

Methods of Starting Three Phase Induction Motors

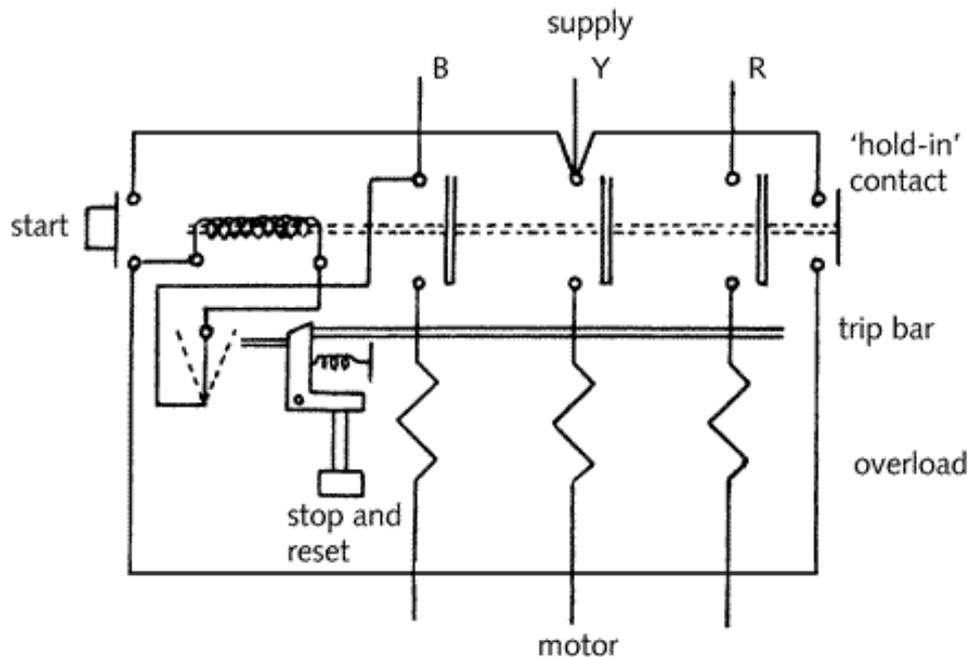
As we know, once a supply is connected to a three phase induction motor a rotating magnetic field will be set up in the stator, this will link and cut the rotor bars which in turn will induce rotor currents and create a rotor field which will interact with the stator field and produce rotation. Of course this means that the three phase induction motor is entirely capable of self starting.

The need for a starter therefore is not, conversely enough, to provide starting but to **reduce heavy starting currents** and provide **overload and no-voltage protection**.

There are a number of different types of starter including 'The Direct On-line Starter', 'The Star-Delta Starter', 'Auto-Transformer' and 'Rotor resistance'. Each will be considered in turn.

Direct-on-Line Starter (DOL)

The DOL starter switches the supply directly on to the contacts of the motor. As the starting current of an induction motor can be 6-8 times the running current the DOL starter is typically only used for motors with a rating of less than 5kW.



In small groups, investigate the DOL starter shown. Seek to answer the following questions:

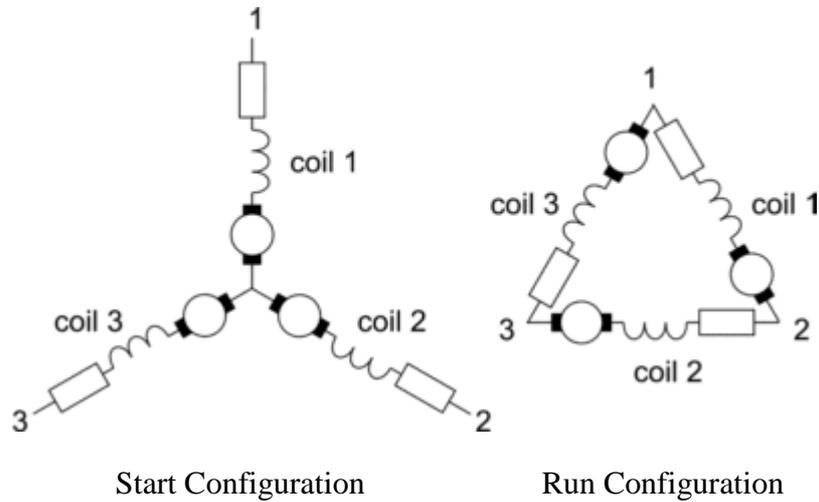
1. What sequence of events takes place subsequent to pressing the start button. (You may wish to consider what type of switch the start button is).
2. How does the stop function activate?
3. How does the overload function activate?

Star Delta starter

This is the most common form of starter used for three phase induction motors. It achieves an effective reduction of starting current by initially connecting the stator windings in star configuration which effectively places any two phases in series across the supply. Starting in star not only has the effect of reducing the motor's start current but also the starting torque.

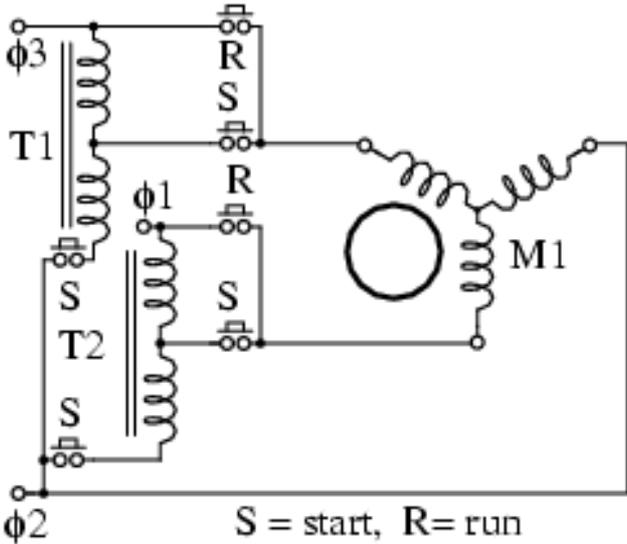
Once up to a particular running speed a double throw switch changes the winding arrangements from star to delta whereupon full running torque is achieved.

Such an arrangement means that the ends of all stator windings must be brought to terminations outside the casing of the motor.



Auto-Transformer Starting

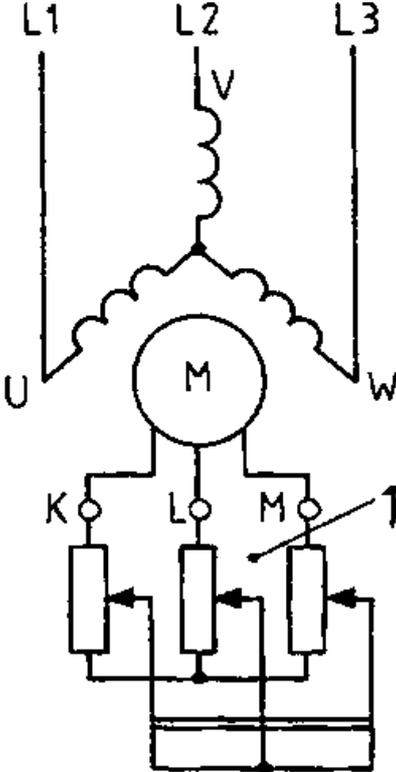
This method of starting reduces the start current by reducing the voltage at start up. It can give lower start up currents than star-delta arrangements but with an associated loss of torque. It is not as commonly utilised as other starting methods but does have the advantage that only three connection conductors are required between starter and motor.



Rotor Resistance Starter

If it is necessary to start a three phase induction motor on load then a wound rotor machine will normally be selected. Such a machine allows an external resistance to be connected to the rotor of the machine through slip rings and brushes.

At start-up the rotor resistance is set at maximum but is reduced as speed increases until eventually it is reduced to zero and the machine runs as if it is a cage rotor machine.



Review

1. Identify the broad reasons for using motor starters with 3 phase induction motors.
2. What is the most common type of motor starter used for three phase induction motors?
3. What are the limitations in employing a DOL motor starter?
4. State one advantage, other than reduced starting currents, for employing an auto-transformer starter.
5. To what part of the motor are the starting resistors connected on a rotor resistance starter?