

MRV

M.A.R.V.E.L. Energy Optimization Technology

- For commercial kitchens ◦ Massive energy savings on HVAC◦ Automated savings reports ◦ Best Balance with Indoor Environment Quality ◦ Integrated fire prevention feature ◦ Optimized ROIs



Declaration(s) and certification(s)



EPD declarations



Main technologies and options

 **Savings Reports**
Automatic monthly reports about energy savings achieved

 **Halton Thermal Imaging (HTI)**
Cooking activity monitoring by thermal imaging

 **Automated Balancing Damper (ABD)**
Independently adjusts the airflow of each exhaust point

 **Real Time Airflow Optimization**
Massive reduction in ventilation volumes

 **Massive Energy and CO₂ Savings**
Up to 64%+ reduction on cooling and heating bill

 **Fan Speed Optimization**
Advanced algorithm for fan pressure and speed adjustment

 **Additional Savings**
Sensible reduction on fans' electricity usage

 **Halton AirWatch (option)**
Savings not made at the expense of working conditions

 **Faster Commissioning**
Self-balanced system (no longer need to balance the ductwork)

 **Halton FireWatch included**
Detects a fire risk before it occurs

 **Halton Touch Screen**
Intuitive LCD user interface

 **Halton Connect™**
Cloud-based control platform with distant monitoring capabilities (1)

 **Halton Care Services (option)**
Reduced operating costs and peace of mind

 **M.A.R.V.E.L. as a Service (option)**
Get M.A.R.V.E.L. without investing in the technology

 **M.A.R.V.E.L. ready (option)**
Pre-equipment options for easier future retrofit

(1) The access to Halton Connect™ web portal is included in the 1-year warranty period. After this period, it is subjected to one of the Halton Care service offer.



Applications

M.A.R.V.E.L. is a Demand Controlled Ventilation (DCV) system specifically designed to drastically reduce the exhaust airflow rates in commercial kitchens - whether they are equipped with hoods, ventilated ceilings, or a combination of both.

By optimizing airflow in real time based on actual cooking activity, M.A.R.V.E.L. significantly lowers energy consumption related to kitchen ventilation, while ensuring optimal working conditions for staff and enhancing fire safety.

M.A.R.V.E.L. can be used in all types of kitchens - closed, opened, or show kitchens - and in general, all food-production environments. It is an asset for projects subjected to [LEED](#) (1), [BREEAM](#) (2), [DGNB](#) (3), [RE2020](#) (4), or other similar programs or certifications.

Description

With an annual energy consumption of 800 TWh/m² (7), the foodservice industry is the highest energy-consuming sector among all commercial and residential buildings in the United States.

HVAC systems typically account for 40 to 60% of a restaurant's energy bill. That's as much as 320 to 480 TWh/m² in energy use.

Kitchen ventilation alone can consume as much energy as the cooking equipment itself. This is a widely observed trend across the industry. It also highlights a major opportunity for energy savings — provided ventilation is intelligently managed and optimized.

Considerable energy savings

- Up to 44%+ additional reduction in exhaust airflow thanks to M.A.R.V.E.L. optimization. This comes on top of the savings already achieved by the Capture Jet™ technology integrated into Halton hoods and ventilated ceilings.
- When factoring in a 35% reduction provided by Capture Jet™, the total exhaust airflow reduction can reach up to 64%.
- Less extracted air means less supply air is needed - air that must otherwise be heated in winter or cooled in summer.

- On that point, the rule is simple: a 64% reduction in airflow equals a 64% saving on the energy bill for heating or cooling the makeup air.
- M.A.R.V.E.L. also features an advanced algorithm for controlling exhaust fan speed. It adjusts both airflow and pressure, rather than maintaining constant pressure - whether it's a simple exhaust fan or a pollution control unit like PolluStop.
- This ensures the fan always operates at the lowest possible speed. This significantly reduces noise levels in the kitchen.
- It especially delivers substantial electricity savings for the exhaust fans, both in transporting air and overcoming the filtration stages of pollution control units.
- These savings come in addition to the energy savings achieved on heating and cooling.
- The end result is unparalleled energy and cost savings compared to all other demand-controlled ventilation (DCV) systems.

How does M.A.R.V.E.L. reduce exhaust airflow so effectively?

- M.A.R.V.E.L. features the Halton Thermal Imaging Sensor. It continuously monitors the surface temperature of cooking appliances for variations linked to cooking activity - directly at the source and without delay.
- The M.A.R.V.E.L. algorithm then cross-references this activity data with an assessment of the heat loads generated by the cooking appliances.
- Exhaust airflow can then be continuously and accurately adjusted across three levels - appliances off, hot/standby, or cooking. It ensures optimal performance at all times.
- M.A.R.V.E.L. settings are fully configurable to accurately adapt to the layout of cooking blocks, regardless of the type of cooking appliances.
- Each hood section is equipped with an ABD (Automatic Balancing Damper), allowing exhaust levels to be adjusted independently for each section.
- For example, if a kitchen has 10 hood sections and only one is in use, only the airflow for that active hood will increase. The others remain at their minimum flow rate.
- The same logic is applied to each of the zones/subdivisions that make up a ventilated ceiling.

Halton Connect™ and Automated Energy Reports

- Actual airflow data measured by M.A.R.V.E.L. is automatically transmitted to the Halton Connect™ IoT (Internet of Things) platform.
- This data is processed to generate monthly reports detailing the energy savings achieved by M.A.R.V.E.L.
- The reports support energy-efficiency and sustainability goals with concrete data.

Optimized ROIs

- M.A.R.V.E.L. is a fully modular platform, with components that can be selected and combined based on requirements. It enables simplified configurations for small kitchens and advanced setups for larger ones.
- This approach maintains performance levels while optimizing return on investment (ROI).

Optimal Indoor Environment Quality

- By continuously adjusting airflow downward and keeping fan speed to a minimum, overall ventilation noise - including peak levels - is significantly reduced. Peak levels are only reached during brief rush periods.
- The optional Halton AirWatch sensor ensures that energy savings are not made at the expense of Indoor Environmental Quality.
- Halton AirWatch helps maintain optimal working conditions, staff wellbeing, and productivity.
- It includes safety loops for the most critical pollutants generated by kitchen processes or ventilation malfunction, thereby also enhancing overall safety.

Additional Fire Prevention Feature

- Choosing M.A.R.V.E.L. provides access to Halton FireWatch technology.
- Halton FireWatch detects thermal anomalies that may signal potential fire hazards and alerts staff to take preventive action.
- This proactive feature complements mandatory fire suppression systems, enhancing overall fire safety.
- It also helps prevent costly shutdowns and revenue losses caused by false activations of the fire suppression system.
- Additionally, Halton FireWatch may contribute to reduced insurance premiums.

Other benefits and features

- Compatible with all Capture Jet™ hoods, ventilated ceilings, Jet Extraction Systems, and Halton Air Handling Units.
- Supports the most complex kitchen configurations by independently controlling up to 4 exhaust fans and up to 12 zones with individual temperature and CO₂ monitoring, or up to 4 zones with IEQ monitoring.
- Coordinates supply VAV boxes to consistently maintain proper air balance.

- Equipped with the Halton Connect IoT platform, offering advanced 24/7 remote monitoring capabilities.
- Maximizes ownership value through Halton Connect & Care smart services, available as an option from kitchen commissioning.
- Provides multiple options for fire alarm management and integration with Building Management Systems (BMS).
- Complete solution—exhaust, supply, and VAV boxes—from a single supplier with comprehensive control.
- Fully self-balancing system that eliminates time-consuming manual balancing.

About MA.R.V.E.L. MaaS

M.A.R.V.E.L. as a Service (MaaS) is an all-inclusive "savings-as-a-service" offer. It consists of supplying Halton Capture Jet™ hoods or ventilated ceilings equipped with the M.A.R.V.E.L. system, at an investment level comparable to standard systems without M.A.R.V.E.L..

The service is based on a monthly fee, representing a fair share of the actual energy savings achieved. This model enables immediate operational savings on kitchen ventilation, while preserving capital expenditure.

- Controlled Capex.
- Immediate Opex reduction.
- Transparent performance monitoring.
- All inclusive predictive maintenance.
- Predictable and sustainably reduced operating costs.

Further information is available through Halton representatives.

About MA.R.V.E.L. ready option

The M.A.R.V.E.L.-Ready configuration includes factory-installed components that become difficult to access after the installation of hoods or ventilated ceilings. This setup facilitates future upgrades, especially when upfront capital expenditure is limited.

This option typically involves delivering the hoods with Automated Balancing Dampers (ABDs) pre-installed and preparing them for future integration with M.A.R.V.E.L. controls.

(1) LEED - Leadership in Energy and Environmental Design (2) BREEAM - Building Research Establishment Environmental Assessment Method (3) DGNB - German Sustainable Building Council (4) RE2020 - French Environmental Regulation 2020 (5) EN 16282-2 Equipment for commercial kitchens - Components for ventilation in commercial kitchens - Part 2 : kitchen ventilation hoods - Design and safety requirements (6) HACCP - Hazard Analysis Critical Control Point (7) Energy Efficiency in Buildings, Transforming the Market (WBCSD World Business Council for Sustainable Development)



Halton Thermal Imaging Sensor

◦ Real time and accurate monitoring for cooking activity ◦ Base for Halton's On Demand technologies



The Halton Thermal Imaging system accurately monitors cooking activity in real time across all types of cooking appliances.

It is the core of all Halton "On Demand" technologies, with M.A.R.V.E.L. the airflow and energy optimization solution, being the most prominent.

How does it work?

The Halton Thermal Imaging operates based on the principle of infrared thermography. It detects the infrared radiation naturally emitted by hot objects (such as cooking plates, pans, burners etc.) — without any physical contact.

It creates a thermal image in the form of a matrix that accurately provides real-time information about both the surface temperature of the cooking appliances and above all their variations, positive or negative, whether linked to the

29.7	31.8	28.7	26.6	25.7	25.9	29.1	33.2	31.8	33.1	32.4	31.5	27.9	23.7	23.0	24.1
29.1	30.1	33.0	31.6	29.2	30.9	30.4	31.1	30.3	32.3	32.0	31.6	29.3	24.0	23.5	23.8
37.2	35.4	37.2	31.1	30.6	31.0	30.1	29.6	31.0	32.5	32.2	32.3	29.8	25.1	23.3	23.2
38.3	34.6	34.5	27.6	29.2	29.0	28.0	31.0	36.6	43.3	40.3	38.9	34.1	26.4	23.1	22.9
26.3	25.3	23.9	23.3	23.4	23.9	25.5	26.6	30.4	36.6	39.2	40.1	37.6	26.1	22.9	22.4
21.8	21.6	21.7	21.8	22.0	21.6	21.4	21.4	21.6	21.4	21.9	21.9	21.9	21.6	21.6	21.8
21.8	21.4	21.4	21.3	22.0	21.5	21.3	21.3	21.1	20.9	20.9	20.9	21.1	20.9	21.0	21.4
21.1	21.1	21.2	21.4	21.6	21.5	21.5	21.6	21.2	20.9	20.8	21.0	20.8	20.8	21.3	21.7

The Halton Thermal Imaging (HTI) Sensor continuously scans the surface of the cooking blocks and provides the M.A.R.V.E.L.

warming up or cooling down phases or during cooking operations that can have very different "signatures".

Halton Thermal Imaging sensor precision combined with M.A.R.V.E.L. ecosystem and algorithm have the unique ability to adjust the ventilation volumes **real-time** and based on the cooking activity. The right exhaust airflow when needed, not more not less, in order to generate massive savings while not degrading the air quality inside the kitchens.

Benefits

- Halton Thermal Imaging sensor makes the M.A.R.V.E.L. system suitable for any type of cooking appliance and process — whether heat-based, steam-based, or a combination of both — regardless of the energy source: electricity, gas, or solid fuel.
- It is one of the key factors that make M.A.R.V.E.L. the most reliable airflow optimization technology, delivering the highest levels of energy efficiency and savings.
- Reaction times virtually reduced to the time required by the ABD dampers to adjust their position and reach the desired airflow.
- Wide action field, suitable to both hoods and ventilated ceilings, enabling reducing the number of sensors required.
- Enables the fire prevention technology Halton FireWatch.
- Gives access to the "On Demand" feature when M.A.R.V.E.L. is combined with other Halton technologies (Cold Mist on Demand or UV on Demand).

algorithm with a matrix that accurately reflects the cooking activity. Each "pixel" in this matrix represents the real-time average surface temperature measured in that specific area.

The HTI sensor, combined with the M.A.R.V.E.L. algorithm and ecosystem, supports the management of all types of cooking processes. This includes, for instance, fryers that release steam and experience a temporary drop in temperature when fries are plunged into the oil bath, as well as combi steamers that can suddenly emit large amounts of heat and humidity at the same time. The system ensures stable and consistent performance across these varying conditions.



Halton AirWatch (option)

◦ Balance Between Massive Savings and Wellbeing ◦ Part of Halton SafeGuard



The Halton AirWatch sensor monitors Indoor Environmental Quality (IEQ) and detects whether it is improving or deteriorating.

When combined with M.A.R.V.E.L. airflow and energy optimization technology, it ensures the optimal balance between significant energy savings and ideal working conditions and productivity for the staff.

How does it work?

Halton AirWatch monitors 8 key factors (out of 11) related to thermal comfort and pollutant exposure in commercial kitchens. It provides clear indexes for Thermal Comfort and Air Quality, two reliable indicators of good Indoor Environmental Quality and working conditions.

Both indexes are reliable indicators of efficient ventilation design and airflow optimization technologies. Halton AirWatch is designed to seamlessly integrate with every M.A.R.V.E.L. system, ensuring that energy savings are never achieved at the expense of staff comfort or safety.

Under abnormal conditions that lead to deteriorated Indoor Environmental Quality (IEQ), as detected by Halton AirWatch, M.A.R.V.E.L. automatically increases exhaust airflow until conditions normalize, then resumes full energy optimization.

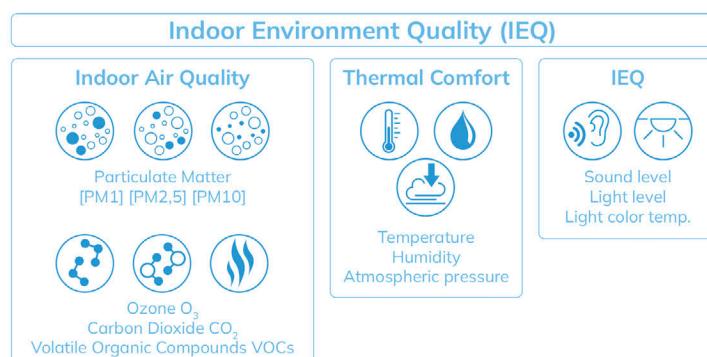
Frequent deterioration of Air Quality may indicate an issue with pollutant capture or a change in kitchen use. Our technicians can remotely investigate and diagnose what can be adjusted remotely prior visit on site if required.

Each AirWatch also tracks lighting and sound levels in its immediate surroundings.

Good to know: the system is based on recommendations from organizations such as the WHO, the EU Air Quality Directive, and WELL V2 standards.

Benefits

- Clear, real-time Thermal Comfort and Air Quality indexes displayed via Halton Touch Screen or Halton Connect™ portal.
- Automated airflow adjustment to constantly reach the best balance between massive energy savings and staff's wellbeing and productivity.
- Configurable safety loops for ozone (O₃), carbon dioxide (CO₂), and PM2.5 that play a key role in guaranteeing a healthy indoor environment.
- Supports up to 4 sensors per system for zone-specific monitoring.
- Can be also used as a diagnosis device.





Halton FireWatch

◦ Enhanced fire prevention ◦ Part of Halton SafeGuard



Halton FireWatch adds a prevention level to Fire Suppression Systems by detecting conditions favorable to a cooking fire before extinguishing system is triggered. Get peace of mind on your fire safety.

How does it work?

Halton Fire Watch is based on Halton's Thermal Imaging Sensor that continuously monitor the surface temperature of cooking appliances to detect anomalies that may indicate a potential fire hazard.

When a risk is detected, Halton's touchscreen (combined with optional visual or audible alarm) alerts the kitchen staff to conditions that increase the likelihood of a fire. It recommends the actions before it breaks out and the fire suppression system

triggers. The system can go till switching off the cooking appliances' power supply.

Benefits

- Mitigates false fire system trips.
- Allows for intervention to reduce risk of fire starting.
- Avoid costly shut down and revenue loss from fire system discharge.
- Potential for insurance premium reduction.
- Cloud based data for insurance companies.
- Monitoring and data back-up services, free for the 1st year of use.
- Fully remotely customizable system to fit your needs when paired with Halton Connect.

Halton FireWatch is part of M.A.R.V.E.L., UV On Demand and Cold Mist On Demand technologies. It is also available as a standalone solution and can be installed in existing kitchens.

Halton FireWatch is part of Halton SafeGuard, the only holistic system that combines Energy Optimization, Indoor Environmental Quality (IEQ), and Safety, all together under one control platform.



Stage 1 alarm - A warning is displayed on Halton Touch Screen. It is relayed with light signal and buzzer fitted on the front of the hoods.

Stage 2 alarm - If the warning is not acted upon, an alarm is displayed on the Touch Screen and its buzzer activates in addition to the one fitted on the hood. The fuel source can be automatically shut off.



Halton Connect™

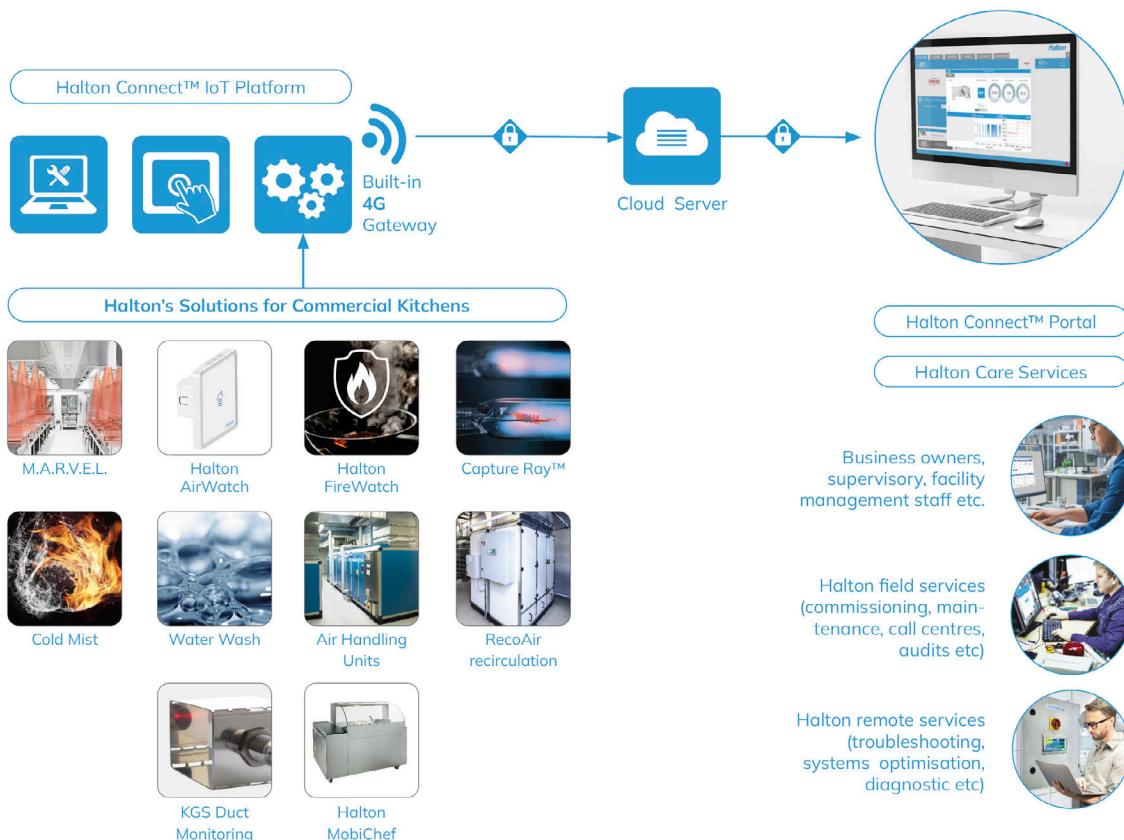
◦ Real time monitoring ◦ Insightful data & reports ◦ Enables predictive maintenance



Halton Connect™ is a state-of-the-art IoT (Internet of Things) platform whose core is an advanced cloud-based portal. It enables 24/7 remote monitoring of the solutions designed by Halton, allowing access to useful information along with powerful data analytics.

Benefits

- 24/7 Monitoring of Halton Technologies and Solutions.
- Access to Halton Connect™ cloud-based portal included during the warranty period, with detailed data on connected solutions.
- Automatic fault notifications and simplified analytics reports.
- Optional advanced reports (energy/water savings, equipment usage, etc.).
- Enables expert analysis to optimize settings and maintain performance at design level or improve it throughout the life cycle.
- Secure, fully independent operation within the building.
- Supports Halton Care predictive maintenance based on real-time analytics. Visits and parts usage are optimized.
- Minimizes downtime from misuse or equipment failure.
- Optional software updates and maintenance for Halton Connect™.





Halton Care (option)

- Smart services for commercial kitchens



Halton Care is a premium service offer supported by Halton's qualified field teams and trusted partners, with Halton Connect™ at its core. It is designed to help maintain peak system performance, reduce operating costs, and provide long-term peace of mind.

Why choose Halton Care Smart Services?

Services are often seen as a cost. But when ventilation and Indoor Environmental Quality (IEQ) technologies are poorly maintained, operational issues escalate—often resulting in higher expenses and disruptions, especially in demanding environments like commercial kitchens.

With Halton Care Smart Services, Halton systems are properly maintained, which translates into tangible savings and greater reliability:

- Reduced energy use and spare part needs.
- Lower cleaning and maintenance costs.
- Prevention of hidden or irreversible equipment damage.
- Fewer staff absences due to better working conditions.

- No revenue loss from unexpected downtime.
- Elimination of nuisance complaints from the surroundings.
- Enhanced hygiene and fire safety etc.

The Halton Connect™ web portal provides valuable, real-time data to Halton engineers and service teams. This enables predictive maintenance and continuous optimization:

- Remote diagnostics and fine-tuning of system settings.
- Visits planned based on actual system needs.
- Optimized spare parts usage and maintenance scheduling.
- Recommendations for operational efficiency and staff wellbeing.
- Insights for better kitchen performance and cost control.

Who better than Halton for Halton products?

Halton's service teams work closely with end users, R&D, manufacturing, and installation teams. This unique synergy allows us to improve our solutions continuously—not only in terms of performance, but also in usability and ease of maintenance.

Remote-first, streamlined maintenance

Thanks to Halton Connect™, most system issues can be resolved remotely—either through guided support to on-site staff or direct software/configuration updates. On-site visits are limited to essential tasks like consumables replacement and periodic general maintenance.

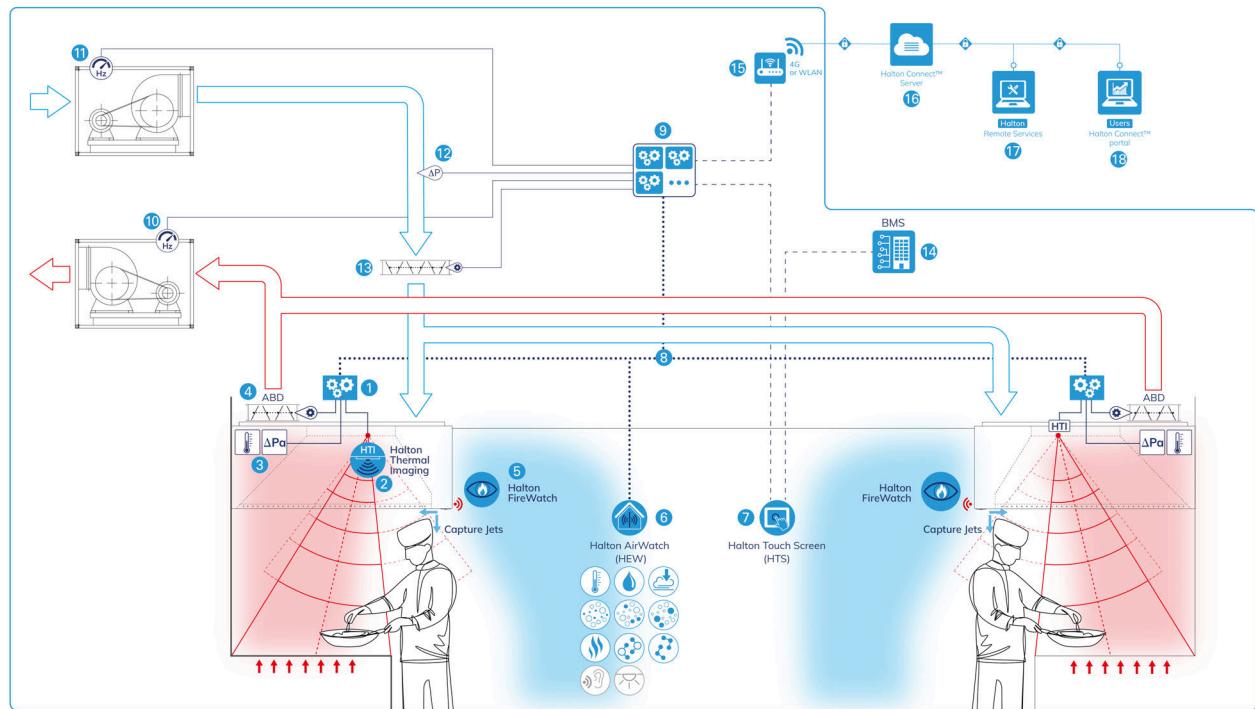


Real-time system data collected

Remote diagnostics and optimization by
Halton experts

Targeted on-site maintenance only
when necessary

MRV Operation Principles



Hood exhaust plenum

- 1 - Integrated exhaust plenum controller.
- 2 - Halton Thermal Imaging (HTI) Sensor.
- 3 - Plenum temperature and pressure sensors.
- 4 - Automated Balancing Damper (ABD).
- 5 - Halton FireWatch audible and visual alarm.

Occupied zone

- 6 - Halton AirWatch (HEW) Indoor Environment Sensor.
- 7 - Halton Touch Screen (HTS).

HVAC equipment and main controllers

- 8 - M.A.R.V.E.L. private network.
- 9 - Main M.A.R.V.E.L. controller. It is composed of modules selected based on the requirements and on the HVAC equipment configuration and size.
- 10 - Frequency inverter of the exhaust fan. Its speed is controlled by

M.A.R.V.E.L., using an exclusive algorithm based on variable airflow and pressure. Alternatively, the fan can be directly managed by the BMS, either through constant pressure control or by relaying the M.A.R.V.E.L. setpoint.

11 - Frequency inverter of the supply fan. Its speed is controlled either by M.A.R.V.E.L. or by the BMS, using a constant pressure logic. Optionally, the M.A.R.V.E.L. control can also operate based on a variable airflow and pressure algorithm.

12 - Duct pressure sensor. Used when a constant pressure logic is applied on the supply fan, whether by M.A.R.V.E.L. or the BMS.

13 - VAV (Variable Air Volume) damper of UTK or UTT type.

Halton Connect™ remote monitoring and communication with Building Management System (BMS)

- 14 - Communication with the BMS via Halton Touch Screen (HTS).
- 15 - 4G or WLAN gateway to Halton Connect™ server.
- 16 - Secure operation data transfer to Halton Connect™ cloud server.
- 17 - Distant connection from Halton Services.
- 18 - Distant connection to users.

Product Environmental Impact

Environmental Product Declaration (EPD)



An Environmental Product Declaration (EPD) is an evaluation of the **environmental impact** of a product or system throughout its entire life cycle, from the raw materials extraction, through to its production, transport and the 'use phase' to its end of life. It includes the recycling or final disposal of the materials composing it. EPDs are based on scientific grounds and standardized methods, in order to provide **unbiased, reliable, and comparable assessments**.

Halton's EPDs comply with several standards:

- ISO EN 14025, which defines the principles and procedures for Type III declarations, i.e. declarations that are checked by independent third parties to guarantee the completeness and conformance to standards. It also establishes the use of the ISO 14040 series in the development of the declarations.
- ISO EN 14040, which defines the principles and framework for **Life Cycle Assessment (LCA)** that enable assessing the environmental impact of a product, process, or service.
- EN 15804, which defines the **Product Category Rules (PCR part A)** applicable to construction products as part of type III declarations.

Complementary Product Category Rules (PCR part B) also apply to the **sub-category of ventilation systems for commercial kitchens**. PCR part B are defined by the European verification organizations, with agreements for mutual recognition.

An EPD consists of two key documents:

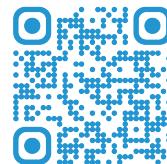
- The underlying **LCA report**, a systematic and comprehensive summary of the LCA project to support the third-party verifier when verifying the EPD. This report is not part of the public communication.
- A **Public EPD document** that provides the LCA results.

Halton's EPDs are verified and registered by and on the [IBU](#) (Institut Bauen und Umwelt) platform or [EPD Hub](#). They are also available on the [ECO Platform](#).

EPDs are available for the Capture Jet™ hoods KVF, KVI, UVF, UVI, CMW-FMOD and CMW-IMOD, as well as for the steam hoods KVV and KVD.

An additional EPD is also available for the UVF or UVI hood equipped with the M.A.R.V.E.L. Demand-Controlled Ventilation (DCV) system. It allows for the assessment of M.A.R.V.E.L.'s additional environmental impact on the KVF, KVI, CMW-FMOD, and CMW-IMOD models.

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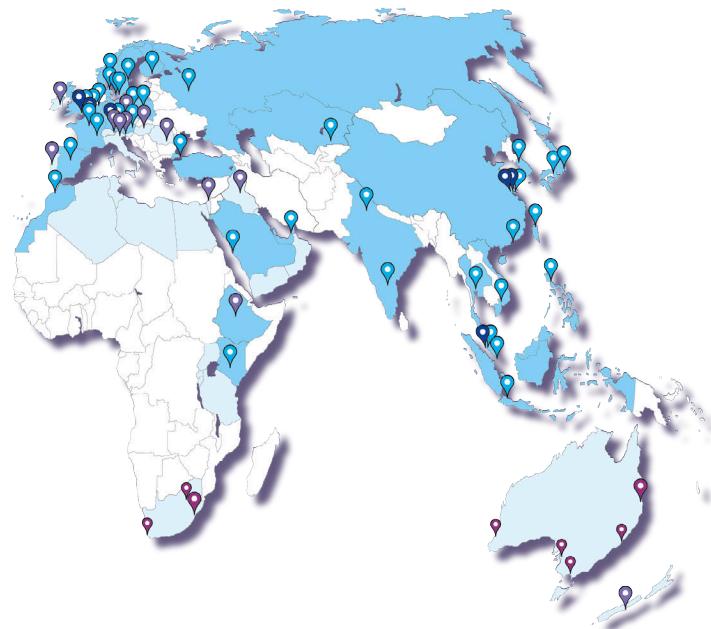
Halton Manufacturing and Sales Facilities in the world

Sales and service centers

Representatives

Factories

Manufacturing licences



Halton Foodservice partnerships



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