

10 tips to optimize the use of variable speed drives

Variable speed drives are becoming increasingly popular in building automation. And with good reason: Compared to conventional motor starting methods, they help reduce energy consumption by up to 60 percent. This requires a drive that is not only fit for the application, but also fit for the intended environment. The following overview illustrates the factors that need to be kept in mind.

Heating, ventilation and air conditioning (HVAC) systems are designed for maximum loads. 85 percent of the time, however, the actual demand is less than the rated output. Yet some ventilation fans and pumps run at full load – unnecessarily. The good news is this does not have to be the case when variable speed drives are used. They allow the speed of electric motors to be precisely controlled. This ensures that the output of these pumps and fans within a system always meet the current demand.

Application-specific planning

Designed specifically for HVAC applications, the G120P variable speed drive from Siemens very efficiently controls air flows and fluid media in building automation systems. It supports active and intelligent control for optimized operation. In addition to reducing operating costs, the variable speed drive can also detect a wide range of events. For example, if the pump is blocked or runs dry, the device can protect the system either by triggering an alarm or by stopping the motor with a suitable fault message. If the pump is not needed, the intelligent hibernation mode can prevent unnecessary wear – and thereby save even more energy.

Implementing an intelligently controlled system of this type does require careful planning. The pump must be configured correctly, and the variable speed drive must be specified based on the individual application to achieve optimum results. The success factors that need to be kept in mind can be summarized in ten points.

1. EMC regulations

EMC regulations impose stricter requirements on residential and commercial buildings than on industrial environments. Therefore, HVAC variable speed drives must not exceed the limits for EMC category C2 (EN 61800-3) and so must utilize a class-A EMC filter. For particularly sensitive areas such as hospitals, the use of equipment that meets EMC category C1 (i.e. filter class B) is recommended. In Europe, the generated harmonic distortions are regulated in the EN 61000-3-12 standard. These limits must not be exceeded. If the variable speed drive does not meet this standard, the use of additional mains harmonic filters must be planned. To comply with EMC requirements, shielded motor cables should always be used. If locally installed IP54/55 devices are used, a separate equipotential earth bonding cable of at least 16 mm² should be planned for and installed if required. If long motor cables are needed, keep in mind that cable lengths of 50 meters or more will not meet EMC standards. Sinusoidal output filters must be used in this case to extend the maximum length up to 200m - with the additional benefit of ensuring a good motor lifetime. The manufacturer should be able to recommend tested combinations of variable speed drives and filters.

2. Easy installation

To protect the area around a variable speed drive against electromagnetic influences during operation, proper installation of the drive is crucial. This includes all cabling installed according to EMC requirements in order to avoid interference in sensitive circuits such as the field bus communication. The most important factor in this context is the proper connection of the motor cable shield at both ends. The construction site logistics should be clarified prior to installation so that the necessary accessories are in place on time, such as the right EMC rated cable gland connections, cable lugs, etc.

3. Installation outside a control panel

In buildings, variable speed drives are frequently installed outside a control panel, for example directly on an air handling unit. This reduces the cost of motor cables, installation and panel space. Suitable variable speed drives are designed as IP54-rated variants and tolerate operating temperatures up to 60°C. This allows IP54 devices to be used even in plant rooms with heating boilers. Coated p.c. boards help prolong the life cycle in very dusty environments. If the drives are mounted on rail

systems, it is necessary to install an air-guide sheet to ensure the required cooling air flow.

4. Easy commissioning

A graphical operator panel with an integral commissioning wizard significantly simplifies the basic setup of the variable speed drive. A modular system that allows the operator panels to be swapped as needed is a particularly elegant and cost-efficient option. A convenient graphical display is used for commissioning; after that, it is possible to switch to a more economical Basic Operator Panel for continuous operation.

A variable speed drive with a parameter cloning function is suitable for series commissioning where the same configuration is used. This allows a configuration to be easily transferred from one device to another in a matter of seconds. The transfer can be done using memory cards or the internal memory of either operator panel. When using IP54 or IP55 devices, it should be possible to swap the operator unit or to access the memory card without any additional tools.

5. Integrated HVAC functionality

A variable speed drive should include all functions needed for the application at hand. However, many variable speed drives are designed primarily for industrial machines and have limited suitability for building applications. Conversely, this means that solutions tailored specifically to HVAC systems have significant benefits. When integrating a variable speed drive into a higher-level building management system, the advantages of decentralized control in the device must be evaluated. This enables the control speed and dynamics to be significantly increased in some situations. For example, multiple integrated PID controllers not only maintain pressure and temperature at the desired level but also control external devices. Multi-zone controllers and real-time functions help enable the variable speed drive to control entire sections of a building autonomously even when operated individually. A built-in PLC functionality ensures that even more complex applications can be implemented effortlessly. In addition, an integrated fire mode increases safety within the building by keeping escape routes free of smoke in an emergency. At the same time, the variable speed drive employs a carefully thought out fault strategy in order to maintain operation as long as possible.

6. Integration into the building management system

It should be possible to integrate the variable speed drive seamlessly into the building management system via the field bus interface. The most common protocols used are Modbus RTU in Europe as well as P1 and BACnet MS/TP in the Americas and Asia. When submitting bids, make sure that the variable speed drive supports the management system's native field bus. Integrating the drive via routers, gateways or converters usually increases hardware costs and reduces performance.

7. Wide range of interfaces

An HVAC variable speed drive ideally has many different connections for control signals, sensors and status messages. In addition to analog and digital inputs and outputs, interfaces for temperature sensors and PTC motor sensors are also important. If these interfaces are present, passive sensors can be planned without using additional hardware. This further reduces the total cost of installation. All inputs and outputs should have a potential-free design.

8. Supporting tools

Supporting tools facilitate planning, commissioning and service. For example, calculating the supply harmonics during planning ensures that unacceptable levels of EMC interference do not occur anywhere in the overall system. During commissioning, convenient operating software makes it possible to create complex applications using the graphical interface. An oscilloscope function simplifies maintenance and fine-tuning. This makes it possible to investigate the cause of faults without additional measuring instruments and to further optimize control loops manually.

9. Easy maintenance

Components such as cooling fans that need to be replaced preventively should be replaceable without tools and without opening the housing. If a component fails, it is important to minimize the downtime and carry out the replacement as effortlessly as possible. A device with modular design is a good solution in this situation. In such a device, the power electronics, for example, can be replaced separately. Devices where the connections for the motor and power lines are designed as plug-in connectors do not require rewiring work when they are replaced. With modular devices, it is usually not necessary to redo the installation of the control cables or

repeat the parameterization. The variable speed drive is back in operation just minutes after maintenance.

A separate backup of all system parameter settings helps minimize downtimes. This is particularly easy to do when the variable speed drive has the ability to save the parameter set to a memory card. As a result, the parameter data can be effortlessly copied to a backup server.

10. Global service and support

The local presence of repair centers is also crucial in minimizing down times. A global support organization guarantees international assistance in the event of malfunctions. Warranty services of leading manufacturers provide cost security both during and beyond the legal warranty period.

Conclusion

Pumps and fans in HVAC systems can be controlled efficiently using variable speed drives. To reduce energy consumption by up to 60 percent, however, the variable speed drive requires application-based specification. Special building automation functionalities and EMC-compliant installation are particularly important.

[Sidebar]

Checklist for specifying variable speed drives

- Compliance with the applicable standards in the building
- EMC-compliant installation, including provision of installation materials
- The right IP rating according to the installation site
- Easy commissioning and parameter transfer
- HVAC functionality for local control
- Seamless integration into the building management system via a native system field bus
- Support for the interfaces required for sensors
- Tools for planning, commissioning and service
- Easy maintenance
- Global availability of training, service, warranty and support

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G120P_Anlage1.jpg

Variable speed drive G120P with graphical operator panel for easy commissioning.



G120P_Anlage2.jpg

Variable speed drives G120P with basic operator panel for economical operation.

For further information on variable speed drives, please see www.siemens.com/G120P or have a look on YouTube at <http://www.youtube.com/playlist?list=PLD7742B1CA8EEFD3D>
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