CONTRACTORS MARKET HARD START KITS FOR CUSTOMER SERVICE & PROFITS

This cover photo shows a 4-ton scroll compressor before and after a hard start kit was added. Inrush current was measured using the True RMS Inrush Current feature of a Fieldpiece SC660 meter. *Meters were provided courtesy of Fieldpiece Instruments Inc.*

Learn about a few real-world examples of contractors making the most of hard start kits, how they work in systems and how they assist compressor startups.

BY JAMES BOWMAN

Images courtesy of RectorSeal Corp.

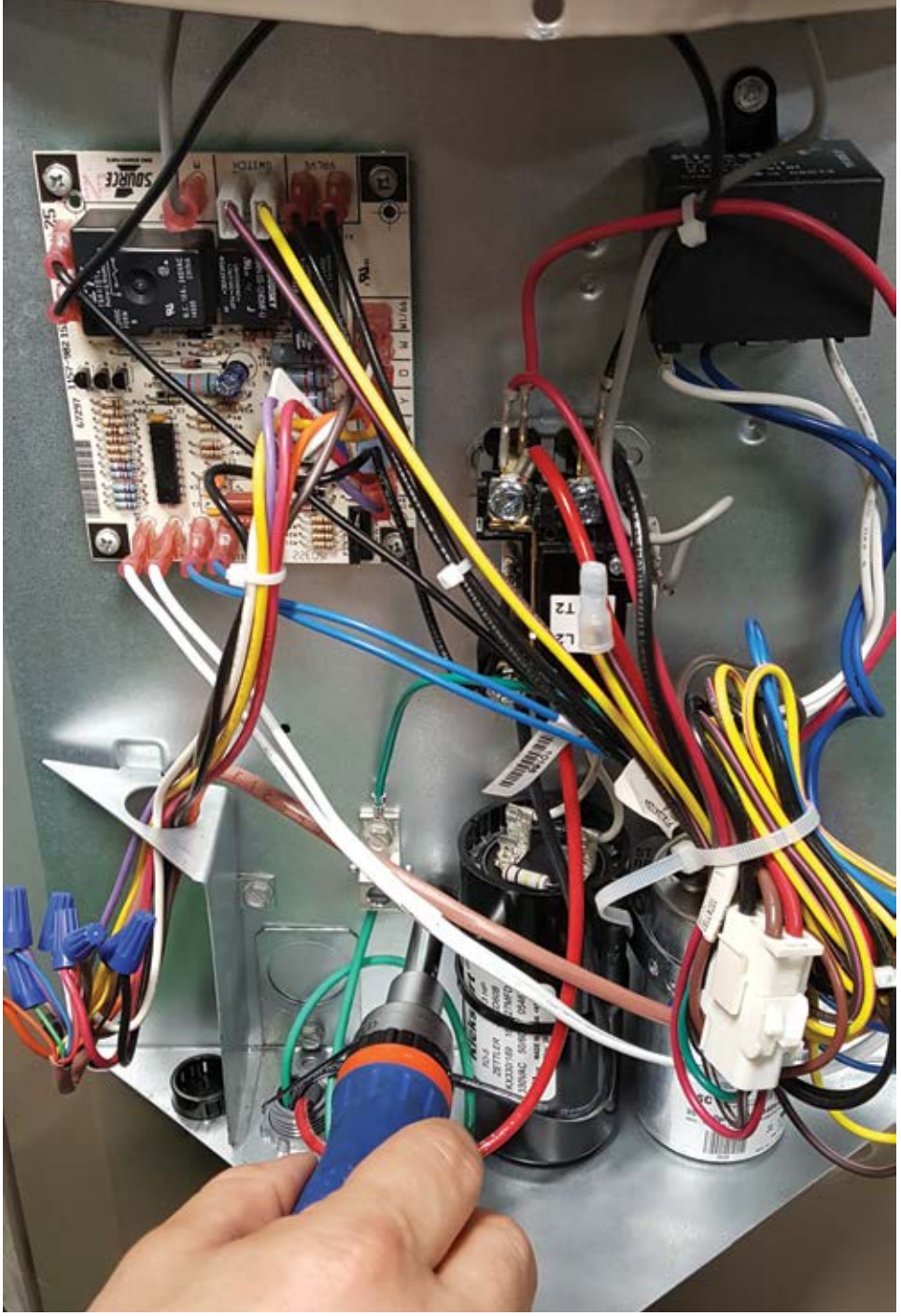
Hard start kits help extend the life of compressors in residential HVAC air-conditioning and heat pumps, but do they really work? Can they prevent compressor motor burnouts and lessen wear-and-tear? Do they help hard starting compressors start up? Can they save a homeowner energy costs? Do they make enough of an energy difference to offer a payback?

These are questions from old school contractors adhering to the "don't fix it if it ain't broke" adage. Many have not yet endorsed hard start kits and are skeptical of their value for air-conditioning systems that appear to be running well. The new school of thought fully endorses hard start kits and many of its contractors are proactively marketing them as add-on sales, profit makers and, most importantly, equipment protection devices for their customers' air-conditioning investments.

James Bagby, Residential Air-conditioning Division Manager at Fox Service Co., an Austin, TX-based HVAC contractor that also has electrical and plumbing divisions, says all contractors should be actively promoting and installing hard start kits as a service to their customers. Fox sells more than 250 two-wire hard start kits per year. The 44-year-old contractor offers incentives to its 25 residential service technicians for promoting hard start kits during preventative maintenance programs and general service calls. Hard start kits are also offered as options to customers buying new or retrofitted HVAC systems.

Fox uses manufacturer-produced hard start kit brochures to help service technicians sell. Besides brochure distribution, each service tech is also trained on presenting benefits, such as reducing heat on compressor motor windings, limiting wear-and-tear and energy savings. Fox also gets cold calls into the office concerning light flickering during air-conditioning startup. Those inquiries typically turn into sales as well.

All sales are not slam dunks though, as some new customers have been told by their former service contractors that



‹‹ Securing the start capacitor in the electrical control compartment is simple with the strap included with the two wire kit.

hard start kits do not work. That is when the hard start kit manufacturers' brochures and websites are invaluable in converting skeptical customers.

"I've installed and sold hard start kits for 17 years beginning when I was an apprentice, and I believe in them to this very day," Bagby said.

State Automatic Heating & Cooling, Batavia, IL, a small mechanical contractor with about 80% of its business in residential work, also aggressively markets hard start kits.

"We sell a few dozen per year, but it doesn't just fall into our laps; we work at it," said Jim Gates, President, who typically charges between $150 and $200 to cover the hard start kit materials/installation labor costs.

Gates' five service techs all have flyers the company has prepared based on several hard start kit manufacturers' literature. Each truck stocks several two-wire hard start kits. Once they open the condenser for annual service or a requested service call, the service tech is required to hand the homeowner the literature. After completing the service, the tech asks the homeowner if they have any questions about hard start kits and if they would like one installed.

On service calls with a failed capacitor, State Automatic gets more aggressive. An office staff salesperson calls the homeowner to explain that a hard start kit will potentially help prevent a future capacitor burnout and offset the expense of another service call.

Occasional calls into the office about light flickering or compressor start-up noise also puts an office sales person into gear to sell a hard start kit. "Many customers may never fully understand the electrical science behind hard start kits, but they 'get it' when you tell them their lights won't flicker anymore, which gives them a visual explanation of the advantages," said Gates.

Another contractor, Fritz Rochester, President, Rochester Heating & Cooling LLC, Fern Creek, KY, sells hard start kits mainly as a remedy for hard-starting compressors, but plans to also proactively market them as preventive maintenance in the future. When an air-conditioner does not start or has trouble starting, Rochester finds a hard start kit is many times the remedy.

Hard start kits are an easy sell, according to Rochester, because the consumer can easily see the difference between a poor startup versus starting up immediately after a hard start kit installation.

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Rochester, a self-taught videographer and a 25-year veteran of the HVAC trade, produced a three-minute video illustrating the inrush current reduction benefits of installing a hard start kit on a common four-ton residential air-conditioner compressor. The video is available at bit.ly/hardstartfeature. In the piece, Rochester features an amp tester inrush with current readings of 121 A and 91 A at startup before and after a hard start kit is installed, respectively. While the video is generally meant for contractors, consumers surfing the Internet for information on hard start kits many times view the video and call him when they are geographically within his service range.

This is just one example of 448 instructional videos that Rochester has made on a variety of HVAC installation and service subjects for contractors. All of them are available at his YouTube channel, "Fritz Rochester."

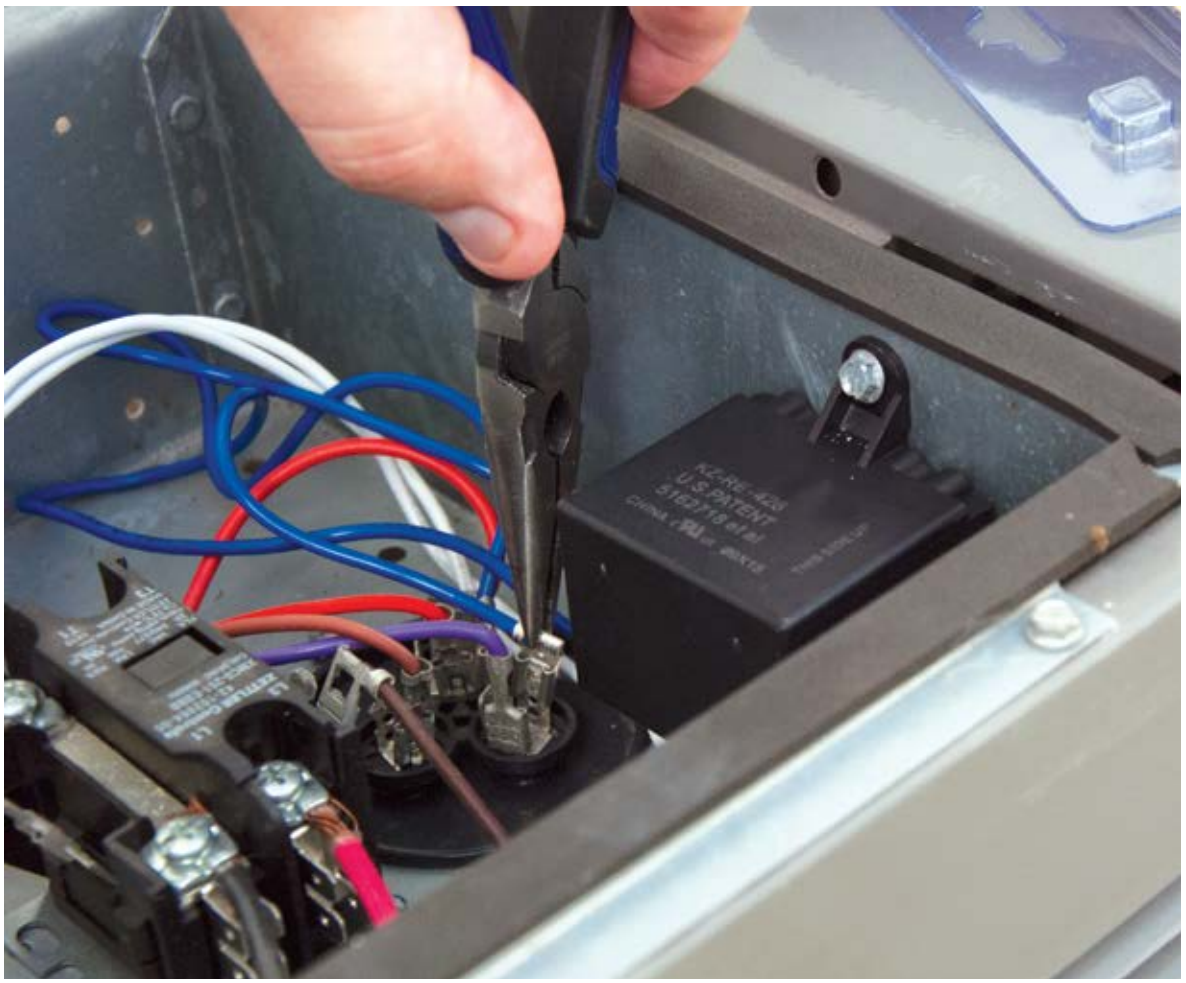
While the video channel draws customers, Rochester plans to begin proactively selling hard start kits by giving customers manufacturer brochures during service calls to promote their equipment protection benefits.

Hard start kit benefits

One of the most important hard start kit benefits is reducing heat on a compressor motor start winding. Heat caused by excessive starting amps combined with an extended starting time will cause a start winding to burn out. A hard start kit reduces inrush current at just the right 1/10th of a second to limit heat, plus wear and tear on the compressor.

There is an energy saving factor too. Reducing the inrush current by even 25% can add up over the lifecycle of the system. For example, a non-heat pump air-conditioning system running four months annually in a moderate climate will cycle approximately 50 times daily for a total of $1,500/year. Heat-pump models operating year-round in the South might be double or triple that amount.

There is a nominal energy savings advantage, as well. The fact that AHRI testing for SEER ratings to ensure a compressor starts in less than 4/10th of a second (at



<< Wiring a two wire kit into the system is easy. Simply connect one blue wire to both sides of a single run capacitor or to the "common" and "herm" terminals of a dual run capacitor. Reversing the blue wires does not change the functionality of the hard start kit.

"Hard start kits offer remedies to a variety of challenges compressors face due to environmental conditions such as voltage supply or installation errors."

different pressures and voltages) confirms the value of efficient starts.

Besides preventive maintenance and energy savings, hard start kits offer remedies to a variety of challenges compressors face due to environmental conditions such as voltage supply or installation errors.

Any of the following scenarios are reasons for installing a hard start kit:

→**Low supply voltage**—Some geographical areas with excessive housing or industrial growth have a demand the electrical infrastructure cannot accommodate. Also, some areas are supplied with 208-V three-phase power, which can dip below 190 V at times, thus requiring a hard start kit on single-phase compressors;

→**Poor quality power supply**—Aging or remote area power grids many times cannot reject heat because of coats of dust generated by extremely dry and hot climates on overhead wires and power transfer stations;

→**Inadequate (undersized) wiring**—Three-phase buildings use smaller gauge wire. Adding single-phase equipment without upgrading to larger gauge wiring can affect compressor operation. Another inadequate wiring situation sometimes occurs in the new home construction industry, because it many times uses the smallest gauge wire allowed by code for value engineering reasons;

→**Pressure differential at startup**—Pressure differentials from using an old compressor with a new coil, a new compressor with an old coil, or using non-bleed TXVs potentially affect the startup;

→**Multiple unit operation**—Multiple units running at the same time in a large home, densely-populated neighborhood, or multi-unit condo or apartment complex can starve compressors of power; and

→**Peak energy usage times**—Periods where the grid is taxed, such as most anywhere in the U.S. during August can affect power.

> **Since excess heat damages compressors, a critical feature of hard start devices is how they sense counter electromotive force (back EMF).**

Additional selling points include the facts that aged systems typically are more difficult to start and new high-SEER systems have lower torque motors needing additional starting assistance.

How hard start kits work

Since excess heat damages compressors, a critical feature of hard start devices is how they sense counter electromotive force (back EMF). A typical startup requires four to eight times more current to actually start the compressor than what is required to run it. It is essential to select a relay that picks up at precisely the right millisecond, to protect the start windings from overheating. A good analogy is the attempt to start a car engine, but continuing to engage the starter motor against the flywheel a 1/2-second more than needed. Eventually, the car's starter will burn out. The same type of damage impacts an air-conditioner compressor motor's windings when multiplying that unnecessary 1/2-second by 30 to 40 startups per day during cooling season.

Hard start devices are divided into three distinct classifications, the traditional three-wire designs, two-wire designs that do not use a potential relay and the approach of a two-wire design that uses a potential relay, the latter which do not need be connected to dedicated locations. Both designs that utilize a mechanical potential relay to sense voltage generated during startup. Three-wire designs measure the back EMF off the motor start windings, while the two-wire designs utilize a mechanical potential relay to measure back EMF off the motor start windings and the run windings. Back EMF is the voltage generated by the motor field as it operates.

There are hundreds of relay and capacitor combinations to accommodate the hundreds of variations of back EMF generated through the start windings. One manufacturer, for example, makes more than 100 relays that are calibrated to have a different pick up, drop out, continuous, impulse and response time voltage.

Consequently, contractors would have to inventory dozens of hard start devices on their trucks to properly match a replacement three-wire device. However, some aftermarket hard start devices come in just two or three universal models based on the compressor horsepower or system tonnage. When the three-wire design is used, it is impossible to use only two or three relays for all equipment on the market, because the start winding voltage varies by hundreds of volts from one compressor model to the next. Additionally, relays only function in a narrow voltage range of around ten to twenty volts. Potential relays are very effective, but they must be matched to pick up at the correct voltage range of the equipment's start winding. The back EMF measured between the start and common winding varies by hundreds of volts, therefore it is nearly impossible to have a universal three-wire hard start device.

On the other hand, there is a way to use a potential relay and start capacitor to create a universal hard start kit with only two relays, by sensing the back EMF between start and run windings through the run capacitor. The back EMF measured between start and run is fairly consistent among all single phase compressors.

The ultimate goal is to eliminate excess heat by starting compressors 50% to 80% more quickly. Not all two-wire devices are the same because some don't have a potential elay, but instead use an electronic circuit board timing device. Typically, two-wire hard start devices with mechanical potential relays sense back EMF more accurately than their electronic counterparts. Two-wire devices using a positive temperature coefficient resistor (PTCR) may not be optimal either. A PTCR does not sense the back EMF, therefore it can potentially cause damage by keeping the motor start windings energized for too long of a period even after the compressor has started.

James Bowman is the National Technical Manager–HVACR of RectorSeal® Corp., Houston, which offers dozens of accessories, tools and products described in this story that can be seen in detail online or in RectorSeal's free HVAC catalog available at 800-231-3345. Bowman is a former service tech that is EPA-certified, NATE-certified, holds a Class A contractor license in Texas, and was the RSES "Speaker of the Year" in 2015. Bowman can be reached at james.bowman@rectorseal.com. For more information, visit www.rectorseal.com.