

Cavitation can occur in open systems when the inlet pressure drops below NPSH for the specific pump



Reducing cavitation risks with variable speed drives

Cavitation can be a serious issue for the water handling industry. It causes damage to pumping systems, reducing their lifetime and requiring costly maintenance and replacement. James Chalmers, ABB vice president, global water & wastewater sales for drives, explains what causes cavitation and how it can be prevented by the latest variable speed drive (VSD) technology

Many fluid handling applications can be affected by cavitation, but it is a particular challenge for the water and wastewater industry where a high number of pumps are deployed.

The result of cavitation is an increased risk of downtime and higher maintenance costs. The issue goes beyond the need to replace a damaged pump. In remote areas, in particular, the cost of sending a maintenance team with heavy lifting equipment to the site might be many times the cost of the pump itself.

Cavitation can happen when the pumping process subjects a liquid to rapid local changes in pressure, creating vapour-filled bubbles. The exact point at which this liquid-to-vapour transition occurs depends on the pressure. At normal atmospheric pressure, water transitions into steam at 100°C. When the system pressure is reduced, this occurs at lower temperatures. Eventually, when the pressure is reduced to a vacuum, the transition happens at room temperature.

Low pressure

When the impeller is spinning in an industrial centrifugal pump, high pressure is created on the front side of the blades. Simultaneously, there is low pressure on the back of the blades. In some conditions the water will vaporise, creating bubbles (see Figure 1). When these vapour bubbles reach areas of high pressure, they implode, collapsing back into liquid form and producing significant shockwaves.

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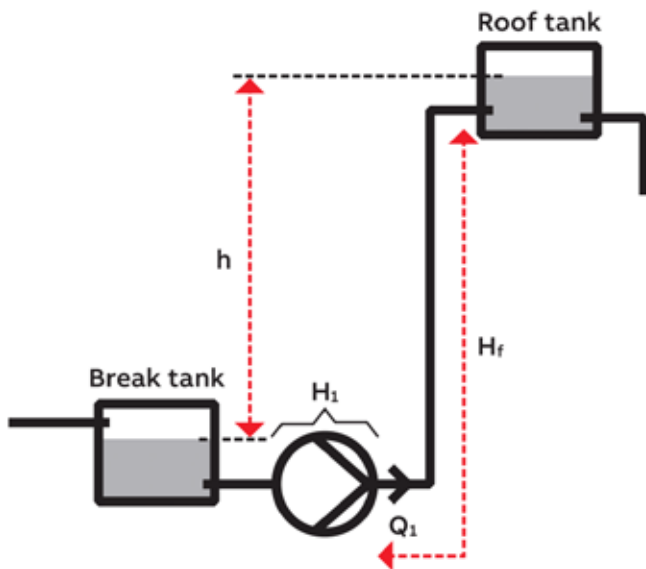
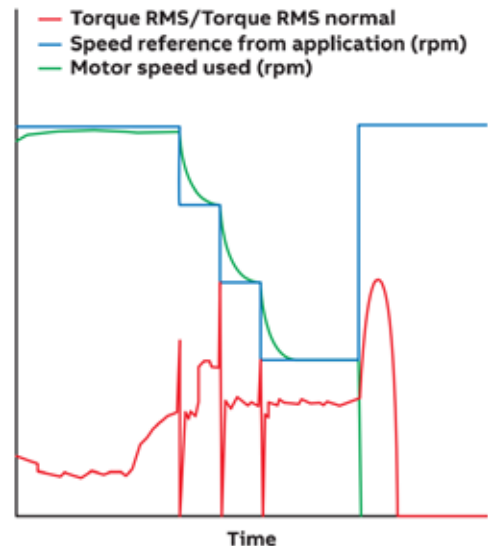


Diagram shows how cavitation can result in a loss of motor speed



The anti-cavitation algorithm checks how the pump motor torque changes over time

The rapid implosions generate a characteristic rumbling or cracking noise associated with cavitation, which sounds like rocks passing through the pump.

Each implosion causes only a tiny shockwave. However, because they occur in large numbers, the cumulative effect impacts pump performance.

Eventually, cavitation damages the pump impeller, housing and other components in the pumping system through wear and metal fatigue.

It is common for cavitation to shorten the life of a pump by as much as half.

In the very worst cases, pumps have been destroyed in a matter of minutes.

The VSD algorithm detects the onset of cavitation by comparing the torque measured on the pump shaft against the nominal torque. If cavitation starts, then the torque curve starts to rise. The software responds by adjusting the speed reference (shown in blue) to a lower level. This results in a reduction in the actual motor speed, as shown in green. The algorithm can be adjusted to suit different operating conditions. In many cases, the VSD will be set up to stop the motor

running if cavitation continues for longer than a set time after the motor speed has been stepped down. In other applications it might be desirable to stop the motor as soon as cavitation is detected.

Drive away the risk of pump cavitation

Pump cavitation is a significant risk for the water industry. If it is not tackled, it can cause significant damage and disruption to pumping operations as well as impacting product quality.

The new generation of intelligent VSDs now make it possible to solve cavitation locally, within the drive, in real time. As the anti-cavitation software is built into the drive, no extra components such as sensors needed. The only additional installation effort required is to set the operating parameters. ■



Pump impeller damaged by cavitation

For further information:
 Visit: new.abb.com/drives/low-voltage-ac/industry-specific-drives/acq580

“When it detects cavitation the VSD adjusts the pump speed automatically”