): Updated guidelines for safe indoor climate in buildings, for maintaining airborne infection risk below an acceptable level, related to the design and operation of demand-based ventilation systems. See www.rehva.eu/activities/covid-19-guidance.

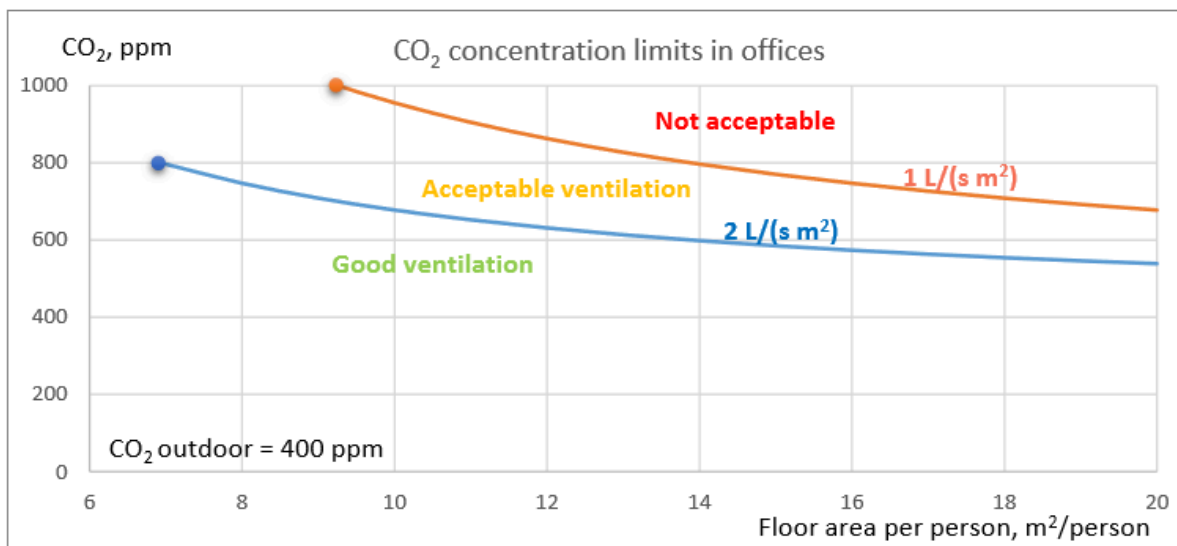


Fig. 39. CO₂ concentration (absolute values that include outdoor concentration) dependency on ventilation rate and occupancy in offices. Source: REHVA Covid-19 guidance.

4.2 Typical design values for ventilation airflow rates specified in standards

Population density according to EN-16798-1			
	Office (person/m ²)	Conference room (person/m ²)	Open office (person/m ²)
Population density	10	2	15
Number of people	1	5	0,7

Room area in calculation (m ²)	10
--	----

EN-16798-1: 2019				
Design criteria: EN 16798-1				
Category	Very low polluting building (LPB-1) l/(s m ²)	Low polluting building (LPB-2) l/(s m ²)	Non low-polluting building (LPB-3) l/(s m ²)	Airflow per non-adapted person l/s, person
1	0,5	1	2	10
2	0,35	0,7	1,4	7
3	0,2	0,4	0,8	4

Airflow calculation: Office						
Category	Airflow (l/s) Very low polluting building (LPB-1)	Airflow (l/s) Low polluting building (LPB-2)	Airflow (l/s) Non low-polluting building (LPB-3)	CO ₂ -concentration (ppm) Very low polluting building (LPB-1)	CO ₂ -concentration (ppm) Low polluting building (LPB-2)	CO ₂ -concentration (ppm) Non-low polluting building (LPB-3)
1	15	20	30	770	678	585
2	10,5	14	21	929	797	665
3	6	8	12	1326	1094	863

Airflow calculation: Conference room						
Category	Airflow (l/s) Very low polluting building (LPB-1)	Airflow (l/s) Low polluting building (LPB-2)	Airflow (l/s) Non low-polluting building (LPB-3)	CO ₂ -concentration (ppm) Very low polluting building (LPB-1)	CO ₂ -concentration (ppm) Low polluting building (LPB-2)	CO ₂ -concentration (ppm) Non-low polluting building (LPB-3)
1	55	60	70	905	863	797
2	38,5	42	49	1122	1061	967
3	22	24	28	1663	1557	1392

WELL Building Standard v2*						
* Well v2, Q2 2021: Concept Air, Feature Enhanced Ventilation Design						
Airflow calculation: Office and conference room						
WELL-points	CO ₂ concentration (ppm)	Airflow (l/s) office	Airflow (l/s) conference room	Airflow (l/s person)	Airflow (l/s m ²) office	Airflow (l/s m ²) conference room
2	750	16	79	16	2	8
1	900	11	56	11	1	6

Fig. 40. Typical design values for ventilation airflow rates specified in standards