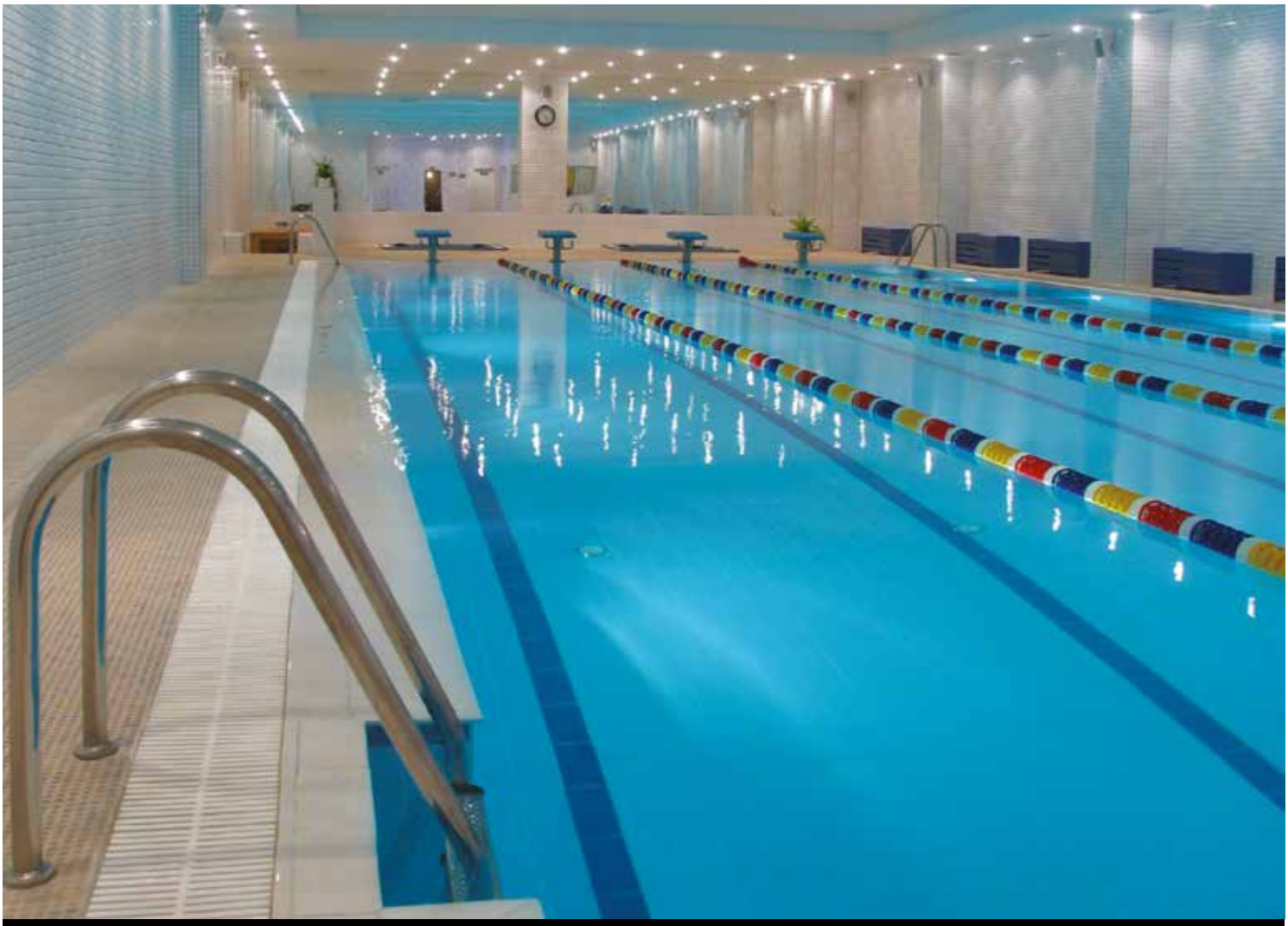


A guide to using variable-speed drives and motors in swimming pool halls

Power and productivity
for a better world™

Meeting the energy and CO_2 reduction challenge

Swimming pool halls are expensive to run, consuming large amounts of electricity. They are among the most energy intensive buildings, typically using five times more energy per square metre than offices.*

The high energy consumption is due to the large volume of water in the pool that continually needs to be circulated, heated, treated, filtered, topped up and replaced. A 25 m pool can hold as much as a million litres of water.

In a large hotel, the swimming pool can account for up to 10 percent of total energy costs.

Sports and leisure centres with swimming pools can have up to 65 percent of their energy consumption used for pool heating and ventilation.

Whilst in a typical sports centre, energy costs are second only to labour costs, accounting for as much as 30 percent of total running costs.

Additionally, the costs for space heating and ventilation are high in all these businesses.

Where the energy is used

Energy is used in the pool area in a number of ways. Each should be considered when looking at ways to reduce energy costs.

- Loss of pool water through evaporation
- High pool hall air temperatures
  - Typically 28 - 30°C to maintain the comfort of pool users and reduce the risk of condensation from humid air
- High extraction/ventilation levels
  - Usually 4 – 10 air changes an hour are needed to remove excess humidity from pool evaporation. All incoming fresh air has to be heated
- Continual pumping of pool water through filters
- Pool filter backwashing

Meet the challenge

Just by making a 10 percent improvement in the management of energy use, UK leisure facilities could save up to £70 million each year and reduce carbon emissions by hundreds of thousands of tonnes.

* Independent findings from the Carbon Trust into the intensive use of energy to maintain the running of a swimming pool.

Variable-speed drives

Swimming pool running costs can be significantly reduced by as much as 50 percent with variable-speed drives (VSDs) from ABB. These devices control the flow of swimming pool pumps and air conditioning 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 air is regulated by dampers, 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 – from 20 to 70 percent
- Fast payback – from six months
- Reduced CO_2 emissions
- Enhanced Capital Allowances avaliable

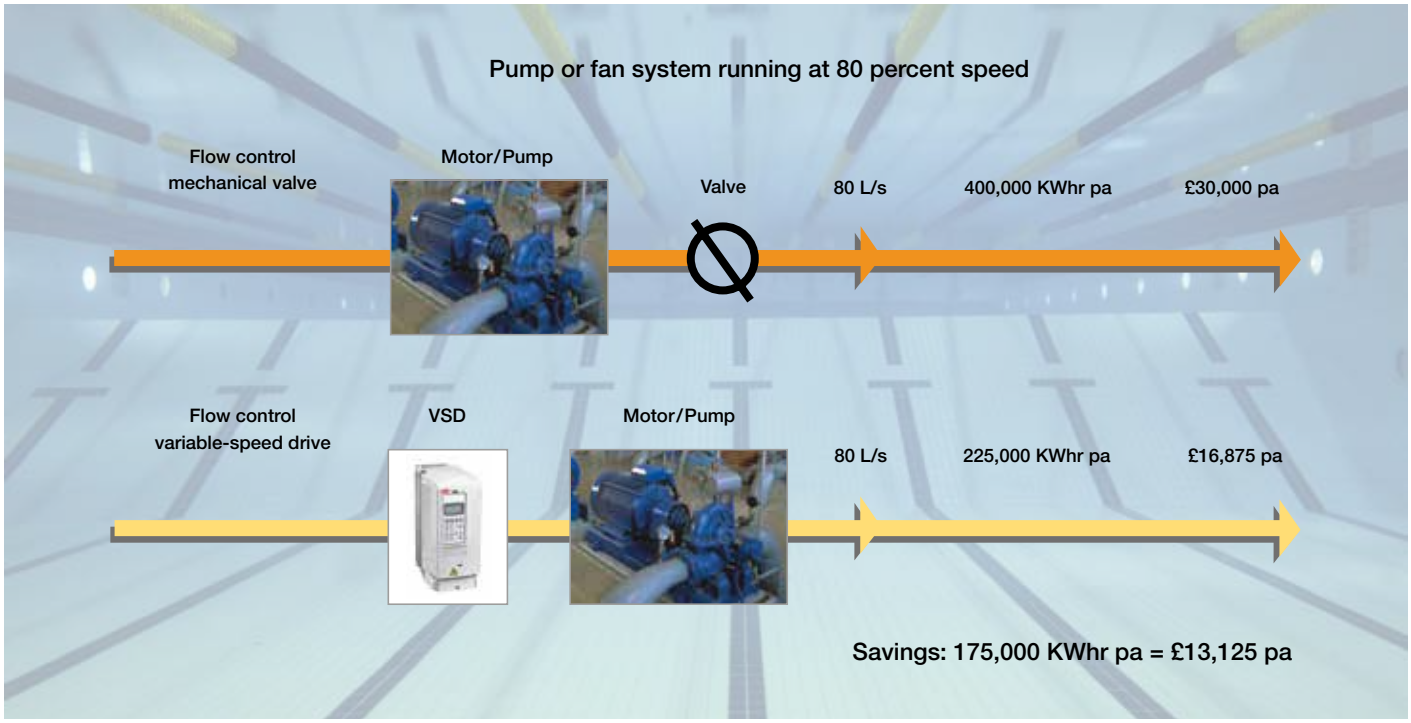
Technical

- 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 swimming pool applications
- Low harmonic solutions available as part of installation design

Swimming pool users

- Cleaner swimming pools
- Better climate controlled environment

Controlling flow with a variable-speed drive is far more efficient than the traditional method of throttling the flow with a control valve or damper.



Swimming hall applications for variable-speed drives

Eliminate waste from oversized pumps

Installers frequently oversize pumps and piping because it is difficult to predict exactly what the demand will be once the system is in operation. While it may be sensible to make provisions for potential future needs in the design, oversized pumps draw power unnecessarily to feed a demand that is not there, with the excess capacity normally throttled by a valve. With a VSD, pump speed can be reduced to match the actual demand.

A swimming pool pump running at 80 percent speed only needs 50 percent of the energy required at full speed.

Reduce pump speed when demand is low

The highest output from the pump is required during backwash of the filter. If the system uses the same pump for circulation as for backwash, the speed can be reduced by approximately 10 percent during normal daytime use.

At night, the speed can be further reduced, typically to 30 percent below backwash speed. By cycling the pump between these day and night settings, energy consumption can be cut by nearly half, compared to running the pump continuously at full speed. Note that these figures are guidelines only. The actual settings must be adjusted for each installation.

Adjust pump for seasonal variation

Further savings can be achieved in pools where the seasonal demand varies. For instance, holiday parks with a large number of visitors in the summer and smaller visitor numbers during the winter months can run the pump at reduced speed in the low season.

A boost button can be fitted to increase filtration rates temporarily to accommodate a sudden rise in demand. In pools that close for parts of the year, the pump can be run at minimum speed rather than shut down altogether, eliminating the need for manual agitation of the water.

Effective control of the filtration rate

A low filtration rate gives the most effective filtration. Large pools with substantial sand filters use the lowest filtration rates; smaller pools with smaller filters use slightly higher rates.

To achieve the most effective filtration rate, users normally use valves to control the flow through the filter. This is an unnecessary waste of energy, as the pump will still be running at full speed but working against a restriction. It is far more energy-efficient to control flow by adjusting the pump speed, using a VSD to reduce the power drawn by the pump motor.

Find the right turnover rate for your pool

Establishing the right turnover rate means making a compromise between different requirements. The turnover rate is the theoretical time it takes for the total pool volume to pass through the filtration system. However, up to seven complete turnover cycles may be needed before 99 percent of the water has actually passed through the filter.

A bubble pool may need its water turned over once every five minutes, while a diving pool may only need the water turned over once every five hours.

The maximum number of people in the pool that the filtration system can support without water quality deteriorating is the maximum design bather load. Pool attendants also need to keep in mind the maximum safe bather load, the number of people who can safely be allowed to use the facility given a certain surface area.

With an ABB drive, you can easily find a filtration rate that works for you, set it accurately and ensure it stays accurate over time.

Up to 70 percent energy saving in an air conditioning system

The air conditioning system is also a major energy consumer in the swimming pool hall. Similar to swimming pool pumps, the speed of air conditioning fan motors can also be reduced in oversized systems; cycled between different speed settings; and operated to demand.

By using VSD to accurately control fan output and running times, large amounts of energy can be saved.

Practical applications

Drives save £77,000 a year for holiday park operators

Bourne Leisure, which owns brands such as Haven, Butlins and Warner Leisure hotels, has swimming pools at a number of its properties. ABB drives have helped to save £77,000 a year on energy bills for its swimming pools.

ABB authorised value provider, APDS, conducted a trial on two of the three filtration pumps at the Devon Cliffs swimming pool. The pump was monitored for a period before a variable-speed drive (VSD) was installed. Monitoring with a temporary VSD fitted demonstrated that considerable energy savings could be made. The direct-on-line pumps were working at 50 Hz drawing an average of 30 A. When the drive was introduced, this figure was reduced to 23 A during the day and 15 A at night, with no effect on water quality.

APDS and ABB recommended fitting VSDs to the pumps feeding the pool filters. The pump filters operate by trapping dirt and debris in the sand filter and returning clean water back to the swimming pool. Pumping the water at a reduced flow rate improved the filtration process and removed more contaminants.

The trial predicted savings for each 18.5 kW pump was £4,899 per annum, giving a payback period of under six months. The actual savings exceeded those predicted in the energy report as the motor speed could be accurately mapped to pool utilisation.

ABB drives ranging from 3.3 to 30 kW were installed in 36 Bourne Leisure owned pools around the country. In total, the company is saving nearly £77,000 per annum on running its pools, with a total payback time of just over a year.

Lower energy consumption in shower areas

In swimming pool halls and gymnasia, changing rooms can also benefit from variable-speed drives. Moisture needs to be extracted from the air through ventilation systems which can be adjusted to meet variation in demands caused by the volume of people using showering facilities.

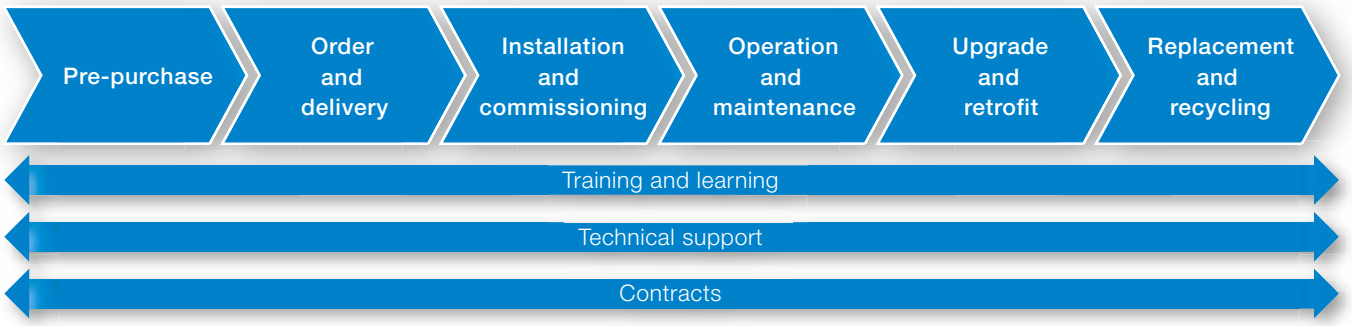
At Konala Comprehensive School, Finland, the gymnasium was considered a high energy consumer. The HVAC system was designed to cope with the maximum capacity of 400 people. Lack of control meant that the HVAC system was running at over 4,500 hours a year at full speed, even though most days saw only 30 people using the gym at one time. Furthermore, the ventilation within the changing rooms was operating continuously, whether or not there was excess moisture.

An energy appraisal found that the annual electricity consumption for the gym ventilation fans alone was 34,200 kWh, 20 percent of the total electricity consumption for the school. Also, 117 MWh of heating energy was released to the outside air through the ventilation system every year, equivalent to 26 percent of the entire school's heating energy consumption. These high energy consumption figures were due to using the fans at full or constant speed.

ABB drives were installed to control new high efficiency ABB motors which in turn drive the supply and return fans.

Following the installation, electricity consumption in its first 10 months fell by 14 percent, while the heating used fell by 16 percent.

Expertise at every stage of the value chain



The services offered for ABB's VSDs span the entire value chain, from the moment a customer makes the first enquiry through to disposal and recycling of the drive. Throughout the value chain, ABB provides training and learning, technical support and contracts. All of this is supported by one of the most extensive global VSD sales and service networks.

Pre-purchase

ABB provides a range of services that help guide the customers to the right products for their applications. Examples of services include correct drive selection and dimensioning, harmonic survey and EMC assessment.

Order and delivery

Orders can be placed through any ABB office or through ABB's authorised value providers. Orders can be placed and tracked online.

ABB's sales and services network offers timely deliveries including express delivery.

Installation and commissioning

While many customers have the resources to undertake installation and commissioning on their own, ABB and its authorised value providers are available to advise or undertake the entire VSD installation and start-up.

Operation and maintenance

With remote monitoring, ABB can guide the customer through a fast and efficient fault-finding procedure as well as analyse the operation of the VSD and the customer's process. From maintenance assessment to preventive maintenance and reconditioning of drives, ABB has all the options covered to keep HVAC installations operational.

Should corrective maintenance of drives be needed, ABB offers on-site and workshop repair, fully backed up by the most extensive spare holding.

Upgrade and retrofit

An existing ABB VSD can often be upgraded to the latest software or hardware to improve the performance of the application.

Existing installations can be economically modernised by retrofitting the latest drive technology to mechanical control equipment, such as inlet guide vanes or dampers or older generations of VSDs.

Instead of replacing an entire VSD or system, it is often more economical to modernise the old installation by reusing all relevant parts of the original equipment and purchasing new where necessary.

Replacement and recycling

ABB can advise on the best replacement VSD while ensuring that the existing one is disposed in a way that meets all local environmental regulations.

Entire value chain services

The main services available throughout the value chain include:

– ABB's Bristol Training Centre offers product and application training in the classroom. ABB also offers training courses at customer sites and on the Internet.

– Technical support – At each stage of the value chain, an ABB expert is available to offer advice to keep the customer's process or plant operational.

– Contracts – DriveCare contracts and other types of agreements, from individual services through to complete drive care covering all repairs and even drive replacements, are available.

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