There are many factors that can have adverse effects on any or all of the components in a given system, resulting in poor performance or complete failure. Out of all these components, the compressor experiences the most stress.
Because of the dramatic reduction in startup current, it also becomes much easier and sometimes less expensive to match the air-conditioner or heat pump with “off grid” power sources, such as generators, solar panels and windmills.

In response to this problem, a number of products were developed to improve overall performance of the compressor by providing startup assistance and monitoring protection. Recent technological advancements have produced software-controlled soft-start devices that not only improve starting characteristics, but also provide protection against undesirable voltage conditions at startup.

How they work
The software-controlled soft-start device monitors supply voltage to determine if conditions are favorable to attempt a startup. If conditions are met, the startup process begins and this is where the true benefit of a soft-start device is observed. The software slightly lengthens the startup time, allowing the soft-start device to “flatten out” the initial spike of inrush current and torque that a compressor normally experiences at startup. In both laboratory and field analysis, the software-controlled soft-start device routinely produces reductions in startup current and torque by as much as 70%. After the installation of the soft-start device, it will take several compressor starts before maximum performance is achieved, as the software component of the soft-start device continuously evaluates startup conditions each time and makes adjustments to improve subsequent starts.

A soft-start device provides other benefits in addition to reducing inrush current and torque. It can reduce or completely eliminate the noise and light flicker associated with the startup of the compressor. Other sensitive electronic equipment in the home can also benefit from the minimizing of supply-voltage drop experienced during compressor startup. Because of the dramatic reduction in startup current, it also becomes much easier and sometimes less expensive to match the air-conditioner or heat pump with “off grid” power sources, such as generators, solar panels and windmills.

While property owners benefit in many ways from the installation of a compressor soft-start device, electric utility providers can also be impacted in positive ways. By lowering the peak demand of the building during compressor startup, it provides a stabilizing effect to the available supply voltage during peak periods of the year. Another challenge faced by electric utilities, especially during the summer months, occurs during an extended power outage caused by storms, accidents, equipment failure, etc. During
Soft-start devices are available in various voltage and horsepower ratings and are compatible with most single-phase and three-phase ac drive, PSC-style electric motors that are under no load at the time of startup. Internally equalized scroll compressors and reciprocating, rotary and screw compressors, which have a metering device with an internal bleed to equalize pressure, are also compatible. The device at the top is for a single-phase drive and the device on the bottom is for a three-phase.

The time required to make necessary corrections to restore power supply, buildings in the service area will likely produce a demand for space conditioning creating a scenario where all air-conditioners, heat pumps and other compressor-bearing equipment will attempt to come back online at the same time. For several years utility providers have promoted the use of programmable thermostats that enable customers to set up a setback schedule for their heating and cooling systems to reduce the overall energy demands during peak times of the day. If everyone set the same schedules for comfort systems, the utility could begin to experience the same type of effect seen by the restoration of power after an outage. The impact of these events can be eased as the volume of soft-start installations on compatible equipment increases.

Compatibility/installation
Soft-start devices are available in various voltage and horsepower ratings and are compatible with most single-phase and three-phase ac drive, PSC-style electric motors that are under no load at the time of startup. Internally equalized scroll compressors and reciprocating, rotary and screw compressors, which have a metering device with an internal bleed to equalize pressure, are also compatible.

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Systems that are generally not compatible and could be potentially harmed by the addition of a soft-start device are variable-speed compressors, electronically commutated motors, VFD-style motors, motors under a load prior to startup and also specialty compressors, such as the R-22 Copeland CT 2-Speed and the R-410A Bristol TS.
The biggest challenge is creating the “real estate” in the control box necessary to mount the device in the correct orientation.

Installation of a soft-start device in the field, which must be performed by a qualified technician, is a relatively simple and quick process, generally taking an hour or less. The biggest challenge is creating the “real estate” in the control box necessary to mount the device in the correct orientation. As awareness of the benefits provided by soft-start devices increase, OEMs have begun offering these devices as factory-installed options with their compatible equipment.

Conclusion
Technicians may be curious about the difference in functionality between a soft-start device and a hard start kit. Here’s a rough analogy: a hard start kit is similar to an emergency room defibrillator used to deliver a high current shock to get a heart beating again because it was unable to start on its own. A soft-start device is similar to a pacemaker that continuously monitors the heart and makes small adjustments to maintain a healthy heart rhythm.

Other fields showing promise for soft-start devices are marine and agricultural applications. Research continues to explore additional opportunities for these products. Whether it is to ease the startup stress on a motor, stop the annoying flicker of lights, reduce demand on secondary power sources, or provide a little relief to an overworked utility during peak periods, there may be a soft-start device ideal for the next application.

A short video demonstrating the performance of one such device can be viewed at www.youtube.com/watch?v=ApscKchMybM

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