



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)



COIMBATORE-35

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME: 23EEB210 / Electrical Machines and Drives

II YEAR MECH/ IV SEMESTER

Unit III – SPEED CONTROL TECHNIQUES

Topic : Starting Methods of Three Phase Induction Motor



STARTING METHOD OF THREE PHASE INDUCTION MOTOR

- There is a necessity to control the high currents during the starting of an induction motor as they will harm the nearby loads, hence need to adopt suitable starting methods of induction motor to reduce the high starting currents.
- The most commonly used starting methods of induction motor are
 - ❖ Direct-On-Line Starter
 - ❖ Auto-Transformer Starter
 - ❖ Star-Delta Starter
 - ❖ Rotor Resistance Starter



DIRECT-ON-LINE STARTER

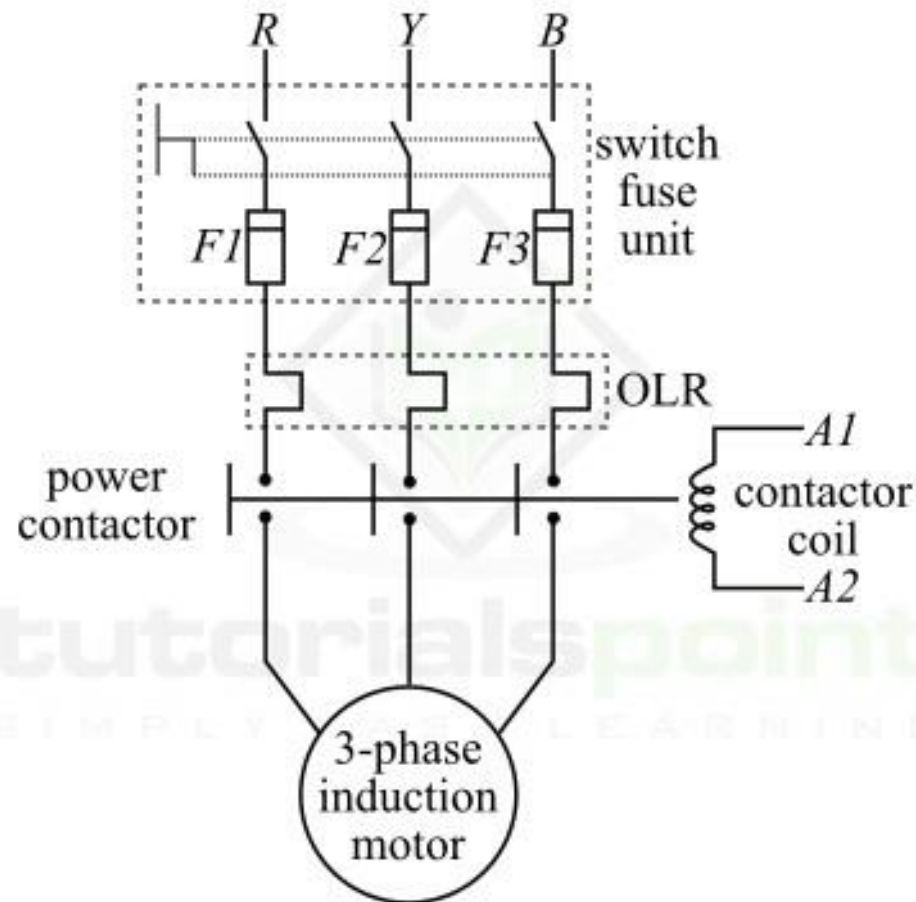


Figure 1 - Direct-On Line Starter



DIRECT-ON-LINE STARTER

- The direct-on line (D.O.L.) starter is one in which the three-phase induction motor is started by connecting it directly to a 3-phase balanced ac supply.
- In this method, the induction motor draws a very high starting current about 4 to 10 times of the full-load current.
- It is because, the impedance of the motor at standstill is low. Therefore, the direct-on line (D.O.L.) method of starting is suitable for the motor of low power rating, usually up to 7.5 kW.



AUTOTRANSFORMER STARTER

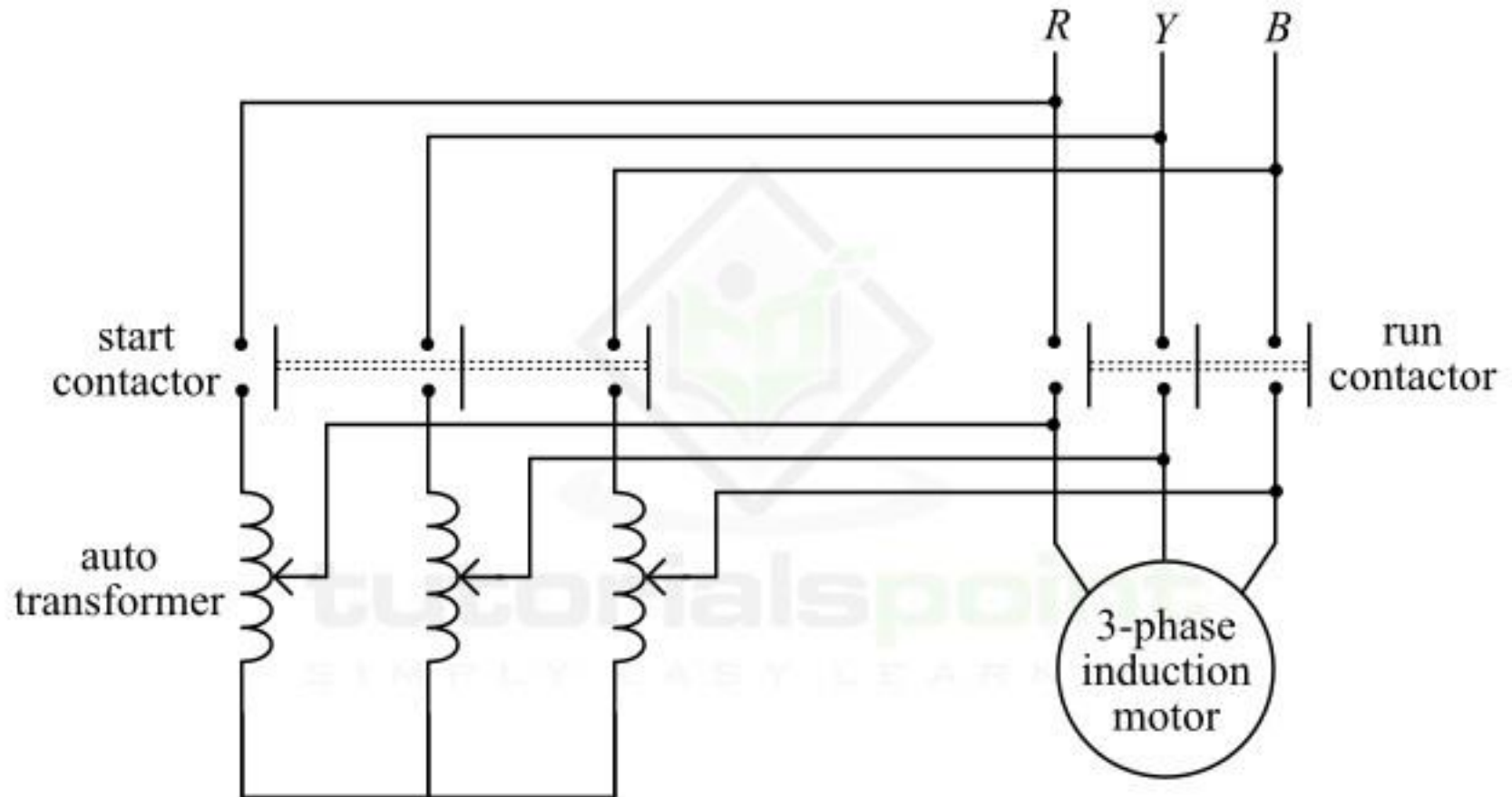


Figure 2 - Autotransformer Starter



AUTOTRANSFORMER STARTER

- In this method of induction motor starting, a three-phase autotransformer is used to supply three-phase electricity to the motor.
- Methods of Starting 3-Phase Induction Motors supply voltage at starting and then connecting the motor to the full supply voltage as the motor attains a sufficient speed.
- The tapings on the autotransformer used for starting the induction motors are provided in such a way that when it is connected in the circuit, 60% to 80% of the supply voltage is applied to the motor.
- At the instant of starting, the autotransformer is put into the circuit and hence reduced voltage is applied to the motor. Consequently, the starting current is limited to a safe value.
- When the motor reaches about 80% of the rated speed, the autotransformer is removed from the circuit through a changeover switch, and the motor is then connected to the full supply voltage.



STAR-DELTA STARTER

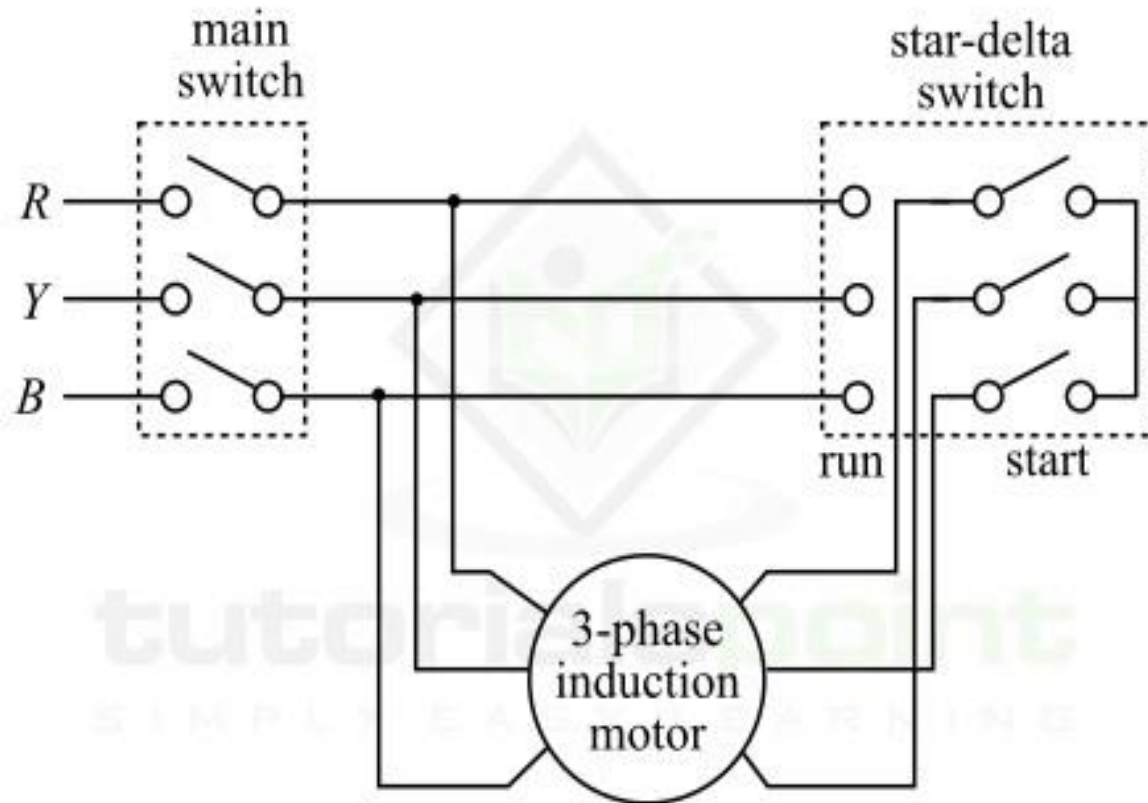


Figure 3 - Star-Delta Starter



STAR-DELTA STARTER

- In this method, the three-phase induction motor is started as a star-connected motor and run as a delta-connected motor.
- The induction motors which are started by star-delta starter has the stator windings which are designed for delta operation and are connected in star during the starting period.
- When the motor attains a sufficient speed, the winding connections are changed from star to delta.
- The six terminals of the stator windings are connected to a changeover switch. At the instant of starting, the changeover switch connects the stator windings in star-configuration.
- As a result, each stator phase gets a voltage equal to $V/\sqrt{3}$, where V is the full line voltage. In this way, the stator windings get a reduced voltage during starting period.



STAR-DELTA STARTER

- When the motor attains a specific speed, the changeover switch turns the connection of stator windings to delta.
- Each phase now gets the full line voltage V , and the motor runs at the normal speed.
- However, this method of starting of three-phase induction motor causes a large reduction in the starting torque of the motor.
- This method is best suited for medium sized induction motors, up to about 25 hp.



ROTOR RESISTANCE STARTER

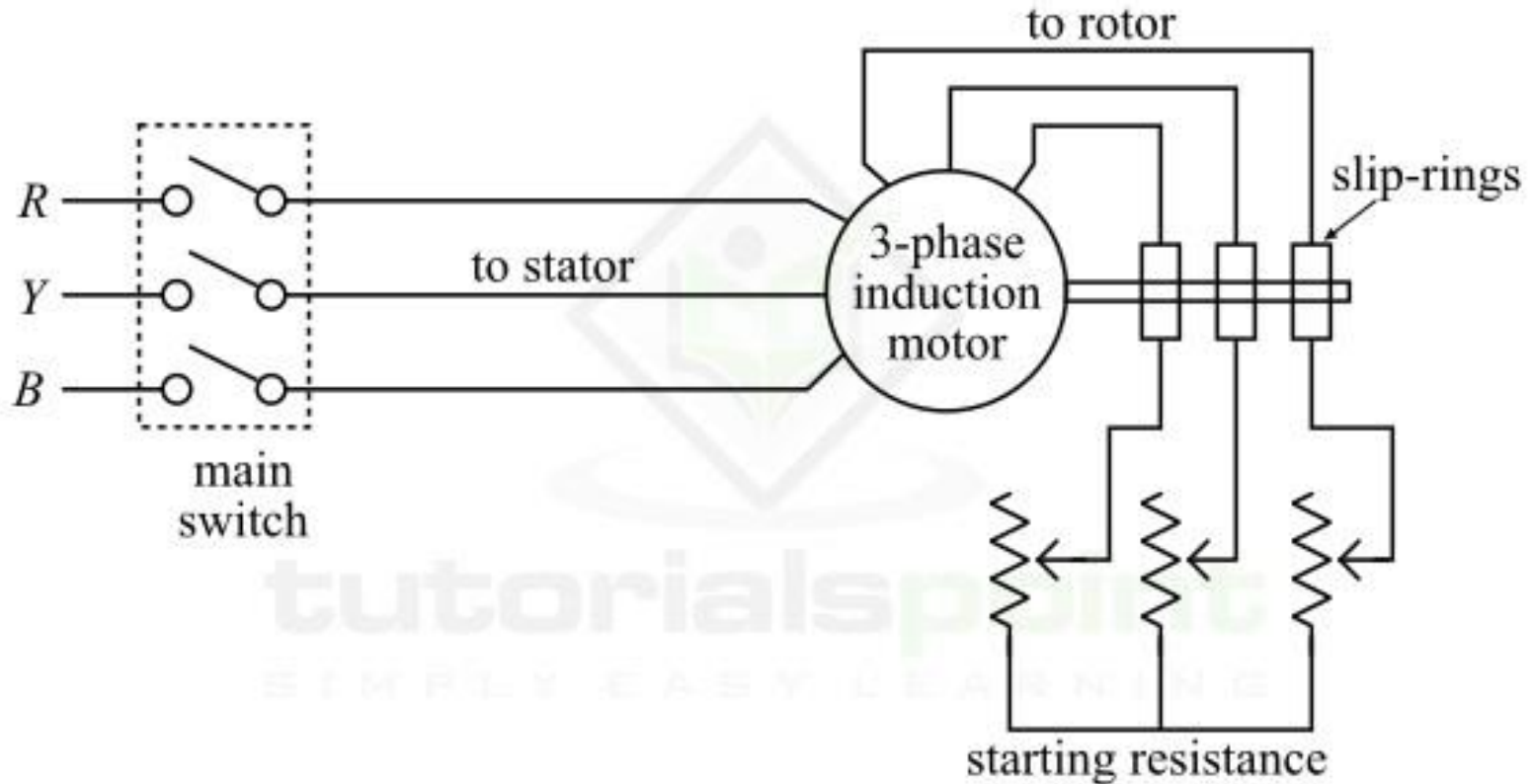


Figure 4 - Rotor Resistance Starter



ROTOR RESISTANCE STARTER

- This method of starting is applicable to slip-ring induction motors only.
- In this method, a variable star-connected rheostat is inserted into the rotor circuit through slip rings, and full supply voltage is applied to the stator winding.
- At the instant of starting, the handle of the star-connected rheostat is set in the 'off' position. Consequently, a maximum resistance is inserted in each phase of the rotor circuit, and reduces the starting current. At the same time, this resistance increases the starting torque.
- When the motor picks up speed, the external resistance is gradually removed from the rotor circuit by moving the rheostat handle. Once the motor attained about 80% of the normal speed, the handle is switched to the 'on' position, and thus the whole external resistance is removed from the rotor circuit.



KEEP
LEARNING.

Thank u

SEE YOU IN NEXT CLASS