



Drives and motors

# A guide to using variable speed drives and motors in hospitals and healthcare centres

## Meeting your Carbon Reduction Commitment (CRC)

# Helping hospitals meet the energy and CO<sub>2</sub> reduction challenge

With energy expenditure amounting to £400 million per year, the healthcare sector needs to look at how it uses energy and identify ways of improving efficiency. The National Health Service (NHS) alone has a carbon footprint of 18 million tonnes of carbon dioxide (CO<sub>2</sub>) per year. Since 1990 the NHS's carbon footprint has increased by 40 percent so to halt and reverse this is going to represent a significant challenge. A hospital is an extremely energy intensive building. Electricity accounts for around 18 percent of a hospital's delivered energy consumption and it represents over 50 percent of a hospital's energy costs. So if energy consumption can be reduced, financial savings can be made as well as substantial reductions in CO<sub>2</sub> output.

In no other building is indoor air quality as critical as in hospitals. It acts as more than just a facilitator of comfort; it impacts on patients' recovery. While temperature and humidity requirements are important in hospitals, it is bacteria concentration and cross-contamination that are of critical importance in Heating, Ventilation and Air Conditioning (HVAC) design. Within hospitals the HVAC system is also the greatest drain on electricity. So if HVAC systems can be made to work more efficiently, huge sums of money can be saved.

By investing in energy efficient variable speed drives (VSDs) and high efficiency electric motors to control HVAC systems, hospitals can potentially lower their energy consumption by as much as 50 percent and above, making huge strides toward freeing up valuable funding for further capital investment.

## The CRC Energy Efficiency Scheme

Hospitals that consume more than 6 GWh/year and use a half-hourly meter, must register for the CRC Energy Efficiency Scheme - a mandatory scheme to promote energy efficiency and reduce carbon emissions. CRC is a UK based cap and trade scheme and is the UK government's preferred method when it comes to controlling emissions. Although revenue neutral to the Exchequer, CRC will have cash flow implications for qualifying organisations. An energy saving of 5 percent will be needed to cover the average cost of administration within an organisation.

CRCs treat whole sections of the economy as a single entity and set targets for group rather than individual companies. Each organisation is allocated an agreed number of carbon allowances which decreases over time. Those individual organisations that can reduce their emissions easily are able to sell their allowances to those organisations who have not met their targets. The cost of carbon allowances will be paid back to participating organisations. However, payment will be based upon a league table of energy efficiency performance.

Those organisations able to reduce their consumption the greatest receive the initial cost plus an additional 10 percent in year one and those at the bottom of the table get their initial cost minus 10 percent.





### Variable speed drives

Hospital electricity costs can be significantly reduced by as much as 50 percent and above with variable speed drives (VSDs) from ABB. These devices control the flow of pumps and fans to eliminate the energy waste that is common with conventional pump and fan control methods.

### How variable speed drives work

Many existing pump and fan systems are based on throttling arrangements: the motor is driven at full speed and then the flow of liquid or gas is regulated by valves, vanes or similar throttling mechanisms. Throttling the output in this way, wastes energy. A VSD can increase the system's efficiency by adjusting the motor speed to the correct operation point and eliminating the need for throttling.

A small reduction in speed can make a big difference in energy consumption. A pump or fan running at half speed consumes only one quarter as much energy as a unit running at full speed. This is because the power required to run a pump or fan changes with the cube of the speed.

Because many pump and fan systems run at less than full capacity for much of the time, VSDs can produce huge savings. If a 100 kW pump is throttled by 50 percent, for example, the investment in a VSD will have a payback of only six months of continuous operation.

### Benefits of variable speed drives

#### Commercial

- Reduced energy consumption – typically 50 percent and above
- Fast payback – from 6 months
- Reduced CO<sub>2</sub> emissions
- Enhanced Capital Allowance
- Interest free loan from the Carbon Trust in partnership with Salix Finance

#### Technical

- Lower maintenance costs
- Starting, stopping and braking can easily be programmed to reduce stress on mechanical equipment
- Increases equipment life and reduces maintenance requirements for pumps, motors and pipework.
- Easily retrofitted into an installation
- Real time clock
- Can easily set up programmes with different running speeds at different times or on different days, making the drive ideal for hospital applications
- Low harmonic solutions available as part of installation design

#### Staff and patients

- Clean air circulation throughout critical hospital areas
- Tighter control over temperature changes
- A more comfortable temperate environment

#### Facilities manager

- Gain control of heating, air condition and ventilation costs
- Easy to retrofit VSD into an installation

# Healthcare applications that benefit from variable speed drives

## HVAC systems with variable speed drives

Many HVAC distribution systems operate at a constant flow rate, however peak demand may only be required for a small percentage of the day. The conventional response to control heating and cooling within hospitals is to control flow to individual rooms, while maintaining peak flow in the central HVAC system. However, this consumes considerable energy and equipment lifespan is shortened.

A much better approach is to use a variable speed drive on HVAC pumps and fans to vary air or water flow to meet changing load demands more precisely.

## Savings in running costs

Pumps and fans offer the best energy savings potential of any equipment in hospitals. Applying a variable speed drive to a 75 kW motor in continuous duty, can save nearly £15,000 per year on one single application, as well as significant reductions in the building's carbon footprint.



## Save on commissioning with BACnet

Within hospitals it is common to have a range of installation equipment from multiple manufacturers. BACnet allows for simple, cross-system integration in buildings. BACnet communication protocol is essentially a set of rules for building automation and control networks, governing the way in which equipment communicates over a computer network. It eliminates the need for adding software gateways reducing installation time from between two and three hours, down to 15 minutes, saving money during installation.

## Birmingham Hospital

Birmingham Hospital is taking advantage of the communication protocol with more than 100 ABB HVAC drives playing a key role in handling the air and water for the new facility. The project is the first major building in the UK to use the BACnet communications protocol to control its building services, saving significant time during commissioning.

## Retrofitting

It has been calculated that only one in four motors used in HVAC applications are controlled by an AC drive. This means that there are many pumps and fans that could benefit from being controlled by a VSD, resulting in significant savings, greater comfort for staff and patients, lower noise levels and reduced maintenance costs.

## The Hammersmith and Charing Cross NHS Trust

The Hammersmith and Charing Cross NHS Trust has retrofitted more than 70 high-efficiency electric motors and variable speed drives at its two London hospitals. The project was carried out with minimal disruption to the normal operation of the hospital and has resulted in improved HVAC efficiency with savings of over 25%.

### Estimating running costs

The best way of determining the cost effectiveness of a potential VSD retrofit is to look at the power needed at each operating condition, firstly with and then without a VSD.

Proposed energy savings can then be calculated by taking the reduction in power at each condition and estimating the savings based on the actual or expected operating time of that condition.

### Replacing existing drives improves efficiency

Existing drives should also be considered for replacement, even if they have not actually failed. An old drive could be costing money unnecessarily, compared to more modern and efficient products.

### What help is available?

#### Finance

For private organisations, the Carbon Trust may be able to help with interest free loans up to £500,000, email: [www.carbontrust.co.uk](mailto:www.carbontrust.co.uk)

For public organisations, Salix Finance is an independent company funded by the Carbon Trust. It works specifically with public sector organisations to reduce energy cost and carbon emissions by providing interest-free funding for investment in capital projects aimed at improving energy efficiency. For further information about Salix financial services, email: [info@salixfinance.co.uk](mailto:info@salixfinance.co.uk), or call **020 3043 8800**.



# Practical applications



## ABB motors and drives arrive just-in-time for Coventry Hospital

### Challenge

Coventry Hospital needed to install a new HVAC system to control airflow throughout the site, ABB was chosen to supply the drives on a just-in-time basis in order to meet the installation time table of Air Handling Systems, the suppliers of the ventilation system.

### Solution

ABB supplied a range of drives and motor packages ranging in size from 0.55 kW to 45 kW. Because the 230 drives and motors packages are matched to each other, the site benefits from extremely efficient power consumption. ABB also provide a 24-hour support service to keep the installation up and running should anything go wrong.

### Benefit

Using variable speed drives to control the flow of air and water in the HVAC system can save well over 50% of the energy, compared to using traditional control methods such as throttling valves and vanes. On a large site like Coventry Hospital, this can have a significant impact on running costs. Matched pairs of ABB high efficiency motors and drives will reduce energy consumption at the new Coventry Hospital by over 1,400 MWh per year for the ventilation system in block A. Similar savings are expected for the planned blocks B and C. The £150,000 contract is one of a number of recent large projects for ABB's sales organisation for dedicated HVAC drives, which was set up 18 months ago. In addition, ABB is also delivering low voltage switchgear to the hospital.

## Clean air supply benefits UK's largest hospital

### Challenge

The £210 million Edinburgh Royal Infirmary, needed to install an air handling system to deal with critical and non-critical areas. This included installation into operating theatres where clean air conditions are critical.

### Solution

The UK's largest new acute teaching hospital is installing ABB variable speed drives, supplied by ABB Drives Alliance member Quantum Controls, to maintain a clean air supply in its operating theatres. The building will use over 100 drives, of varying sizes, from ABB's AC drives range throughout the hospital for its air handling applications.

The air handling units have been divided into critical and non-critical applications. All the 20 operating theatres are classed as critical applications and each will have three to four ABB drives.

The Building Management System (BMS) monitors the system for any reduction in performance. The BMS then signals the drive to increase the airflow accordingly. The theatres are not in constant use, therefore the drives are often employed in a standby mode, maintaining a reduced airflow in order to save energy.

### Benefit

The operating theatres now operate a filtered airflow with a maintained air volume. As static pressure builds up over the air filters, the drives compensate for the reduction in flow rate maintaining the air volume.

Five of the operating theatres are dedicated to orthopaedics. Bone operations need a particularly clean environment, with more frequent changes of air. The drives need to maintain a flow rate of 1.65m<sup>3</sup>/s with the air filtered through special ultra-clean hoods containing extra filters. Other areas such as safety cabinets and fume cupboards also have air-handling units powered by ABB drives, maintaining a sterile environment.

# Lifecycle Support

## ABB Drives Alliance – your single point of contact

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ABB Drives Alliance is a network of independent drive specialists in strategic locations across the country. Your local ABB Drives Alliance partner can help assess your requirement and show your potential energy savings. If you decide to go ahead, your local ABB Drives Alliance partner can help supply the right drive, install and help you run the equipment, as well as upgrade existing drive installations.

ABB Drives Alliance can provide nationwide service and support for all your drive installations.

### The drive for the future

When you choose an ABB drive, you automatically become part of the most comprehensive product lifecycle management scheme in the industry.

ABB's lifecycle management model ensures that the required product support is always available and paves the way for a smooth transition to a new product at the end of the life cycle.

A drive product will remain current for about 10 years, known as the 'active' phase. After this, service support will remain available for a further 10 to 15 years, the 'classic' phase.



**Sales, Support and Service**

In the 'limited' phase, development of the product has ceased but services remain as long as parts are available.

The 'obsolete' phase starts when product support is no longer possible at reasonable cost.

Through contact with your ABB Drives Alliance member you will be kept up to date with the support plans for your drive. At the end of the product life, you will be recommended an appropriate replacement. The old drive will be removed and recycled in accordance with local regulations.



# Contact us

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