

Constant Airflow Regulator: Principles & Applications

Dynamic control system

A dynamically vs statically controlled system can eliminate environmental factors, occupants tampering and recalibration concerns.

Dynamic pressure independent control has a lot of advantages while installed in a building. It:

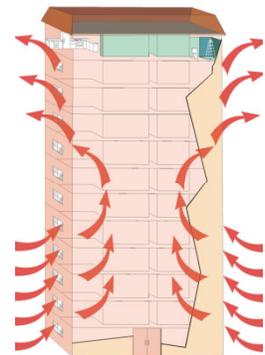
- Automatically adjusts to changes in terms of pressure and airflow.
- Compensates for *stack effect** phenomenon
- Allows fan operation at lower pressure.
- Simplifies building pressurization control.
- Eliminates cross-contamination.
- Improves life safety system operation.
- Reduces draft.
- Saves energy.

* What is stack effect?

Definition from *ASHRAE Fundamentals, Chapter 26*:

Stack pressure differences exist when the building is pressurized relative outdoors, which causes flow out of the building. In the absence of other driving forces (wind), when indoor air is warmer than outdoors, the base of the building is depressurized and the top is pressurized relative to outdoors.

→ It can dramatically affects the system performance in a building.



Dynamic Pressure Independent Control Solution: CAR

Constant Airflow Regulator (CAR) is a simple and smart solution designed by Aldes to efficiently balance airflows in HVAC ductwork to constant level through a passive control.

→ Advantages of CAR:

- Automatically regulates airflows in low or high pressure systems.
- Simplifies design engineering and compensates for minor errors.
- Eliminates on-site balancing of forced HVAC systems.
- No electrical or pneumatic sensors or controls are needed.
- Simple installation - inserts in duct.
- Simple maintenance - free design.
- Saves energy
- Increases comfort
- Improves Indoor Air Quality (IAQ)



→ Principles:

Constant airflow is achieved through the inflating/deflating action of CAR's silicon bulb.



Construction:

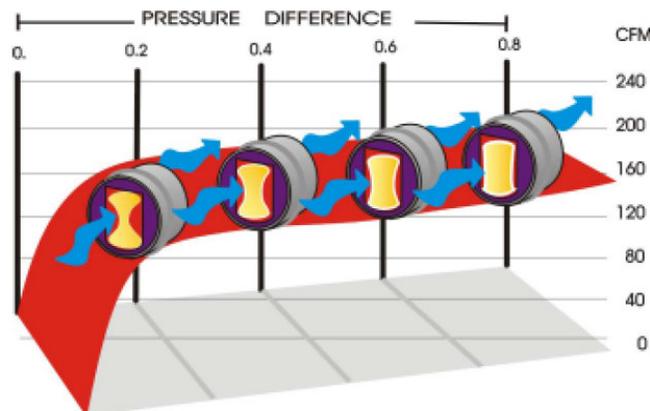
- Constant airflow regulator (MR) is supplied as an assembly of flame resistant plastic body housed in 0.60mm thick galvanised steel sleeve.
- Silicon bulb is installed in the plastic body housing. Constant airflow is achieved by the inflating-deflating action of the silicon bulb based solely on the increase or decrease of static pressure inside duct.
- Sleeve of MR is fitted with brush type gasket to ensure air tightness between the constant airflow regulator and the interior surface of the duct.
- Operating differential pressure range: 50 – 200Pa (Standard MR)
150 – 600Pa (High pressure MR)
- Operating temperature range: -10 oC to +60 oC

Operation:

- At minimum differential pressure, the bulb is deflated and has the shape similar to an hourglass.
- As the differential pressure increases across the bulb, the bulb inflates, thereby reducing the free area around the bulb, and increasing the air velocity resulting in a constant airflow ($Q=V.A$).

This occurs regardless of pressure differences in the range of **50 to 200 Pa**. The air velocity in the duct is in the range of **0.3 to 3.5m/s**.

The Constant Airflow Regulator is able to hold a very consistent airflow across a broad range of air pressures.

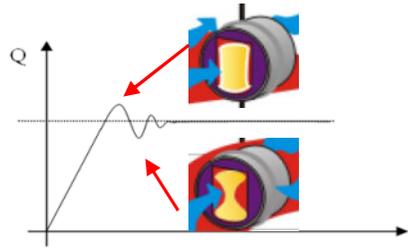


This curve illustrates the immediate action of a decreasing free area and increasing velocity resulting from increasing pressure to main constant airflow.

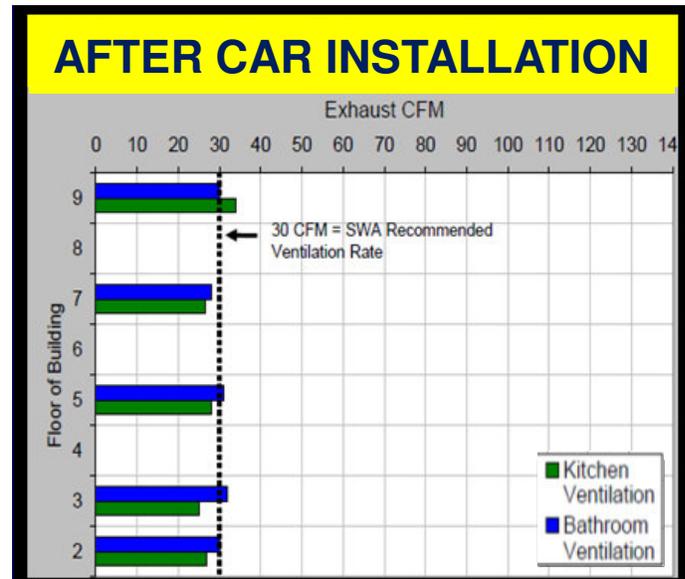
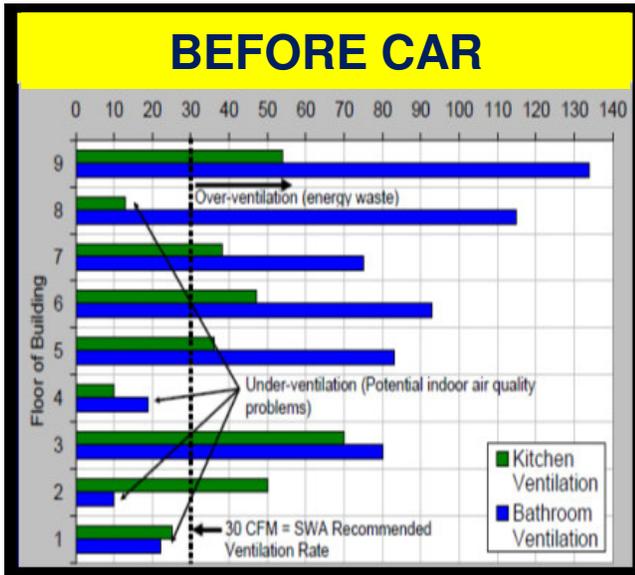
→ Results:

Regulation around the appropriate airflow by controlling the free area (Q=V.):

+/- 10 % for MR > 50 m³/h
+/- 15 % for MR ≤ 50 m³/h



Using CAR from Aldes definitely **avoids energy waste** and **improves IAQ** while **reducing exhaust airflows**.

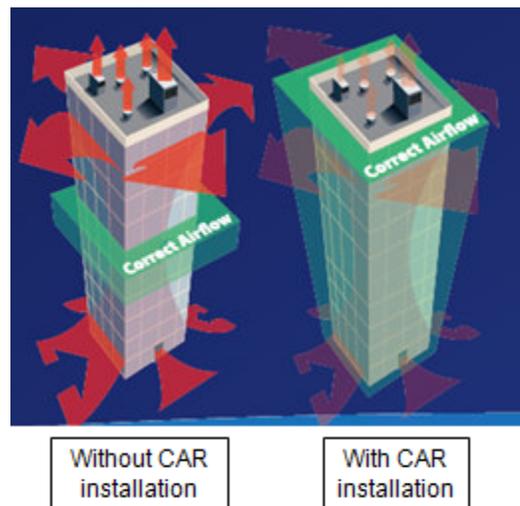


Applications of CAR

→ Correcting Stack effect:

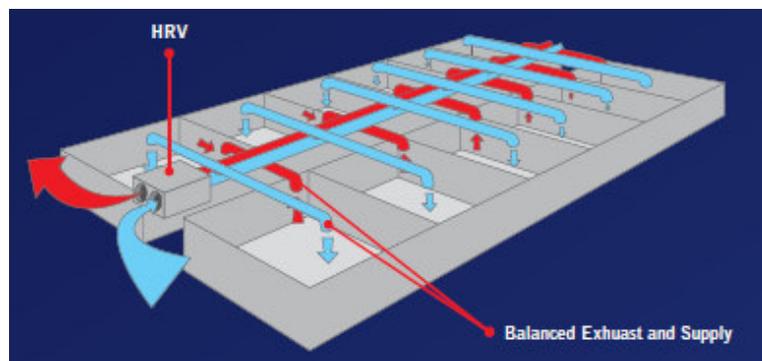
With cold outside air, warm indoor air expands and rises like a chimney. This results in pressure variation to vertically ducted central ventilation systems, causing **over-ventilation** at some levels **that wastes energy**, and **under-ventilation** at other levels that **prevents proper contaminant removal**.

Installing a CAR at each grille user location eliminates stack effect on the ventilation system.



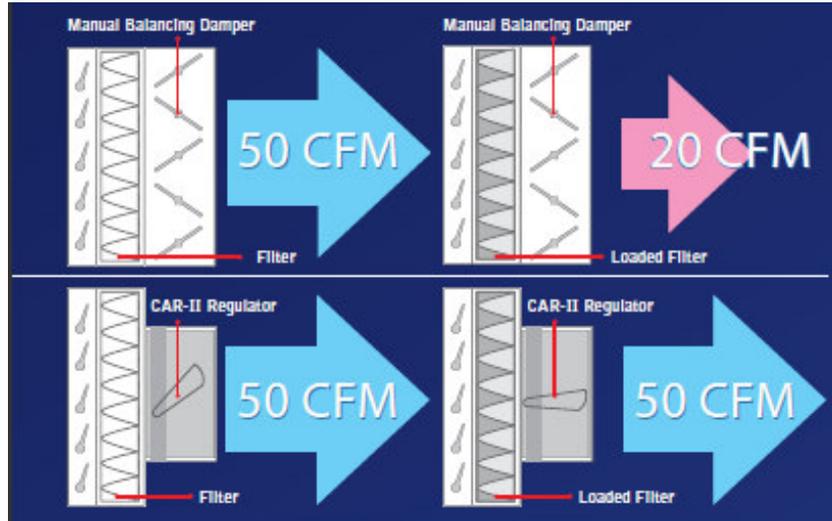
→ Automatic airflow balancing:

Supply and return/exhaust airflow for each area is automatically balanced by installing the CAR in the branch ducts or terminal device locations. CAR's are commonly used in heat and energy recovery systems to ensure maximum efficiency.



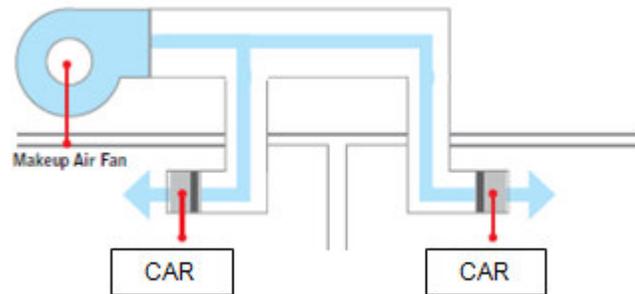
→ **Automatic correction:**

Installation challenges and user interaction can result in “field” modifications to intended system designs. CAR will automatically adjust to compensate for changes in duct length, duct leakage, proper filter selection, filter loading, and damper settings, to always deliver the proper designed airflow rate.



→ **Make-up air control:**

CARs are used to control the amount of outside air brought into a building when installed in; makeup air fan systems and AHU outside air plenums. This guarantees a delivered air flow rate and prevents over-ventilation in windy conditions.



Aldes Middle East & CAR

- Several million pieces have already been installed Worldwide.
- CAR saves commissioning time and money to adjust airflow → replacement of VCDs
- CAR can replace CAV Boxes (CAR-MR upto 1100 cfm) → no electrical motors required.
- CAR can be supplied within an aesthetic grille as one single solution for exhaust applications (cf Aldes ME Flash n°37: Bap'SI twin)

