









# Choosing Relays, Contactors and Motor Starters

RELAYS	CONTACTORS	MOTOR STARTERS
 <p data-bbox="358 495 430 520">5X826</p>  <p data-bbox="358 783 430 808">5X847</p>	 <p data-bbox="732 516 803 541">5B109</p>  <p data-bbox="732 762 803 787">3DY20</p>	 <p data-bbox="1097 527 1169 552">4DF48</p>  <p data-bbox="1252 527 1323 552">3CY82</p>  <p data-bbox="1097 789 1169 814">1H474</p>  <p data-bbox="1252 789 1323 814">1H413</p>

## WHAT IS THE DIFFERENCE?

**Special Note: Motor Starters, contactors, and relays, like any switching device, have a finite life. Normal failure modes include contact sticking and improper operation. Any installation where property damage and/or personal injury could result, because the switch did not open or close requires the installation of backup systems.**

### Relays

**Relays control current flow in a circuit based on signals obtained from an information source.**

A relay is a simple electromechanical switch made up of an electromagnetic coil and a set of contacts. An electric signal (Voltage) gets sent to the COIL creating a magnetic field, closing the armature, which closes Normally Open (N.O.) and opens Normally Closed (N.C.) Contacts.

The voltage of the coil does not always have to be the same voltage

going through the contacts. Often, it is not the same.

### To select a relay:

1. Identify coil voltage.
2. Identify maximum amperage and maximum voltage going through contacts.
3. Identify how many sets of N.O. and N.C. contacts the relay needs to switch at the same time.

Motor Starters, contactors, and relays all operate on the same basic principle. The first three steps for selection will be the same.

### **General Purpose Relays**

Sometimes called “ice cube relays” (because they are small and square and with clear plastic like an ice cube). These relays are usually rated up to 10 or 15 amps and are mostly intended for use in control circuits. They can also be used with small motor loads, generally under ½ HP.

### **Power Relays**

Sometimes called “open face” or “clapper relays”. Usually rated up to 20 or 30 amps. They are intended for use on direct switching of small motors and heating applications that are not subject to a high cycle rate.

### **Mercury Displacement Relays**

Used for high current (power) applications. Usually used on process heating applications where a high cycle rate and quiet operation is needed.

## Contactors

### **A contactor does not provide overload protection.**

Contactors are used to electrically turn on or off high current, non-motor loads or in motor loads where overload protection is separately provided. The contactor operates by applying a control voltage to the contactor coil. When the coil is energized, the moveable contacts are closed against the stationary contacts, thus completing a circuit (when the load is wired to Normally Open contacts), or breaking a circuit (when the load is wired to Normally Closed contacts).

### **NEMA Contactors**

NEMA (National Electrical Manufacturers' Association) establishes product design standards and test specifications for these contactors. These contactors are capable of general jogging and reversing duty. NEMA contactors can be applied with limited application information.

### **IEC Contactors**

IEC (International Electrotechnical Commission - mainly Europe) publishes recommendations for certain product design parameters and laboratory test procedures. In general, IEC standards allow the contactor to have smaller creepage path and a higher temperature rise than NEMA, which results in a smaller physical size. Also, when sizing an IEC contactor, knowing an application's duty cycle, jogging, and reversing characteristics become important.

### **Definite Purpose Contactor**

Similar in function to a general purpose NEMA contactor. However, they are lighter duty and often considered a throw away when compared to an equivalent NEMA or IEC contactor. Used in HVAC systems, refrigeration, food processing systems, pumps and compressors.

## Motor-Starters

Motor-Starters are action devices that start and stop motors and provide over-load protection. While the core of a motor starter is a contactor, its ability to provide over-load protection is the trait which makes these items different than a simple contactor.

**Standard starters do not include a disconnection means or short circuit protection.** Over-load relays and accompanying thermal units (aka "heaters" or "heater elements") sense excessive current flowing to a motor and protect the motor from overloads. If more current is flowing than the motor is designed to handle, the overload relay causes the motor to shut down by disengaging the contactor's coil voltage.

The National Electric Code (NEC) requires that motor circuit protection must protect the branch circuit conductors, the motor starter, and the motor itself against over-current caused by short circuits or grounds.

The NEC also requires that if the motor starter is mounted out of sight of the motor, or the motor is more than 50 feet from the motor, some means of disconnecting the motor from the power source must be provided. The Code does not specify how this is to be accomplished. One method is to use an individual starter with a separate fusible disconnect switch or circuit breaker.

A more economical means of satisfying the NEC requirements for disconnecting the motor is to

use a Combination Motor-Starter.

### **Definite Purpose Motor-Starters**

Use Definite Purpose Contactors as the main relay portion of the motor-starter.

### **NEMA Magnetic Motor-Starters**

Use NEMA Magnetic Contactors as the main relay portion of the motor-starter.

### **Combination Motor-Starters**

Built around a NEMA Magnetic Motor-Starter, this also uses a fused (or un-fused) switch or a circuit breaker contained in the same enclosure. Because the devices are contained in the same enclosure, there are many advantages and cost savings to be realized.

### **NEMA Manual Motor-Starters**

Is a NEMA recognized motor starter that requires a person to manually start or stop by hand. It provides overload protection, **but has no coil. Good for HVAC systems and applications where there is minimal risk of an injury to people or damage to equipment if power-feed to starter were to be stopped and then suddenly started again (example a power outage and sudden restoration.)**

### **IEC Manual Motor-Starters**

Is an IEC recognized motor starter that requires a person to manually start or stop. It provides overload protection, **but has no coil. Good for HVAC systems and applications where there is minimal risk of an injury to people or damage to equipment if power-feed to starter were to be stopped and then suddenly started again (example a power outage and sudden restoration.)**