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Basics of induction Motors

Power and control wirings of DOL and RDOL

Different starting methods are employed for starting induction motors because they draw more starting current during starting. To prevent damage to the windings due to the high starting current flow, we employ different types of starters.

Most large induction motors are started directly on line, but when very large motors are started that way, they cause a disturbance of voltage on the supply lines due to large starting current surges. To limit the starting current surge, large induction motors are started at reduced voltage and then have full supply voltage reconnected when they run up to near rotated speed.

Two methods of reduced voltage starting are star delta starting and autotransformer stating. Contactors perform the switching action in the starter to connect and disconnect the power supply to the motor. If the current is above the rated current for the motor, the contactor will be tripped automatically to disconnect the motor from the supply.

Starting methods of Induction motor include:

- Direct –On– line (DOL) starters for less than 10 Kw motors.
- Star–Delta starters for large motors. The stator winding is initially connected in a star configuration and later on changed over to a Delta connection, when the motor reaches rated speed.
- Auto transformer.

DOL Starter:

- It is simple and cheap starter for a 3-phase induction motor.
- The contacts close against spring action.
- This method is normally limited to smaller cage induction motors, because starting current can be as high as eight times the full load current of the motor. Use of a double –cage rotor requires lower staring current (approximately four times) and use of quick acting A.V.R enables motors of 75 Kw and above to be started direct on line.
- An isolator is required to isolate the starter from the supply for maintenance.
- Protection must be provided for the motor. Some of the safety protections are over-current protection, under-voltage protection, short circuit protection, etc. Control circuit voltage is sometimes stepped down through an autotransformer.

Contactor:

- A contactor has three components. The contacts are the current carrying part of the contactor. This includes power contacts, auxiliary contacts, and contact springs.
- The electromagnet (or "coil") provides the driving force to close the contacts.
- Enclosures are made of insulating materials like Bakelite, nylon and thermosetting plastics to protect and insulate the contacts and to provide some measure of protection against personnel touching the contacts.
- Open-frame contactors may have a further enclosure to protect against dust, oil, explosion hazards and weather.
- Magnetic blowouts use blowout coils to lengthen and move the electric arc. These are especially useful in DC power circuits.

- AC arcs have periods of low current, during which the arc can be extinguished with relative ease, but DC arcs have continuous high current, so blowing them out requires the arc to be stretched further than an AC arc of the same current.

OVER LOAD RELAY:

Overload relays are 3 poles. The motor current flows through their bimetals (1 per phase) which are indirectly heated. Under the effect of the heating, the bimetals bend, cause the relay to trip and the position of the auxiliary contacts to change. The relay setting range is graduated in amps. In compliance with international and national standards, the setting current is the motor nominal current and not the tripping current (no tripping at 1.05 x setting current, tripping at 1.2 x setting current). The tripping curves (cold or warm starting, 3 phases and 2 phases).

PUSH BUTTON:

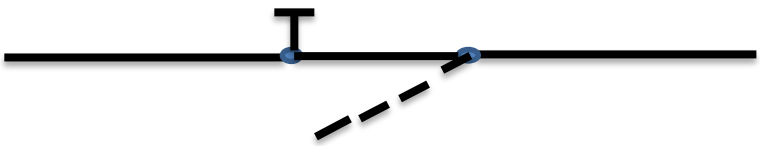
A push-button is a simple switch mechanism for controlling some electrical machines or a process, especially Motors.

OFF PUSH BUTTON

ON PUSH BUTTON

Normally Open (NO): An NO is a switch which is usually open and when pressed it becomes close, and when release it again becomes open.

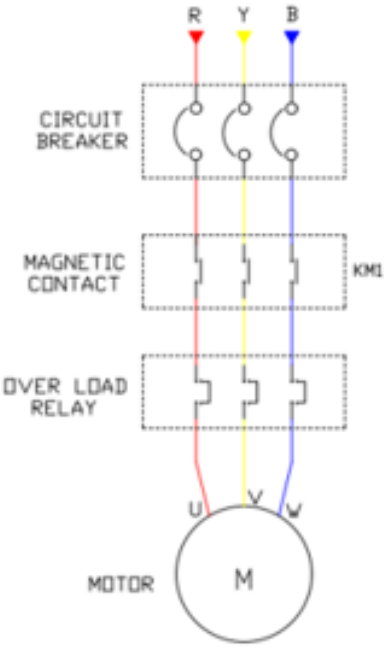
Normally Close (NC): An NC is a switch which is usually close and when pressed it becomes open, and when release it again becomes close.



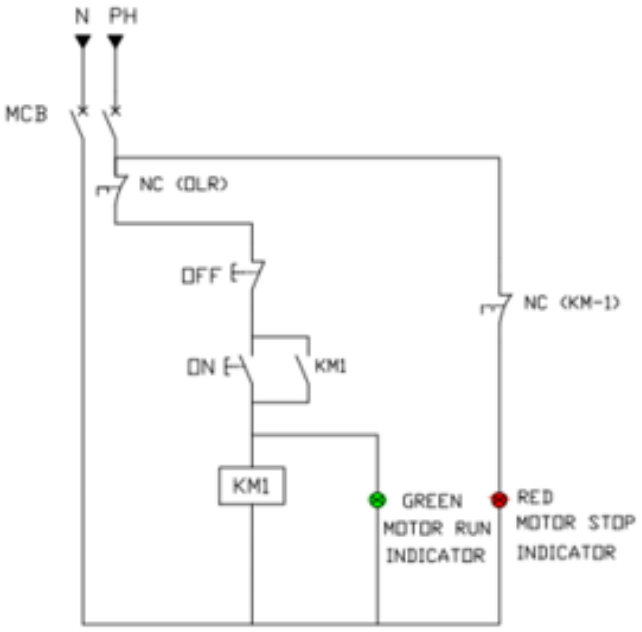
To start, the contactor is closed, applying full line voltage to the motor windings. The motor will draw a very high inrush current for a very short time, the magnetic field in the iron, and then the current will be limited to the Locked Rotor Current of the motor. The motor will develop Locked Rotor Torque

and begin to accelerate towards full speed.

As the motor accelerates, the current will begin to drop, but will not drop significantly until the motor is at a high speed, typically about 85% of synchronous speed. The actual starting current curve is a function of the motor design, and the terminal voltage, and is totally independent of the motor load.



DOL POWER WIRING



DOL CONTROL WIRING

Power wiring:

- From the mains supply is directly connected to MCCB.
- From the output of the MCCB it is given to the contactor.
- And the contactor output is connected to the terminals of the motor.

Control wiring:

- Two push buttons are taken. 1 – start and 1 – stop.
- Control wiring is connected as per the circuit diagram.

How to start the motor:

- Press the start push button, the circuit latches and motor start running.

Press the stop button, the circuit upholds the contactor and the motor stop running