4 Steps to Reduce Your HVAC Energy Cost

with a Quick Payback

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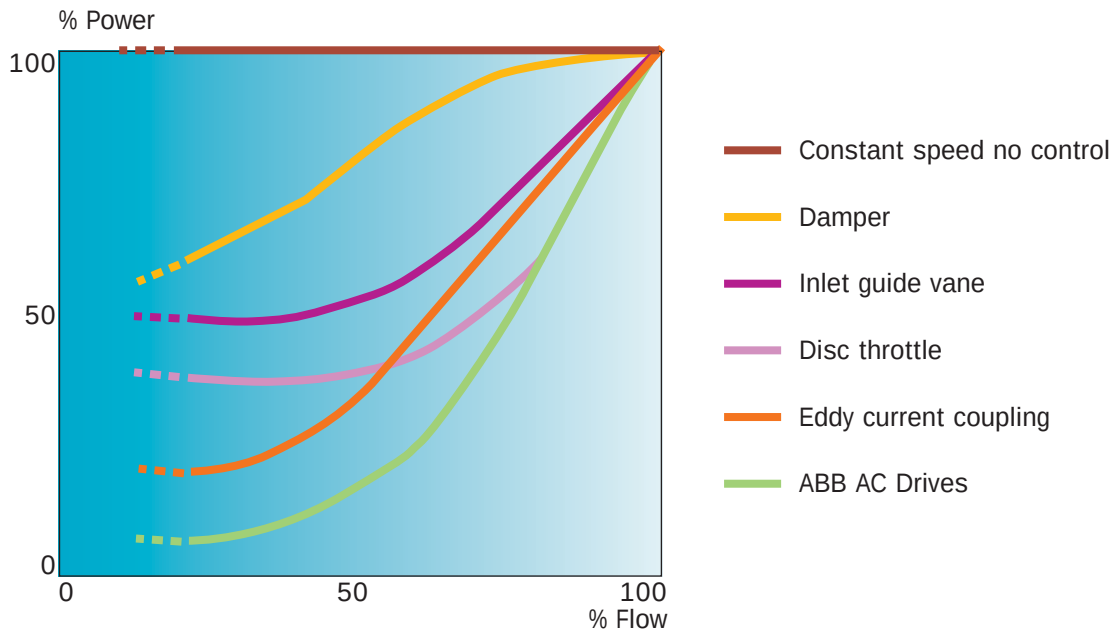
HVAC Variable Frequency Drive Solutions running on bypass can waste 56% or more energy for your HVAC air handling system

Despite the economic advantages and significant energy savings available by using AC Variable Frequency Drives in HVAC applications, many building operators do not repair or replace drives when they fail since the motors can easily continue to run through a bypass contactor. While this is a great solution for short term outages, continued operation in this mode quickly becomes a very expensive way to operate a fan.

>>THE CHALLENGE

Budget cuts and competitive pressures have reduced building maintenance staffs in many public and private enterprises. This frequently results in a re-prioritization of activities, forcing



concentration on addressing issues which are required to be fixed at the moment. Repair items such as a HVAC drive system operating in bypass mode may be considered only a nuisance, to be dealt with as time permits. And of course, time seldom does so permit.

HISTORICAL PERSPECTIVE

Consider the rational for installing HVAC Variable Frequency Drives over the past 10-15 years to control the air flow in buildings. These drives were originally installed to replace the throttling systems designed to regulate flow of air in the system. While throttling reduced the flow, the motor still ran at nearly full load speed and in some cases worked even harder to overcome the added system restriction. By reducing the speed of the motor, the variable speed drive ensures no more energy than necessary is used to achieve the required flow.

For example, **in theory** a fan running at half speed consumes only one-eighth of the energy compared to one running at full speed. Field experience has shown that when the effect of static back pressure is factored in, the relationship is somewhere between 1/4th and 1/8th of the energy consumed at full speed depending on the applications mechanical application.

BYPASS FAILURES

Recent studies indicate that 8-12% of HVAC Drive Systems are running in a bypass mode due to a drive fault. The intent of a bypass contactor is for use in case of a drive failure for **short time emergency service**. It was never intended to be a long term solution to a drive malfunction. While the misapplication of long term use is understandable due to increased pressures on typically under-manned building maintenance organizations, there are proven approaches to solving this pressing problem.

Why worry about this now? Energy costs continue to soar. Between 1999 and 2004 electricity costs increased by nearly 15% (source Department of Energy). When VFD's were purchased for the application, the additional costs were justified based on saving money and improving profitability by using less energy for HVAC air handling in the building. As an example of how long term use of bypass contactors effects energy costs, if 10% of the drives are in bypass mode up to 56% more energy can be consumed by the HVAC air handling system. This is based on the assumption of all motors being the same size, and all HVAC systems are operating on average at 50% flow.

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NEXT STEPS

The path forward presents two clear choices. **First**, do nothing and continue to lose increasing amounts of money every day as additional VFD systems periodically fail and go into bypass operation. **Second**, develop a program which will change the way drives are proactively maintained.

A typical Preventative Maintenance Program is centered around the following activities:

1. Review your situation. Utilize either an outside or internal resource person to inventory the drives in the building or complex to gather the following information:

- The number of installed drives and the make and model of each unit.
- Age of the drives and how long they actually have been in service.
- The HP of each drive.
- The duty cycle of each drive. Note that load-level vs. length-of-time data may be difficult to determine so this will often be an estimate.
- The number of drives operating in the bypass mode.
- Existing replacement drive inventory and on-hand spare parts to support downtime.

2. Replace or repair all of the drives operating in the bypass mode to begin realizing the original energy savings. It is important to work with a supplier that demonstrates the capability to easily replace or repair drives. Select one that will assist in the maintenance and support on an ongoing basis

3. Create or contract a Preventative Maintenance Program which focuses on the specific issues of drives and how to keep them up and running. These activities typically include, but are not limited to:

With the VFD deenergized

- Inspection of the environmental conditions on each drive.
- Inspection of power components and circuit boards for deterioration.
- Inspection for loose connections.
- Cleaning interior components of the drives.

With the VFD reenergized

- Simulation or variation of signals from the control system to verify that the VSD is responding properly.
- Calibration of the drive to original factory settings.
- Review of the drive application for possible upgrades and operational enhancements.

4. Replace older and highly critical drives before they fail. When a drive is over 10

years old and/or in a demanding and highly critical application consideration should be given to replacing it before failure. Even with the cost of a new drive and installation, the benefits will include lower operating costs and improved client comfort. Simple-payback, ten-year-life-cycle-costing or other financial analysis techniques may be performed to formally evaluate the economics for drive change out.

CONCLUSION

VFD systems installed in the facility have a proven track record of energy costs and improving client comfort. The ability to keep drives running as designed will assure continued savings and comfortable clients.

A number of significant improvements have been made to present-day VFD systems compared to what was available ten years ago. Drives size and parts count have been reduced along with cost while increasing performance, quality and warranty periods. Commonly available features include embedded PI control functions which eliminate the need for closed loop output signals from the BAS. The PI controller typically includes feedback inverse, square root and differential control functions on board which lower your costs of HVAC control systems installation and wiring.

VFD units now typically combine sophisticated IGBT power switching with advanced microprocessor logic to reduce audible motor noise and meet accepted power quality standards. A number of communication options are available which can be tailored to a wide variety of BAS data and control formats. On board metering of electrical kW and kWh information provides data useful in efficiency and billing calculations.

If you are interested in the four steps above, but need some guidance on where to start, a complementary facilities audit from ABB Drives will help you map out the process and define where you can lower your energy costs. To have an audit conducted by one of their drive experts, please call Jeff Miller at (262) 780-3865. This audit service is available in most major US metropolitan areas.

FOR FURTHER INFORMATION

For additional resource information regarding operating costs and VFD technical data, contact **Wayne Stebbins** at **Perigon Engineering**:

wayne.stebbins@perigoneng.com
931 Industrial Drive
Matthews, NC 28105
704-246-2145