

Halton – M.A.R.V.E.L.

– Intelligent Demand Controlled Ventilation system
for professional kitchens



M.A.R.V.E.L. : Revolutionising kitchen energy footprint.



The M.A.R.V.E.L. system* is packed full of technological innovations representing the best expression of the Halton High Performance Kitchen (HPK) concept. This is the first truly intelligent, responsive, and completely flexible demand controlled ventilation (DCV) system specifically designed for hoods and ventilated ceilings.

M.A.R.V.E.L., in combination with Capture Jet™ technology, offers the lowest levels of energy consumption currently possible and provides complete comfort for users.

The first innovation:

M.A.R.V.E.L. is able to identify the current status of the cooking equipment (switched off, heating to cooking temperature, or cooking in progress).

The second innovation:

M.A.R.V.E.L. has the unique ability to adjust the exhaust flow rate to match these three statuses and, above all, hood by hood and in a totally independent manner. If only one of the cooking ranges in the kitchen is operating, the flow rate for that hood or the ventilation ceiling zone concerned will be automatically

adjusted to that required. The other hoods or zones will continue operation at a low flow rate.

The third innovation:

M.A.R.V.E.L. is capable of continuously regulating the flow rate achieved with the extraction fans but also, and most importantly, their pressure. By operating at a variable pressure and flow rate, this system enables you to fine tune the equipment to the exact area and overall requirements, with power consumption kept to the absolute minimum. The associated supply fans are also controlled so as to guarantee the air flow balance of the kitchen.

The fourth innovation:

M.A.R.V.E.L. is a totally flexible system. It can be reprogrammed at any time in response to changes in kitchen layout.

* Model-based Automated Regulation of Ventilation Exhaust Level



Combination of M.A.R.V.E.L. and Capture Jet™ technology: 64% reduction in the exhaust flow rate from that of traditional systems.



Chick-fil-A is an American fast-food chain. One first restaurant was equipped with the M.A.R.V.E.L.* system, used in combination with six KVI and KVL-model Capture Jet hoods.

Reducing energy consumption in the fast-food environment is both a major issue and a real challenge. This type of catering has two specific features that affect the possibilities for energy-efficiency:

- A very wide time span for the use of the cooking equipment and therefore a high energy saving potential
- A higher, steadier rate of use of the cooking equipment than in other types of catering establishments, which at the same time limits these savings

The restaurant was equipped with energy consumption monitors, for one week, in order to evaluate the exact savings achieved.

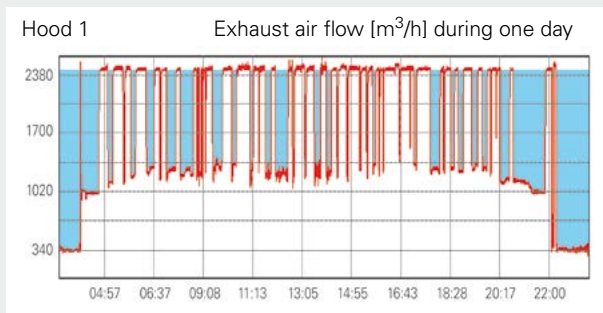
Capture Jet™ technology enables an initial exhaust flow rate reduction of 30 to 40% in comparison with traditional simple flux hoods.

Chick-fil-A equipped its first restaurants with Capture Jet hoods in 2001, after which exhaust flow rates were reduced initially by 35%, falling from 7700 to 5000 m³/h.

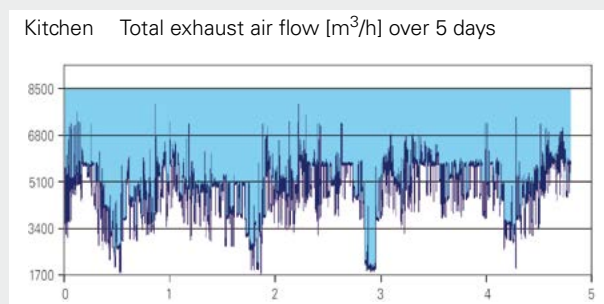
It was only natural for Chick-fil-A to pursue its energy-efficiency goals by installing the M.A.R.V.E.L. system in one of their restaurants.

The energy audit revealed opportunities for an additional average reduction of exhaust flow rates by 44% with the use of M.A.R.V.E.L.

The curve shown below represents the variation in exhaust flow rates for hood 1 (type KVI) over a full day of operation. The reduction in flow rate achieved with M.A.R.V.E.L. is represented by the blue area.



The curve shown below represents the variation in the flow rates for all six hoods for five days' operation. The average reduction in the flow rate is 44%.



Flow rates, reduced by 35% thanks to Capture Jet™ technology, are therefore further reduced by 44% with the M.A.R.V.E.L. demand-controlled ventilation system.

This combination therefore provides a total reduction in exhaust flow rates of 63.6% when compared with traditional systems.

For other types of applications, such as those used in gastronomic restaurants, centralised catering facilities, etc., the savings potential is even higher.

* Model-based Automated Regulation of Ventilation Exhaust Level

Combination of M.A.R.V.E.L. and Capture Jet technology™:

Rapid, fine-tuned and adapted to the requirements of the equipment.

Kitchen 'energy profiles' can be differentiated by three fundamental factors:

- The daily operation period
- The rate of use of the equipment or simultaneity coefficient (all pieces of equipment are never all in cooking mode simultaneously)
- The regularity of operation (from regular activity for company restaurants or canteens to occasional operation for kitchens that prepare food for banquets).

M.A.R.V.E.L.* was designed to adapt in an automatic, permanent, and highly responsive manner without human intervention, and to suit all possible kitchen operation settings.

Thanks to the IRIS™ technology (Infrared Radiation Index Sensor, patent pending), M.A.R.V.E.L.

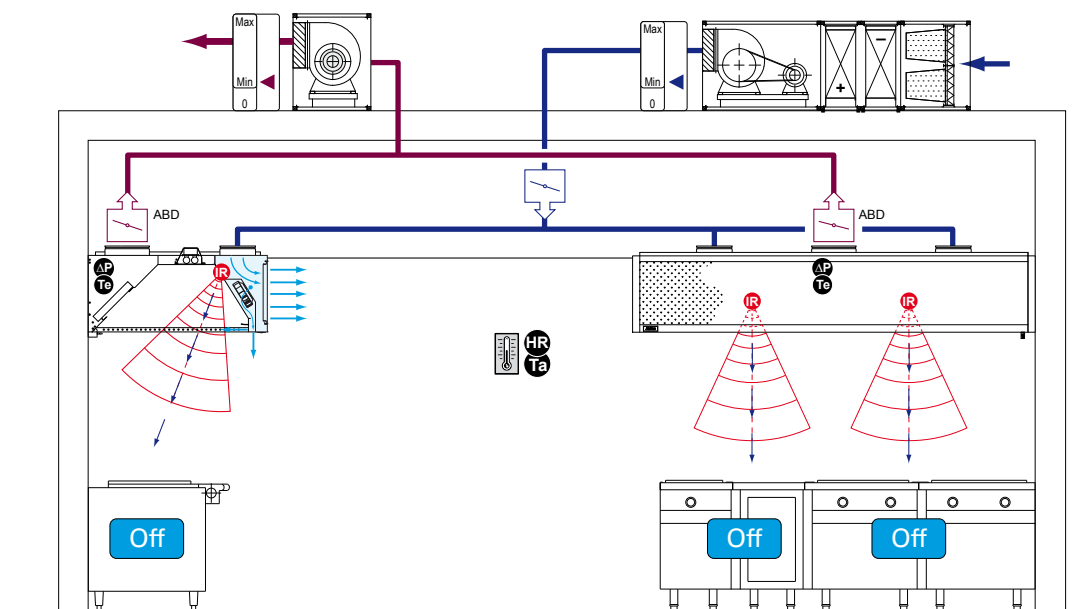
continuously measures the actual status of each item of kitchen equipment:

- Switched off
- Heating up to cooking temperature
- Hot, cooking in progress.

On the basis of the status, and thanks to the ABD motorised dampers integrated into the hood or the exhaust plenums of ventilated ceilings, M.A.R.V.E.L. adjusts the exhaust and supply air flow rates automatically, hood by hood or zone by zone (even if all sensors are connected to a single fan).

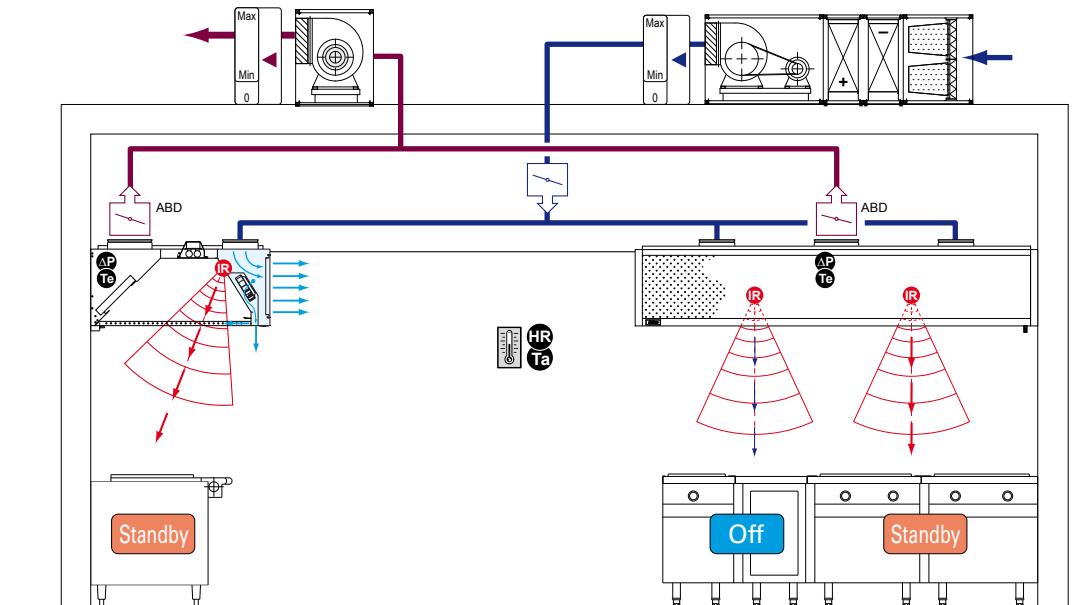
* Model-based Automated Regulation of Ventilation Exhaust Level

1 - Preparation of the kitchen



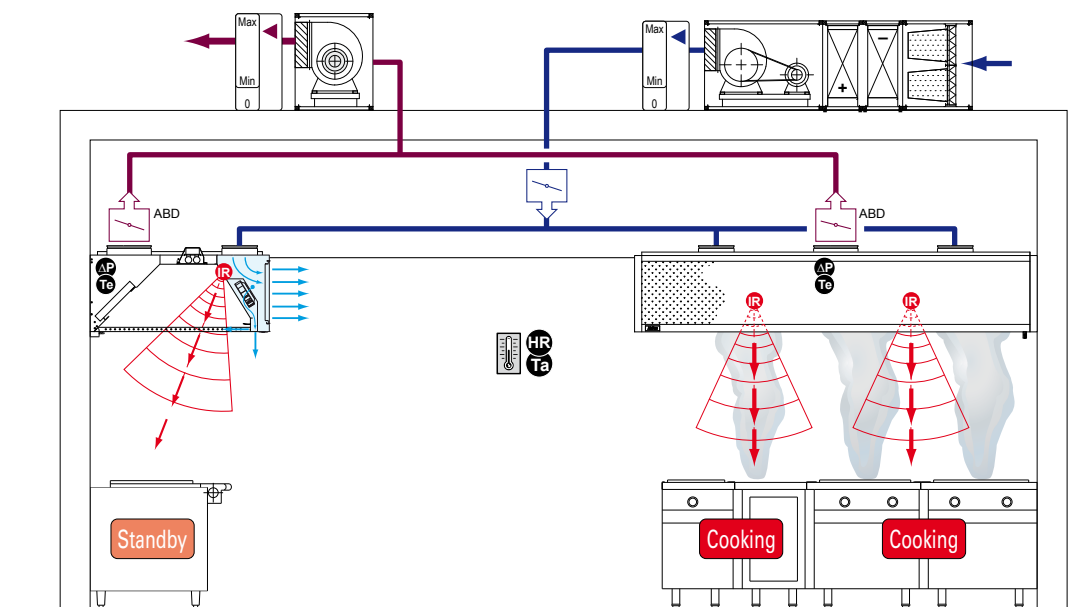
When the kitchen is not in operation, M.A.R.V.E.L. can be programmed to stop the ventilation or to continue it at a low flow rate that keeps proper hygiene maintained during the inactivity. In the latter case, the fans and dampers are automatically adjusted to the minimum programmed settings.

2 - Heating of the equipment



The cooking equipment is gradually heated according to the requirements of the menus to be prepared. The IRIS™ sensors associated with temperature sensors detect the state of the equipment concerned (hot and in hold). The system then automatically adjusts the position of each individual damper and the fan speed, in order to achieve the exact flow rate required for each hood in response to changing requirements.

3 - Full-scale activity of the kitchen



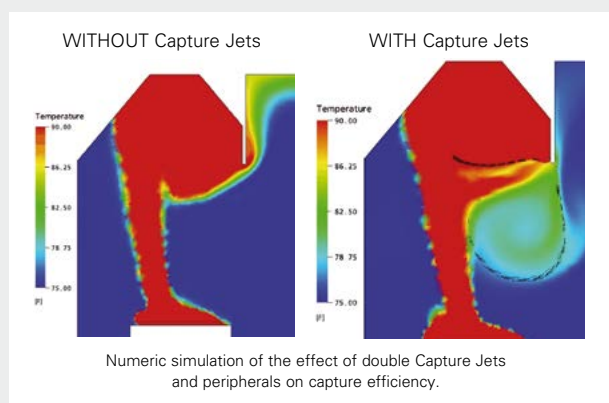
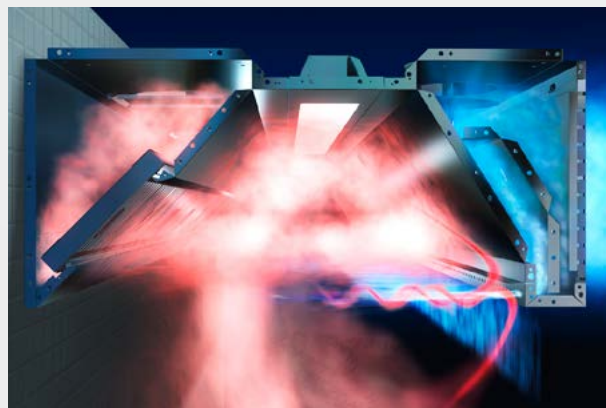
When the kitchen is fully active, most of the equipment enters cooking mode while the other equipment generally remains on standby. The infrared sensors once again detect this change in activity, as it occurs. The exhaust (and fan) flow rate is then automatically adapted to the change in requirements, hood by hood in real time.

Capture Jet™ technology: Essential control of capture and containment.

M.A.R.V.E.L.* offers the unique possibility of changing the exhaust and supply air flow rates:

- according to the equipment's activity
- in real time
- hood by hood or zone by zone for the ceilings
- to provide the exact flow required, without compromising pollutant capture efficiency or air quality

However, M.A.R.V.E.L. does not directly affect the maximum flow rate. Only the hood's own efficiency and a rigorous requirement calculation method enable reliable determination of the maximum flow rate.



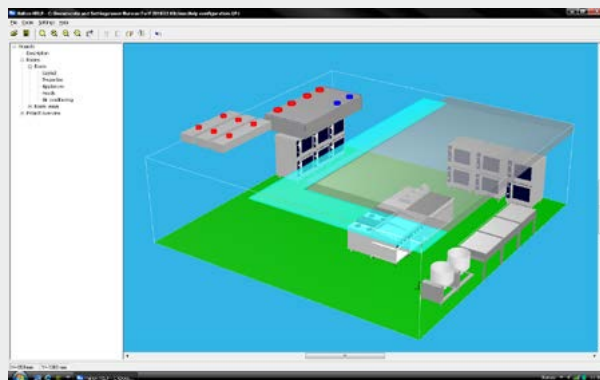
Numeric simulation of the effect of double Capture Jets and peripherals on capture efficiency.

Capture Jet™ technology allows reduction of the maximum exhaust flow rates needed, in comparison to those required with traditional hoods, by 30 to 40%. M.A.R.V.E.L., when combined with patented Capture Jet™ technology (double jets and peripherals), enables you to decrease these flow rates further, to achieve a total reduction of 64%. The two technologies therefore go completely hand in hand.

Capture Jets efficiency is determined with exhaust flow rate calculation tool HELP HVC.

HELP HVC (Halton Energy Layout Program for Hoods and Ventilated Ceilings) is a user-friendly graphical tool that calculates exhaust flow rates according to the type of cooking equipment, its power, its installation configurations, and the measured efficiency of the Capture Jets. It performs precise calculation of the convective flows (with VDI 2052 and Halton data) in order to determine the exact flow rate required for exhausting them – no more and no less.

HELP HVC guarantees that M.A.R.V.E.L.'s action is reliable from the outset (with the lowest possible maximum flow rate).



* Model-based Automated Regulation of Ventilation Exhaust Level

M.A.R.V.E.L.:

Advantages and features.



- Adjustment of the exhaust and supply air flow rates in real time and according to the use of each item of cooking equipment installed in the kitchen.
- Individual and independent variation of air flow rates (hood by hood or zone by zone for the ventilated ceilings), whether the installations are equipped with just one or several fans.
- A 64% reduction in flow rates thanks to the combination of M.A.R.V.E.L. and Capture Jets.
- Reduction in the energy consumption related to heating and/or cooling of the fresh compensation air in kitchens.
- Permanent optimisation of the power consumption of the fan motors as a result of the variable air flow rate and pressure regulation.
- Time savings in installation and start-up, thanks to a self-calibration procedure that eliminates complex manual balancing of the air system.

- The exhaust fan starts up automatically when the cooking equipment is turned on and stops as soon as it is switched off. The system supports minimum permanent ventilation settings. It has a manual and programmed on/off function.
- The temperature and relative humidity in the kitchen can be controlled to ensure optimal comfort and hygiene.
- The system provides extensive data reporting and connectivity capabilities (LON, Ethernet, SMS, PDA, etc.).
- Fire safety functions enable extraction to be switched to maximum flow and compensation to be switched off. The dampers are equipped with automatic return to fully open or closed position according to statutory requirements.
- The air flow control units of the M.A.R.V.E.L. system are part of the common monitoring platform for solutions employing the Halton High Performance Kitchen concept. M.A.R.V.E.L. is 100% compatible with Capture Ray UV technology monitoring systems and Pollustop ecology units.
- The system is pre-set in the factory. Therefore, commissioning, performed by a professional Halton technician, involves only adjustment according to the actual site configurations and the final conditions of use of the equipment.





M.A.R.V.E.L. is the outcome of the complementary skills of several divisions of the Halton group and a ceaseless desire to develop useful innovations and continuous improvement. This unique, patented demand-controlled ventilation system is based on IRIS™ technology.

The IRIS™ sensor

IRIS™ sensors were developed for real-time measurement and control of the thermal signature of each type of kitchen appliance. They emit a beam that can instantaneously measure changes in the surface temperature of the kitchen equipment. The sensors are controlled by our special algorithm that rapidly adjusts the exhaust air flow. Heat and pollutants generated by the cooking activities are then evacuated quickly, efficiently, and appropriately. The hoods can be equipped with 1–3 sensors, depending on their length. The number and position of the sensors may vary to suit each particular cooking range. The sensors are installed on the air supply plenum of the hoods so that the necessary pressure is maintained and they do not get dirty.

The controllers

M.A.R.V.E.L. uses two types of controller:

- The hood controller: This controller is built into every hood and operates the sensors and the damper. It runs the associated kitchen equipment, determines the flow rate appropriate for the current operation, measures the exhaust air flow rate, and operates the damper accordingly.
- The computing system: It collects the information from all of the hood controllers and controls the exhaust and supply fans on that basis. It also handles the auto-calibration procedure and adjusts the fan pressure.

The ABD motorised dampers (exhaust air)

Each exhaust plenum is equipped with an ABD (automatic balancing damper) motorised damper unit with or without a return function. The dampers are equipped with two inclined damper blades to reduce the accumulation of dirt and help fat flow away towards the exhaust plenums.

Halton air flow regulators and VAV boxes (supply air)

Halton air flow regulators and VAV boxes ensure a balance between the supply air flow and the exhaust rate for all of the ABD dampers and are controlled by the computing system. A kitchen may be equipped with several of these regulators or VAV boxes, with the number dependent on the size of the air supply devices selected. Low-speed displacement from the occupied zone is the best solution in terms of comfort and effectiveness if there are significant changes in air flow rate.



IRIS™ sensor



Hood controller



Motorised ABD damper



Halton Regulators and VAV boxes

Differential pressure sensor (hood extraction plenum)

A differential pressure sensor is built into each LHC controller. The pressure is read at the exhaust plenums in order to allow use of the TAB (Testing and Balancing) coefficients for products so equipped and to obtain reliable air flow rate readings.

Duct temperature sensor

There is one duct temperature sensor per hood, installed on the extraction plenum.

Room temperature sensor

The room temperature sensor provides kitchen temperature and humidity measurement.

User interface (console)

A console must be installed for each group of 12 hood sections. The console triggers an indicator light or an audible alarm in the event of a communication fault. The consoles are usually installed on the front of the hoods.

Communication and settings

The system is pre-programmed at the factory. It can be accessed via a PDA (with Windows Mobile) or a PC. The PDA communicates with the controller via the consoles. Most settings can be adjusted in this way.

The system can also communicate with the building's technical management system. For this purpose, a LON interface or Ethernet connection may be set up.

VFD frequency control device

The frequency control device, not supplied by Halton, is essential for the M.A.R.V.E.L. system that operates it, for adjusting the speed of the exhaust and supply fans on a permanent basis.



User interface (touchscreen)

Optionally, the console may be replaced with a touchscreen installed in the kitchen. This offers a very user-friendly way of accessing the system, allowing the settings for both the M.A.R.V.E.L. system (controlled access) and all other solutions of the High Performance Kitchen concept to be adjusted quickly and easily.





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