



SNS COLLEGE OF TECHNOLOGY

**Coimbatore-35
An Autonomous Institution**



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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

19EET304/ IOT FOR ELECTRICAL SCIENCES

III YEAR VI SEM

UNIT 6 – ACTIVATION DEVICES

TOPIC 6 –power Contactor





What is a Relay?


Relay is a simple electromagnetic switch which makes or breaks the electric connection between the power supply and the load. A typical relay uses an electric signal to control an electromagnet, which operates the armature of the relay for making or breaking the connection.

What is a Contactor?

A **contactor** is an electromagnetic switch which is designed to make or break the connection between the electric power supply and the load. In practice, The contactors are mainly used to control the high power-consuming devices because they offer heavy-duty contacts so as to provide safe switching of power circuits.



Contactor

A yellow gear icon with various electrical symbols inside, including a lightbulb, a plug, a lightning bolt, and a circuit diagram. The gear is set against a green and blue gradient background.

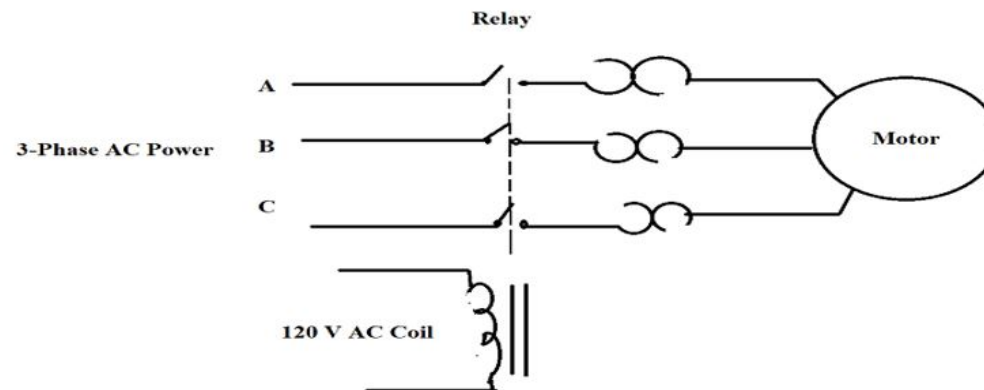
Contactors are electrically controlled switching devices which are used for switching electrically. The basic operation of this is similar to a relay, but the only difference is that contactors can carry large current compared to relay up to 12500A. They cannot provide short circuit or overload protection but can break the contact when coil excites.

Construction of a Contactor

- The contactor consists of two iron cores, where one is fixed and the other one is the movable coil and it is an insulated copper coil. Where the copper coil is located on the fixed core.
- There are six main contacts for power connection, where three are fixed cores and the other three are movable cores.
- These contacts are made from pure copper, and the contact points are made from special alloy to withstand high starting current and temperature.

Construction of a Contactor

A spring which is located between coil and the movable core, auxiliary contacts it could be normally open or closed. The main contacts cut on and off the light current loads such as contactors coil, relays, timers, and many other control circuit parts are linked to contact mechanism. A three-phase AC power supply provided to the circuit which is shown below,



Parts



Coil

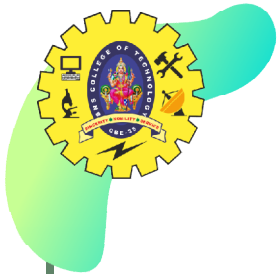
It provides a force which is required to close the contact. The coil is also named as an electromagnet. An enclosure is used to safeguard the coil and contactor.

Enclosure

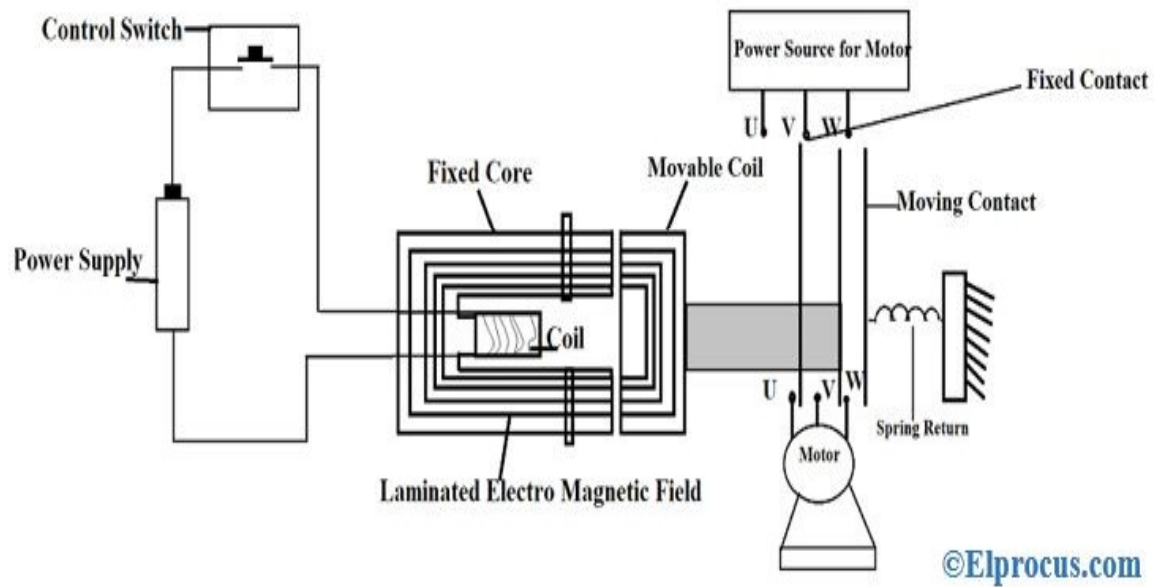
It acts like an insulator and protector, which protects the circuit from any electrical contact, dust, oil, etc. They are made up of different materials like Nylon 6, Bakelite, Thermosetting plastic, etc.

Contacts

The main function of this is that it carries the current to various parts of the circuit. There are classified into contact springs, auxiliary contacts, and power contacts. Where each of the contacts has its own functions, which is explained in principle of operation of the contactor.



Contactor





Working Principle of Contactors

- An electromagnetic field is generated whenever current flows where the moving coils attract each other.
- A large amount of current is drawn initially by an electromagnetic coil. The moving contact is pushed forward by moving core, as a result, the force created by the electromagnet holds the moving and fixed contacts together.
- On de-energizing, the contactor coil gravity or spring moves back the electro-magnetic coil to its initial position and there is no flow of current in the circuit.



Contd...

- If contactors are energized with AC current, a small portion of the coil is the shaded coil, where the magnetic flux in the core is slightly delayed. This effect is too average as it prevents the core from buzzing at twice line frequency. There are internal tipping point processes to ensure rapid action so that contactors can open and closed very rapidly.
- From the figure the supply is given using a switch, that is when the switch is closed current flows through the contactor coil and attaches the moving core. The contactor attached to the moving core closes and the motor starts running. When the switch is released the electromagnetic energizes spring arrangement pause the moving coil back to its initial position and power supply to the motor is cut off.



How to Choose a Correct Replacement for a Contactor?



A correct replacement for this can be chosen as follows

- Firstly, one should check the coil voltage, which is a voltage used to energize the contactor.
- Checking for auxiliary contacts available, that is how many open and closed nodes are used in the contactor.
- Checking the rating which is mentioned in a table format on it.
- ARC suppression concept arises whenever the contacts are open or closed. If there is a heavy load breakdown, an arc that is formed damages the contacts. Along with it if the temperature is high the arc causes harmful gases like carbon monoxide which leads to a reduction of the lifetime of motors.



Types of Contactors

These are classified based on three factors they are

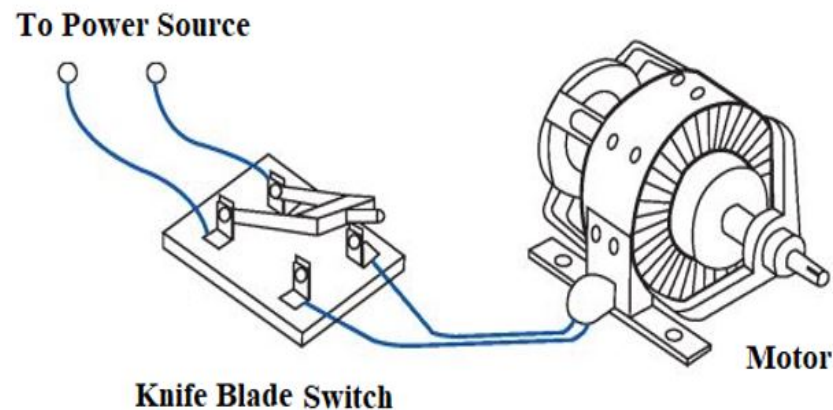
- The load being used
- The current capacity and
- The power rating.



Knife Blade Switch

It is the first contactor used to control an electric motor in the late 1800s.

It consists of a metal strip, which acts as a switch in connecting and disconnecting the connection. But the disadvantage of this method is that its switching process is very fast, due to which corrosion occurs in the copper material, depending on the capacity of current the size of the motor is increased which leads to high physical damage.



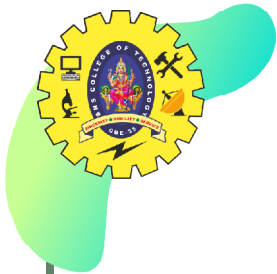
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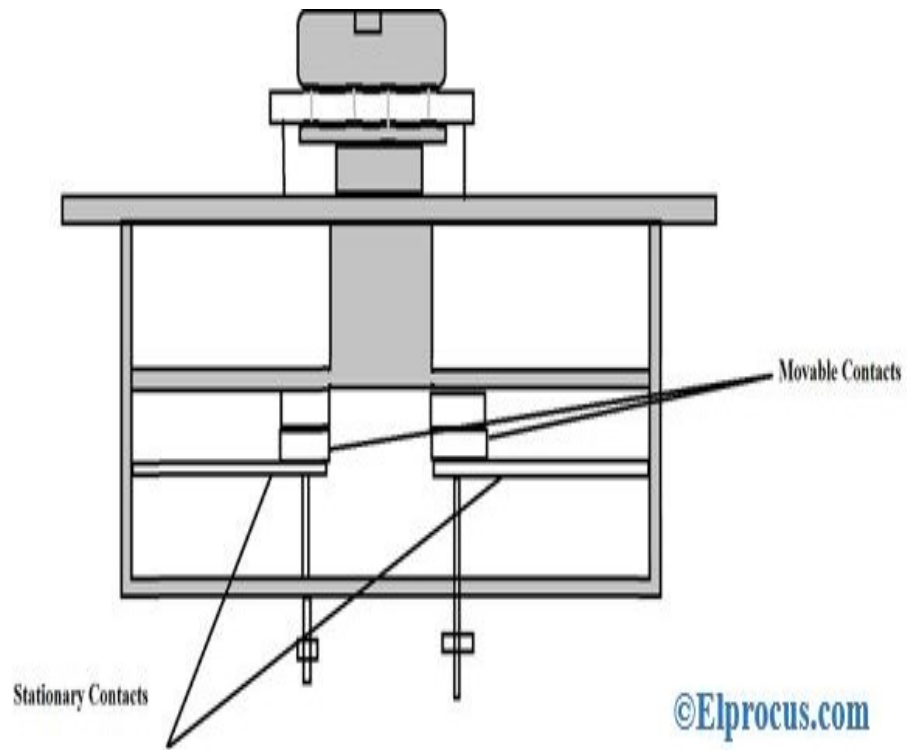
Manual Contactor

The disadvantages of knife blade contractors are overcome using a manual contactor. Some of the features of these are,

- The operation performed is safe
- They are properly encased in order to protect from external environment problem
- The size of the manual connector is small
- Only a single break is used
- The switches are controlled using a contactor



Manual Contactor



Magnetic Contactor

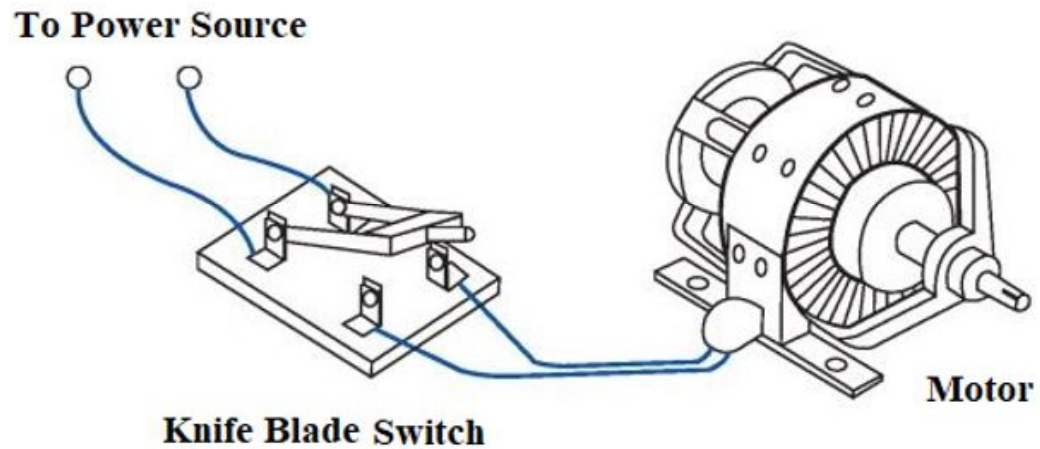
- It operates electromagnetically that is it can be operated remotely, less amount of current is enough to make a connection and remove the connection.
- It is the most advanced contactor.



ASSESSMENT - 1



How to replace the switch by contactor





Difference between AC Contactors and DC Contactors



AC Contactors	DC Contactors
They are designed for the contactors with self-extinguishing arc is drawn whenever the contact opens	They are specially designed to suppress electrical arching when there is switching in the DC circuit.
They don't use freewheel diode	They use freewheel diode
Separation time is less	Separation time is higher if the load is heavy a shunt load is attached to the main contact.





Advantages&Disadvantages



The following are the advantages of the contactor

- Fast switching operation
- Suitable for both AC and DC devices
- Simple in construction.

Disadvantages

The following are the disadvantages of the contactor

In the absence of magnetic-field, the coil may burn

Aging of components causes corrosion of materials when exposed to moisture.

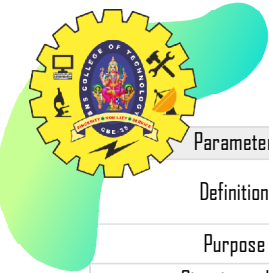


Applications of Contactors



The following are the application of contactors

- It controls lighting
- Magnetic starter
- Vacuum contactor
- Mercury relay
- Mercury-wetted relay.



Difference between Contactor and Relay

Parameter	Contactor	Relay
Definition	A contactor is an electrically operated switch which is designed to make or break the electrical power circuits.	A relay is an electromagnetic switch that is designed to operate electrically and used for switching the circuits by using low power signals.
Purpose	The switching of high voltage and current circuits is the main purpose of contactors.	The switching of low voltage and current circuits is the purpose of relays.
Circuit symbol		
Load capacity	The contactors are generally used for the switching of loads greater than 10 A.	The relays are generally used for switching of the loads of 10 A or less.
Voltage rating	Contactors are rated up to 1000 V.	The voltage ratings of relays are up to 250 V.
Power consumption	The size of electromagnet used in a contactor is large, thus it consumes more power.	The size of electromagnet used in a relay is relatively smaller in size, thus it requires less power to energize than a contactor.
Open & close contactor standards	Contactors are mostly designed to operate with normally open (NO) contacts. Thus, when the electromagnet of contactor is de-energized there is no connection.	Relays are commonly designed to have both normally open (NO) and normally closed (NC) contacts depending upon the application.
Auxiliary contacts	Contactors are often fitted with some auxiliary contacts that can be NO or NC. However, the auxiliary contacts are provided to perform additional functions related to control of the contactor.	A typical relay does not have any auxiliary contacts.
Switching speed	For the same application, the switching speed of a contactor is slow.	The switching speed of a relay is relatively more.
Suitability	Contactors are suitable for switching of both control and power circuits.	Relay is suitable for control circuits only.
Size	The physical size of a contactor is relatively larger.	The size of a relay is smaller than a contactor.
Spring loaded contacts	As contactors are used for switching high power loads, thus they should contain spring loaded contacts to ensure the circuit is broken when de-energized to provide additional safety.	The use of spring loaded contacts is much less common in relays because they are used in low power switching applications.
Arc suppression	Arc suppression is provided in contactors because they carry high power loads.	As the relays are not designed for high power applications, thus the arcing is not a concern and hence, the arc suppression feature is commonly not used in relays.
Overload safety	Overload safety is provided in contactors that interrupts the circuit if the current exceeds a set threshold for a selected period of time (usually 10 to 30 seconds). This helps to protect the equipment from damages due to high currents.	The overload safety is not generally provided in case of relays.
Safety	Contactors provide more safety measure in the circuit.	Relays provides less safety to the circuit.
Cost	Contactors are expensive devices.	Relays are less expensive than contactors.
Applications	Contactors can be used for switching of 1-phase as well as 3-phase loads such as motor power circuits, motor starters, switching circuit of capacitor banks, magnetic starters, etc.	The relays are mostly used in control circuits of single phase loads such as protection systems, control circuit of circuit breakers, motor control circuit etc.



References



- <https://www.elprocus.com/what-is-contactor-construction-types-and-applications/>
- <https://www.electricaltechnology.org/2020/06/electrical-contactor.html>
- <https://www.electricalclassroom.com/contactor-working-application-types/>
- <https://realpars.com/contactor/>





Thank You

