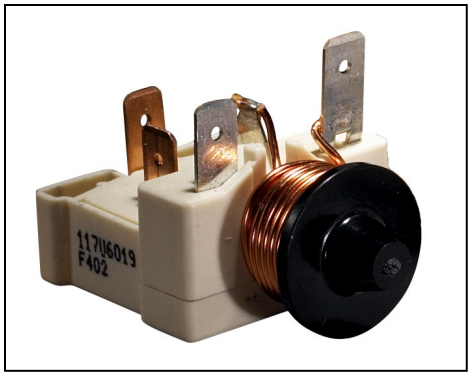
ENGINEERING TOMORROW

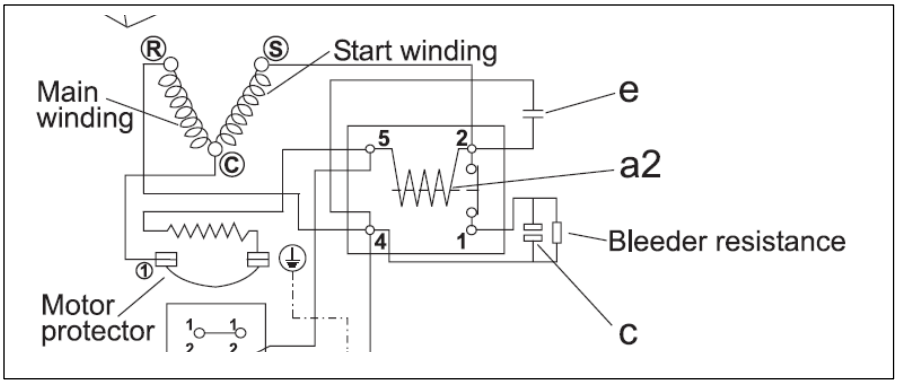
Friday Fun Facts |

Potential and Current Relays

A compressor motor must generate enough force (Torque) to overcome the pressure difference between the high and low sides of the system and since the motor is not initially turning, it draws high amperage until it comes up to speed. If the motor cannot not start, it will continue to draw high current until the overload opens. How much torque is required depends on whether the pressures can equalize in the off cycle. Scroll compressors start unloaded so generally do not need high starting torque (HST) hardware unless there are exceptional circumstances.

For systems equipped with a TXV, the pressures may not equalize during the off cycle so the compressor must overcome high resistance to start. In these systems, the use of high starting torque (HST) accessories is required. This consists of a start capacitor, start relay (Current relay or potential relay) and motor protector. The start relay assures the start capacitor and start winding are in or brought into the circuit when power is first applied to the compressor. The start capacitor allows the compressor motor to generate a much greater amount of starting torque than induction starting alone can.

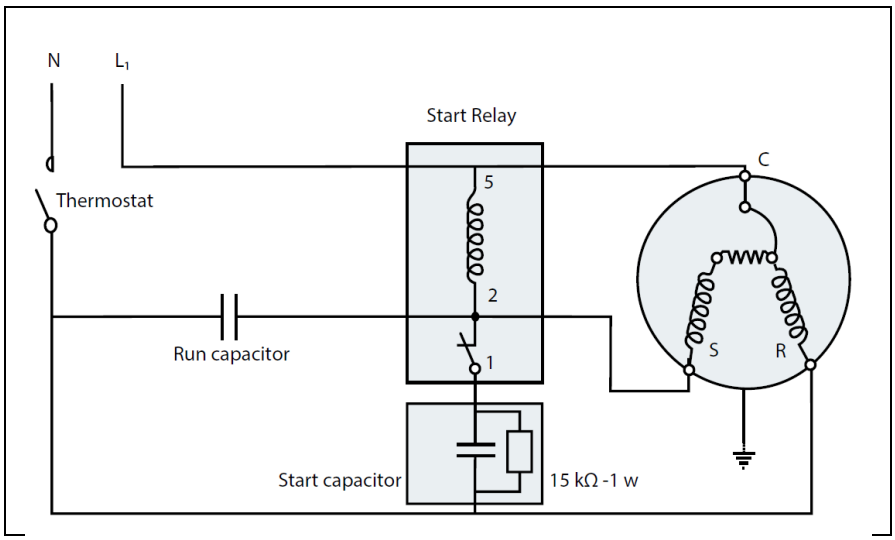


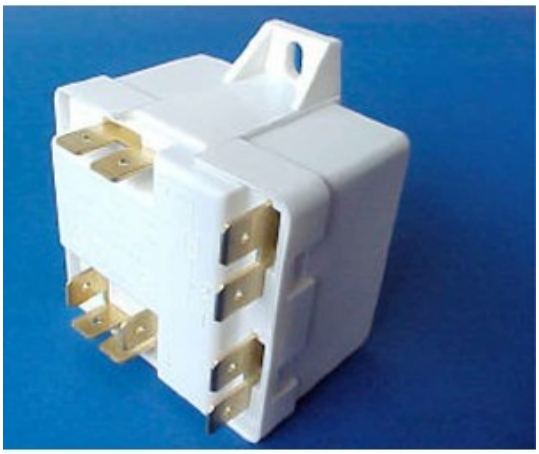


Left image: Current relay used on a Danfoss compressor. The relay closes and brings the start capacitor into the circuit when current rises to 12.1 amps and opens when the current drops to 9.3 amps removing the start capacitor from the circuit. Right image: Schematic of compressor circuit with current relay coil a2 and relay contact is between 2 & 1. Start cap is labelled C.

Compressors smaller than ¾ hp generally use a starting device known as a current relay to a bring in the start winding and start capacitor upon initial start-up. They are normally open when the compressor is not energized and reopen when it comes up to speed. When power is first applied to the compressor and it tries to start, the current is very high and this current energizes the current relay coil, closing it. As the run winding increases in speed, the inrush current drops in value until it is too low to maintain the current relay in the closed position, causing it to open due to a spring pushing against the force of the magnetic field produced by the relay coil

Potential relays are normally closed and rely on the compressor motor coming up to speed and producing sufficient back electromotive force (EMF) in the start winding. Once the back EMF value is high enough, sufficient current is induced in the relay coil to energize the relay coil and remove the start capacitor and start winding from the electrical circuit. As such, it is only engaged for a short time on start up. Generally, you will see potential relay on single phase compressors ~¾ HP and above.





Potential (Start) relay shown in schematic of a capacitor start/run circuit (Left diagram). 2 and 5 are the start relay coil and 1 is the relay contact for engaging the start winding upon start up. Note the start relay contact is shown as normally closed. It will open when the back EMF from the start winding is high enough to energize the start relay coil, causing the contact to open. Image of Danfoss potential relay on right