

HVAC drives with disconnect

Drives with integral disconnect or circuit breaker

Variable frequency drives come in a variety of packages. The drive may be loose (drive-only), packaged with a main input disconnect, packaged with a bypass, or part of a much larger panel that includes other air handler or pump skid logic. This technical note focuses on a drive packaged with some form of disconnect.

Why include a main input disconnect?

A disconnect at the drive provides several advantages. Those advantages differ based on an individual's role on a project. Below are examples of feedback heard from various stakeholders.

- Consulting Engineers say “There is one less coordination item when I have the drive supplier include a disconnect with the drive. I can rely on the drive supplier to properly size the disconnect and fuses. The final installed cost is typically lower than a separate disconnect wired near the drive, thus this helps the project come in within budget.”
- Electrical contractors say “Installation is easier. Some of these installations are quite limited on physical space and I don't need to squeeze a separate fused disconnect next to the drive.”
- Maintenance/technicians say “Having the disconnect at the drive allows for quick and obvious lock-out tag-out (LOTO) of the drive. The handle mechanism used by ABB is easy to add a lock to it. The disconnect ABB uses feels robust and has good detent to it, which gives me confidence, unlike some other disconnects seen with VFDs.”
- Building owners say “The slim ABB ACH580-PDR drive with disconnect package allows for a simple and clean look that uses minimal space in my building.”

Selection of the disconnect

There are (3) types of disconnecting means used with drives. Circuit breakers, a standard disconnect, or a fused disconnect. Selection of the disconnecting means should consider the desired SCCR rating of the package, whether there are fuses already included, and whether there is a bypass.

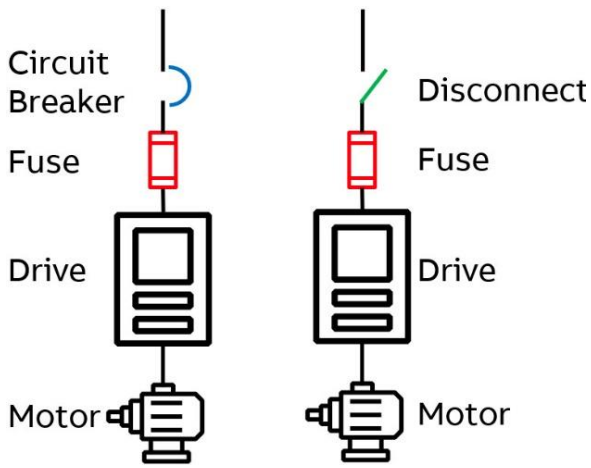


Figure 1: One-line of drives with disconnecting means

All ABB ACH580 packages include fuses in front of the drive. Figure 1 shows a simplified schematic of two different drives with a disconnecting means. The difference between the two packages is the disconnect type used. One package uses a circuit breaker (blue) and the other uses a simple disconnect (green). Both drive packages include fuses (red). The fuses provide protection to the drive. While the circuit breaker adds minimal value, the circuit breaker style of disconnect adds minimal value. Thus, for HVACR applications without a bypass, the ACH580-PDR (standard disconnect) is typically chosen over the ACH580-PCR (circuit breaker version), as a standard disconnect is more economical than a circuit breaker. Both packages include a 100 kA SCCR at 208/240/480 VAC.

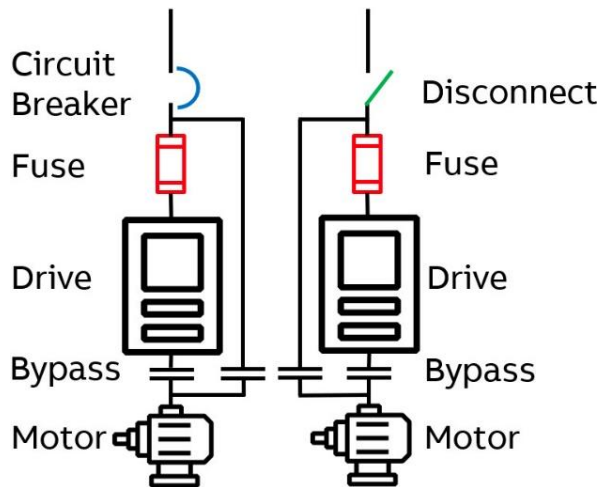


Figure 2: One-line of drives with bypass and disconnect

Adding a bypass to a drive package does impact the selection of the disconnect type. As shown in Figure 2, the drive path has fuses, but there are no fuses in the bypass path. In the case of the circuit breaker disconnect, that breaker is providing the short circuit protection for bypass mode operation. In the case of a simple disconnect, the drive/bypass package does not include short circuit protection for bypass mode, thus additional protection is needed to be supplied and installed upstream by the installing contractor. Thus, for ease of coordination, the circuit breaker style of disconnect is typically used in bypass packages. For ABB ACH580 bypass packages, the ACH580-VCR / ACH580-BCR (circuit breaker version) is typically chosen over the ACH580-VDR / ACH580-BDR (standard disconnect). Only the ACH580-VCR and ACH580-BCR packages include a 100 kA SCCR at 208/240/480 VAC without the need for further upstream coordination.

Occasionally fused disconnects are packaged with drives. Whether there is a fused disconnect, or disconnect with a separate fuse block, as long as equivalent fuses are used in both situations then there is no difference to the VFD protection. In both cases fuses provide protection to the drive and upstream circuit. However, one should note that the primary intent of fuses is not to prevent the VFD from failing in the first place, instead the fuses make sure the drive fails in a safe manner. Fuses are intended to protect the drive from failing in a catastrophic way. If fuses are not provided by the drive manufacturer, care should be taken to make sure the drive is installed per the manufacturer's instructions, including proper selection of the fuses.

What does an installation of ABB packaged drives look like?

The ACH580-PDR is a drive with integral disconnect, fuse block and fuses. Using 480 VAC as an example, packages up through 60 HP have a design with the VFD on top, and the disconnect and fuses located in the bottom portion.

Figures 3 through 5 show ACH580 drives installed at health care facilities. Figure 3 shows a standard installation in the United States, with dedicated metal conduits for input power wire, output power wire, and controls. Having dedicated and continuous metal conduit runs greatly reduces the chances for electrical noise issues – which is an important topic for health care facilities. VFD cable or shielded/armored cable are also excellent solutions. Figure 5 shows the drive mounted directly on an indoor air handling unit.



Figure 3: ACH580 with conduit



Figure 4: ACH580-PDR drives



Figure 5: AHU mounted drive

Summary

A drive with an integrated disconnect and fuses provide an all-in-one compact design, LOTO, and protects the drive. In most cases a circuit breaker style disconnect is not necessary, as the fuses operate faster than the circuit breaker. However, when a bypass is included in the drive package, then the circuit breaker is important as it provides short circuit protection for the bypass mode.