



VACON HVAC AC DRIVES

COMFORT & CONTROL IN BUILDING AUTOMATION

VACON
DRIVEN BY DRIVES

THE SMARTER WAY TO REDUCE CO₂ EMISSIONS

Heating, ventilation and air-conditioning (HVAC) is all about efficiency. Room temperatures need to be maintained at optimum levels to achieve maximum productivity. This productivity may relate to work or leisure activities, but it makes no difference. Everyone wants the right temperature, humidity and amount of fresh air to make them comfortable. At the same time it is essential to consider how to achieve targets in reducing CO₂ levels to avoid causing irreversible harm to the earth's environment.

The heat load per square metre is rising. Buildings accommodate large numbers of people and the number of PCs, copy machines, printers, servers, etc. is increasing, while the requirements for ambient conditions are getting stricter. The key questions are: does everything need a control system and, if control is needed, what is the smartest way of implementing it to reduce the impact on the world? It is a question of balancing the necessary control against what is best for the environment.

1°C increase in global temperature would cause the Arctic Ocean ice to melt by 2040

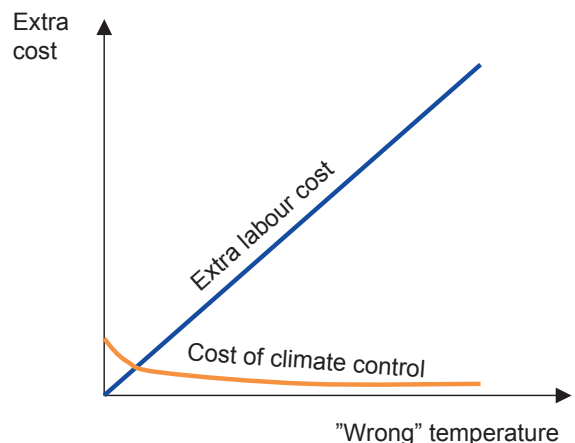
According to leading climatologists, global warming will result in an ice-free Arctic Ocean by summer 2040. The average temperature increase is not remarkable, only 1.5°C (Intergovernmental Panel on Climate Change, IPCC). But this small change will have bigger consequences: the sea level will rise 6.5 m if just the ice sheets covering Greenland melt. 40% of all energy in Europe and USA is consumed in buildings. More than half of this is in HVAC applications.

2°C reduction in temperature boosts productivity by EUR 160,000 in an office with 100 workers

Productivity drops two per cent for each degree centigrade above 25°C. In terms of resources, a two-degree increase in temperature means that four per cent more workers are needed. In an office with 100 people, with an average cost of EUR 40,000 per person, this means EUR 160,000 in extra labour costs. The cost of reducing the temperature by two degrees would be only EUR 4,000 for the same office. It is also necessary to consider the impact on employee satisfaction and health (Based on research carried out at the Helsinki University of Technology, Institute of HVAC, Finland).

3°C increase in office temperature cuts energy consumption by 12%

Each degree by which the level of air conditioning or heating is cut in a building reduces the energy consumption by 3–5%. The electrical energy consumed by pumps and fans in HVAC typically drops by 20–50% annually if speed control is applied with AC drives. So it does make sense to control the speed in HVAC applications. At the very least, the level of air conditioning or heating should be reduced during the night. Buildings are globally the biggest consumer of energy. HVAC applications use the biggest share of energy in buildings.



Labour cost is affected by office temperature more than the cost to set the temperature right.

Chilled water and hot water pumps

Should the primary pump be speed controlled? Should all loads have speed controlled pumps or is it enough to have one common speed controlled pump for all loads?

Cooling towers

Should the speed of the condenser pump or cooling tower fan or both be controlled? Where is the biggest potential for savings and improved control?

Supply and return fans

Should constant air volume be converted to full scale variable air volume, or should speed control just be added to the supply and return air fans?

Compressor

What are the benefits if the compressor is driven by drives?

Stairway ventilation

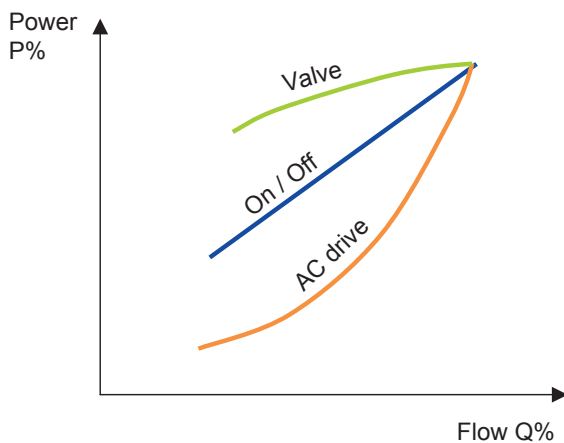
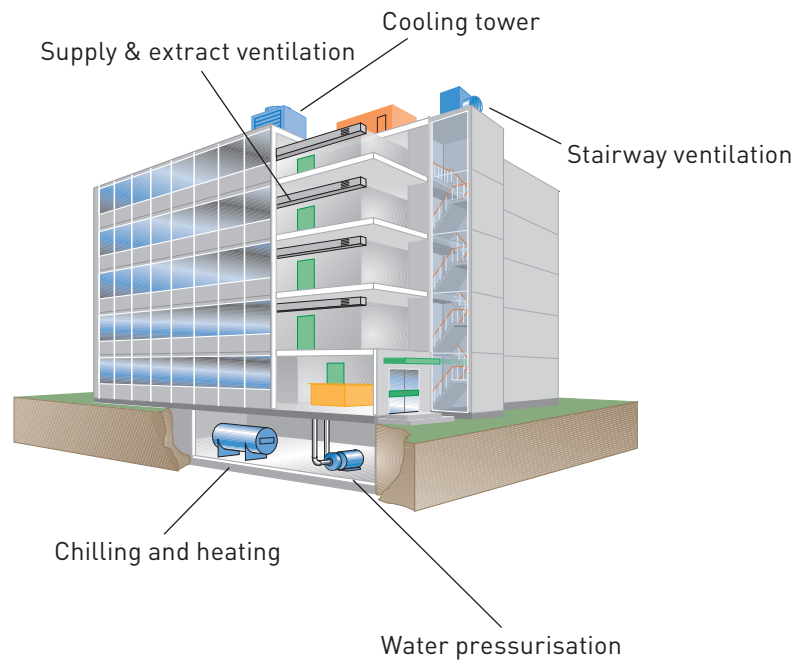
How should the stairway ventilation system operate in case of fire? Does an AC drive make this more complicated?

Boiler pumps and fans

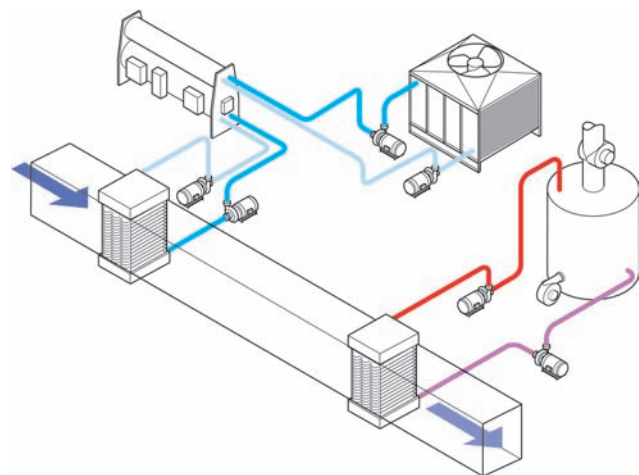
Does variable speed make it easier to fit and tune the boiler to exhaust piping and hot water circulation?

Building automation

How should all these points be controlled: centrally with a field equipment controller or with automation integrated in an AC drive? What will be the method of communication in the future?



Electrical power consumed by pump at partial loads is remarkably less than with on/off or valve control.



The basic building blocks of an HVAC system: chilled water circulation, hot water circulation and air circulation.

EFFICIENT INVESTMENT

In building automation and in HVAC applications in particular, the payback period for an AC drive is typically one year or less. When compared with a lifetime of 10 years or more, this makes an AC drive an excellent investment.

Save energy and time, and conserve the environment

To keep the costs of the investment to a minimum over the lifetime of the building automation system, Vacon boosts energy savings and minimizes maintenance.

- **Energy cost:** Controlling the process with an AC drive can reduce electrical energy consumption by 20–50%. Please see the energy calculator at www.vacon.com.
- **Energy cost:** With built-in features such as real time clock, motor current optimization and sleep function, you can save and measure the savings with Vacon HVAC drives.
- **Maintenance cost:** All components have a typical lifetime of 10 years or more, including the capacitors and fan. There is no need to change any parts during periodic maintenance.
- **Maintenance cost:** The extensive technical support network of Vacon and its partners ensures effective service operations 24 hours a day, 7 days a week.

Compliance to standards made easy

Commercial, industrial and even residential buildings contain more and more equipment that is sensitive to disturbances. To ensure that your building automation complies with all the relevant standards, we have built them into Vacon HVAC drives.

- **EMC:** EN 61000-3-12, EN 61800-3 (1996) + A11 (2000) Category C1&C2
- **Safety:** 61800-5-1(2007), UL 508 C
- **Approvals:** CE, UL, cUL

Vacon HVAC save the cost of additional equipment

The Vacon HVAC contains numerous features that make additional controllers redundant. This saves the costs of additional controllers, and of their housing, power supply and cabling.

- **Fire mode:** To ensure that smoke exhaust fans function and thus potentially save lives, the Vacon HVAC overrides the self-protection and motor protection diagnostics.
- **Multipump/fan:** The Vacon HVAC can control several pumps or fans connected direct-on-line, in addition to the unit that is speed controlled. This makes additional controllers unnecessary.
- **PID:** Every Vacon HVAC has a built-in PID controller, so it acts as a controller for part of the HVAC process. With two PID controllers in the Vacon HVAC, actuators can be controlled through the drive I/O.
- **PLC:** Vacon AC drives have a fully programmable PLC inside. This saves the cost of an external PLC.
- **Real time clock:** With the real time clock, the Vacon HVAC can be programmed to control the HVAC in different ways when the office is busy and when it is closed.
- **Energy monitoring:** The Vacon HVAC monitors the kWh consumption and allows you to calculate the actual savings

In HVAC applications, the AC drive is connected to the building management system or field equipment controllers, and to the electrical network. All the necessary standard and optional hardware to integrate the drive into the automation and electrical networks is built in.

- **Chokes:** To minimize current harmonics.
- **RFI filter:** To minimize radio frequency disturbances.
- **Serial bus:** Built in and powered in. No need for extra housing.
- **Ethernet:** Built in and powered in. No need for extra housing.
- **I/O:** Standard I/O and optional expansion cards.

With all these built-in features, Vacon's IP54 enclosure is still one of the smallest on the HVAC market.
The AC drive does not need to be installed in a costly cabinet.

EFFICIENT INSTALLATION

Easy mounting built in



Size does matter, when you have to lift and mount the AC drive on the wall. The Vacon HVAC is one of the smallest HVAC drives on the market but still has everything built in.

- **IP54:** Mount it on the wall, fast and easy. All screws are accessible from the front. No cabinet needed.
- **All in one:** Just install one unit instead of several components. Minimize the time for installation work with the Vacon HVAC drive with built-in chokes, RFI filters, serial bus, Ethernet, I/O, PLC and keypad.
- **Manuals:** The Vacon HVAC has a dedicated installation manual for HVAC applications. All the relevant information can easily be found in the manual.

Easy connections built in



To ensure that your electrician can safely and effectively make the electrical connections, we have designed the mechanics and electrical connections for Vacon HVAC drives to be user friendly.

- **Terminals:** Removable control terminals allow ergonomic cabling.
- **Clamps:** The innovative cable seal and clamps make expensive cable throughput clamps obsolete.
- **Space:** Adequate connection space for the cables.
- **Safety:** Power terminals and control terminals are separated. This makes the control wiring work safe.
- **Manuals:** Dedicated manuals show examples of connections for different applications.

Easy commissioning built in



To ensure that anyone can safely and quickly commission the Vacon HVAC drive, whatever their background, we have developed an automatic commissioning function.

- **Auto commission:** There is no need to set parameters, it is all done automatically for basic applications.
- **Wizards:** In case you want to fine-tune the AC drive, our start-up, PID, serial communication and multipump wizards make it very easy and fast for you.
- **Manuals:** The embedded manual in the graphical keypad is always available.
- **PC tools:** The Vacon Live PC tool makes a demanding application or complex system easy to commission, while creating a backup copy as well.

World-class technical support locally



No matter how easy the AC drive is to install and commission, it is still reassuring to know that help is always available, locally. As a dedicated 100% drives manufacturer, Vacon technical support can focus on one thing: supporting you in your drives related challenges.

- **Local support:** Trained by global experts to match your demand.
- **Global support:** To ensure that local support is available globally.

COMFORT AND EFFICIENCY FOR USERS

Silence everywhere

Noise from a fan, pump compressor or motor is not appreciated by the users, the end customers of the building. We have taken this into account when designing the Vacon HVAC drive.

- **Silent fans or pumps:** Skip frequencies to avoid mechanical resonances. This makes the system silent and avoids unnecessary wear and tear.
- **Silent motors:** The high inverter switching frequency keeps the noise of the motor to a minimum.
- **Silent drives:** The cooling fan in the Vacon HVAC is speed controlled in accordance with the temperature. During low load times, like night time, the drive is pleasantly silent.
- **Silent HVAC systems:** When the HVAC system is speed controlled, the noise level is reduced during times when the maximum capacity is not needed.

Mechanical stress

Controlled acceleration and deceleration instead of jump starting or stopping with contactors means the mechanical system will have a longer lifetime and require less maintenance.

- **Pumps:** Smooth ramp-down avoids the hammer effect on pipes and valves. Pipes have a longer lifetime without mechanical shocks.
- **Fans:** Controlled acceleration means the belts will not slip, so they don't create noise or wear out so fast.
- **Compressors:** Smooth ramps reduce the stress on the compressor shaft and fluid and gas piping.

Electrical stress

With direct online starting, the electrical system momentarily takes up to seven times the nominal current. Transients like this may cause all kinds of unwanted phenomena. The electrical network will either suffer from frequent failures or need to be over-dimensioned. The voltage dips will also affect other equipment connected to the same network.

- **Current:** With an AC drive you can limit the maximum current taken by the system and thus use smaller fuses, switchgear and cabling. Smaller fuses mean a smaller monthly bill from your power company.
- **Voltage:** Switching heavy loads to the electrical network with contactors causes voltage dips and spikes. Using an AC drive will do away with these.
- **Reactive power:** Motors connected directly to the electrical network will consume both reactive power and active power from the network. With an AC drive, only active power is needed and the extra heat losses due to reactive power are avoided in the network.

Easy maintenance built in

To ensure that your technical staff does not have to use extra time in servicing AC drives, we have made Vacon HVAC drives maintenance-free. The Vacon HVAC also has built-in features that simplify the maintenance of process equipment such as motors, pumps and fans.

- **Long life:** No periodic maintenance needed. Components are designed to last.
- **Process diagnostics:** If a belt is broken or a pump is empty or jammed, the Vacon HVAC drive will let you know.
- **Maintenance:** Motor switch ride-through (patent pending) allows the motor to be disconnected and connected while running without tripping the AC drive. This is convenient when motor and drive are in different locations, as in roof-top fans.
- **Manuals:** Fault descriptions and suggested actions built in the keypad, the manual is always there when you need it.

Professional technical support always available

To ensure that technical staff never have to re-invent the wheel, our technically experienced personnel and partners are available to give support locally in more than 100 countries and in over 70 service centres on all continents.

Environmentally friendly

To do our share in providing for future generations, we have switched to materials that are substantially less polluting in the Vacon HVAC. In fact, the overall ecological footprint of our AC drives is positive, due to the energy savings they give.

- **Ecological footprint:** The Vacon HVAC drives have a positive overall impact on the environment due to the energy saved over their lifetime.
- **Waste directive:** RoHS compliant; there is no lead in printed circuit boards.
- **New technology capacitors:** Thin film capacitors do not contain toxic electrolytes, unlike the old electrolytic capacitors.

PROVEN TECHNOLOGY FOR HVAC

Heathrow Airport, Terminal 5, UK

In complex HVAC installations, seamless system integration becomes a success factor. More than 800 Vacon AC drives communicate via Ethernet with the building management system at Heathrow Terminal 5.



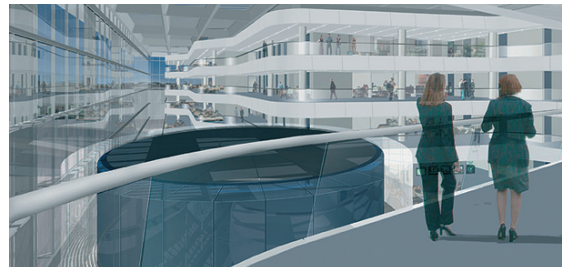
Inox multiplex cinema, Pune, India

Audiences enjoy Bollywood productions with disturbance-free audio visuals in a comfortable ambience. Vacon AC drives control air handling units at the Inox multiplex cinema in Pune, India.



DR multimedia house, Copenhagen, Denmark

Pleasant indoor air and temperature are essential in the multimedia house, which was built for 3,000 people in Copenhagen, Denmark.



Raffles private hospital, Singapore

An interference-free electrical environment is as essential for medical equipment as a comfortable ambience is for hospital patients.



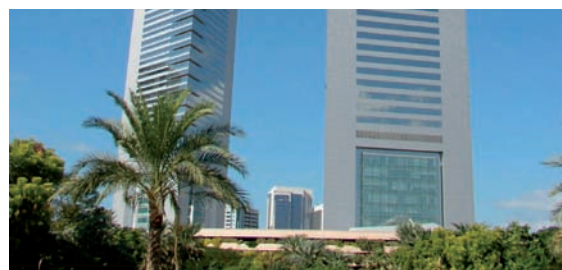
Sello shopping centre, Espoo, Finland

American-style malls have come to stay in Finland. Sello has become the place to chill out on hot summer days (and cold winter days, too) in Espoo, Finland.



Jumeirah Emirates Towers, Dubai, UAE

The reliability of the HVAC system is critical in what is one of the hottest places in terms of climate and for the construction business.





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