



SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME : 19EE407 ELECTRICAL MACHINES AND DRIVES

II YEAR / 04 SEMESTER MECH

Unit 3 – SPEED CONTROL TECHNIQUES

Induction Motors Starting Methods



Starter

- ✓ By Adjusting voltage during starting , the current drawn by the motor and the torque produced by the motor can be reduced and controlled.

Functions of Starter

- ✓ Start and stop the motor
- ✓ Limit inrush current when necessary
- ✓ Permit automatic control when required
- ✓ Protect motor and other connected equipments from over voltage, no voltage, under voltage, single phasing etc



TYPES OF STARTERS

For Squirrel Cage Induction Motor:

- ✓ Primary / Stator Resistance Starter
- ✓ DOL (Direct On-Line) Starter
- ✓ Auto Transformer Starter
- ✓ Star – Delta Starter

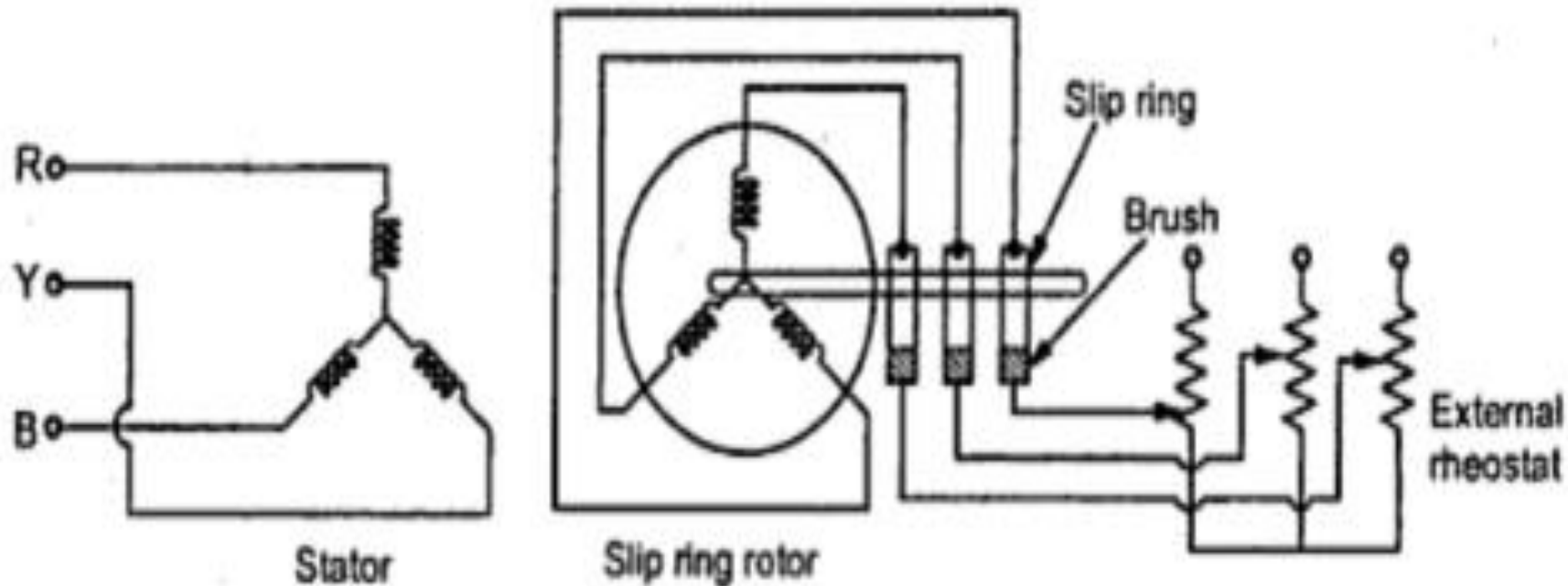
For Slip-ring Induction Motor:

- ✓ Rotor Resistance Starter



ROTOR RESISTANCE STARTER

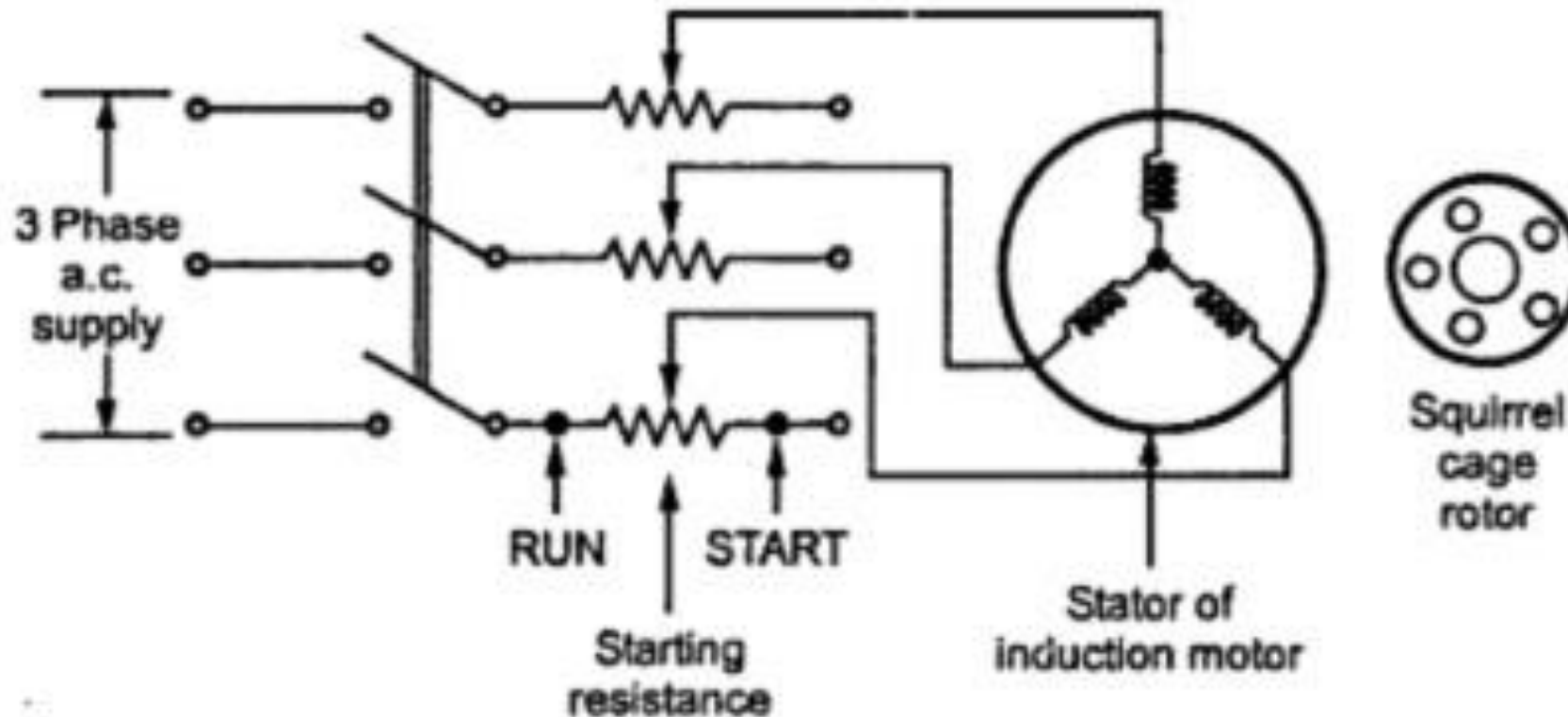
- ✓ Motor is started with full line voltage across the stator.
- ✓ Variable resistance is inserted in each rotor phase.
- ✓ This reduces starting current and increases rotor torque.
- ✓ As motor accelerates resistance is cut out in steps and short circuited by slip rings.





STATOR RESISTANCE STARTER

- ✓ Resistors or Reactors are connected in series with stator winding.
- ✓ Voltage drop in them causes a reduced voltage across the stator.
- ✓ As the motor picks up speed, resistors or reactors are cut out in steps and finally short circuited.





ADVANTAGES

Smooth acceleration.

High power factor during starting.

Less expensive than auto-transformer starter.

Closed transition starting

Up to 7 accelerating points available.

Resistors give off heat.

Low torque efficiency.

Starting duration usually exceeds

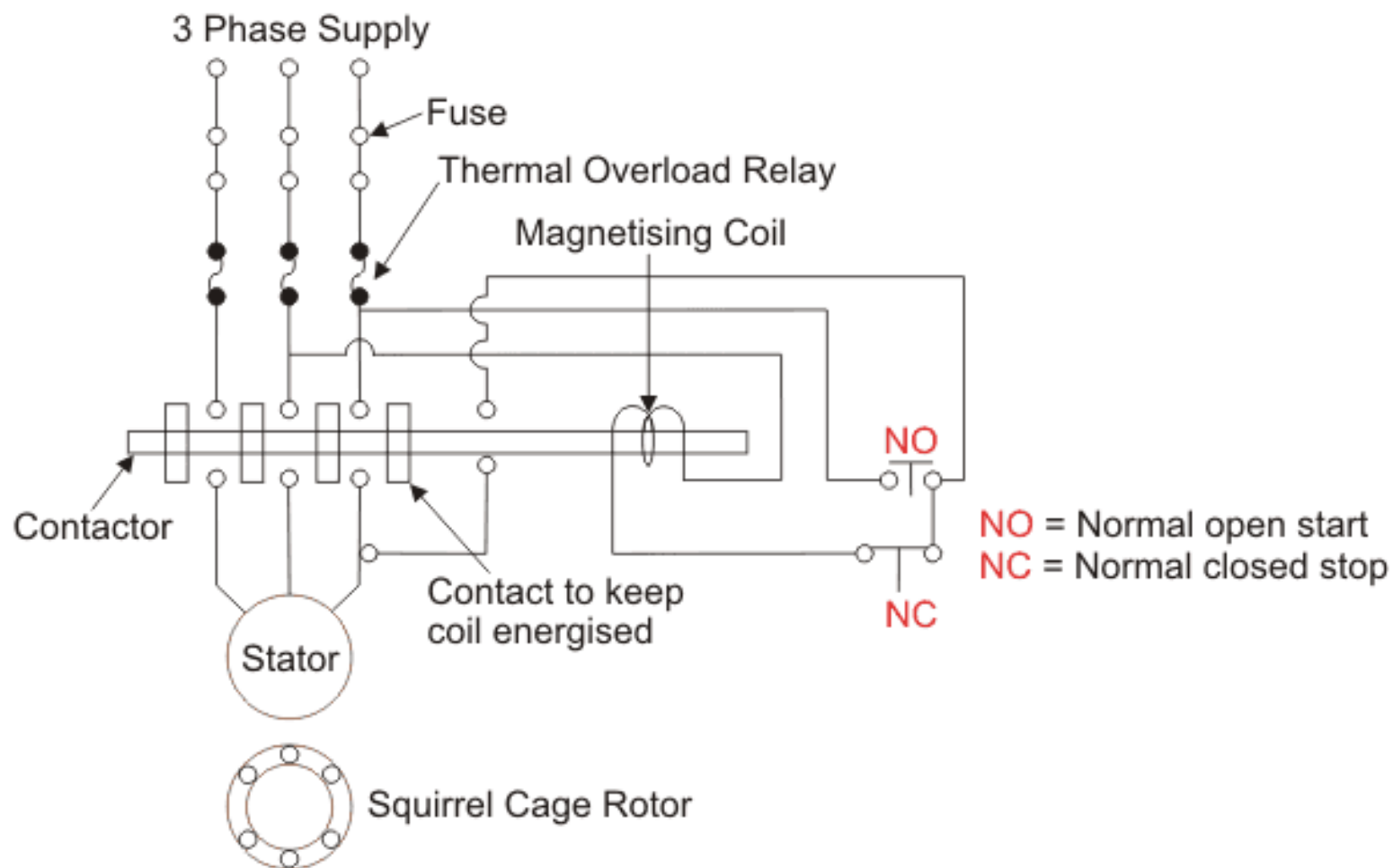
Starting voltage is difficult to adjust.

DISADVANTAGES



DOL STARTER

- ✓ Induction motor is connected directly across its 3-phase supply.
- ✓ The DOL starter consists of two switches namely start and stop
- ✓ It also has a circuit breaker (or) MCCB, overload relay & contactor for protecting the motor





Advantages

- Inexpensive.
- Gives almost complete starting torque at the beginning.
- Designing, operating and controlling this starter is easy.



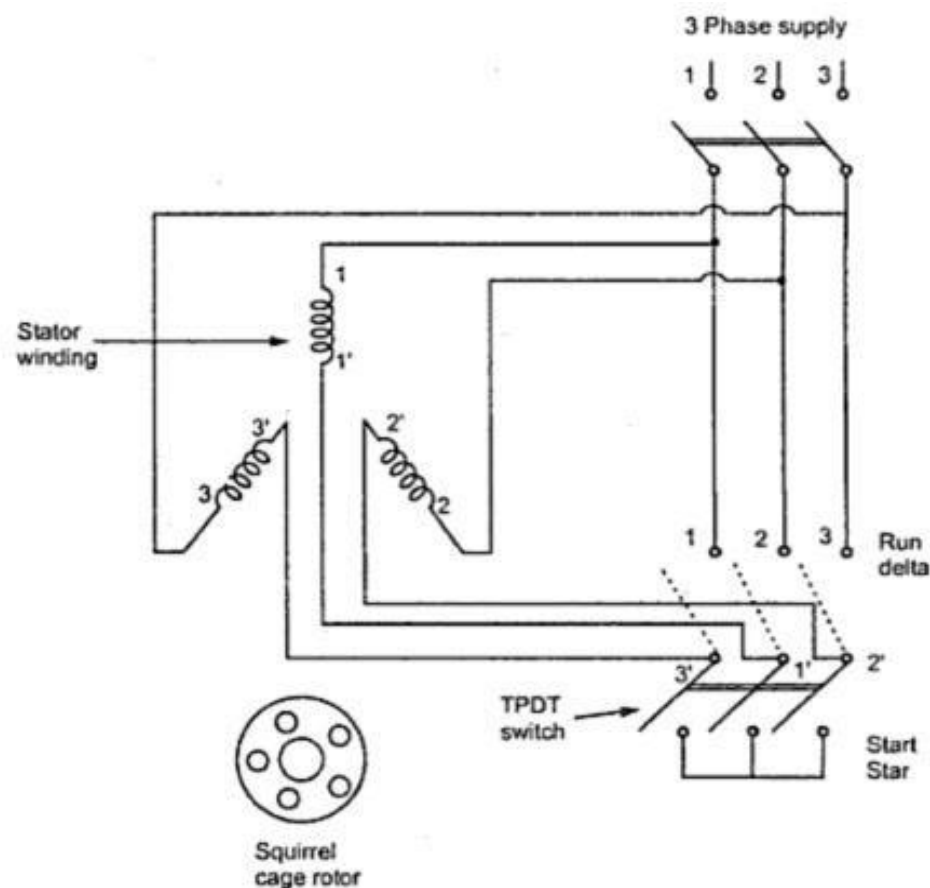
Disadvantages

- Starting current is very high.
- This starter causes an important dip in voltage.
- The lifespan of the machine might be reduced.



STAR – DELTA STARTER

- ✓ It is based on the fact that in star connection, 57.7% of the total line voltage appears across the coils.
- ✓ Stator windings are connected in star at the starting instant.
- ✓ After the motor attains required speed, a change over switch connects them in delta.





Advantages:

- Suitable for high inertia loads.
- Simple, cheap, effective and efficient.

Disadvantages:

- limited to applications where high starting torque is not required.
- Not suitable for line voltages exceeding 3000V.



AUTO-TRANSFORMER STARTER

- ✓ Reduced voltage is obtained by taking tappings from a three phase autotransformer.
- ✓ Transformer oil is mostly used as the arc quenching medium.
- ✓ This can be manually or magnetically operated

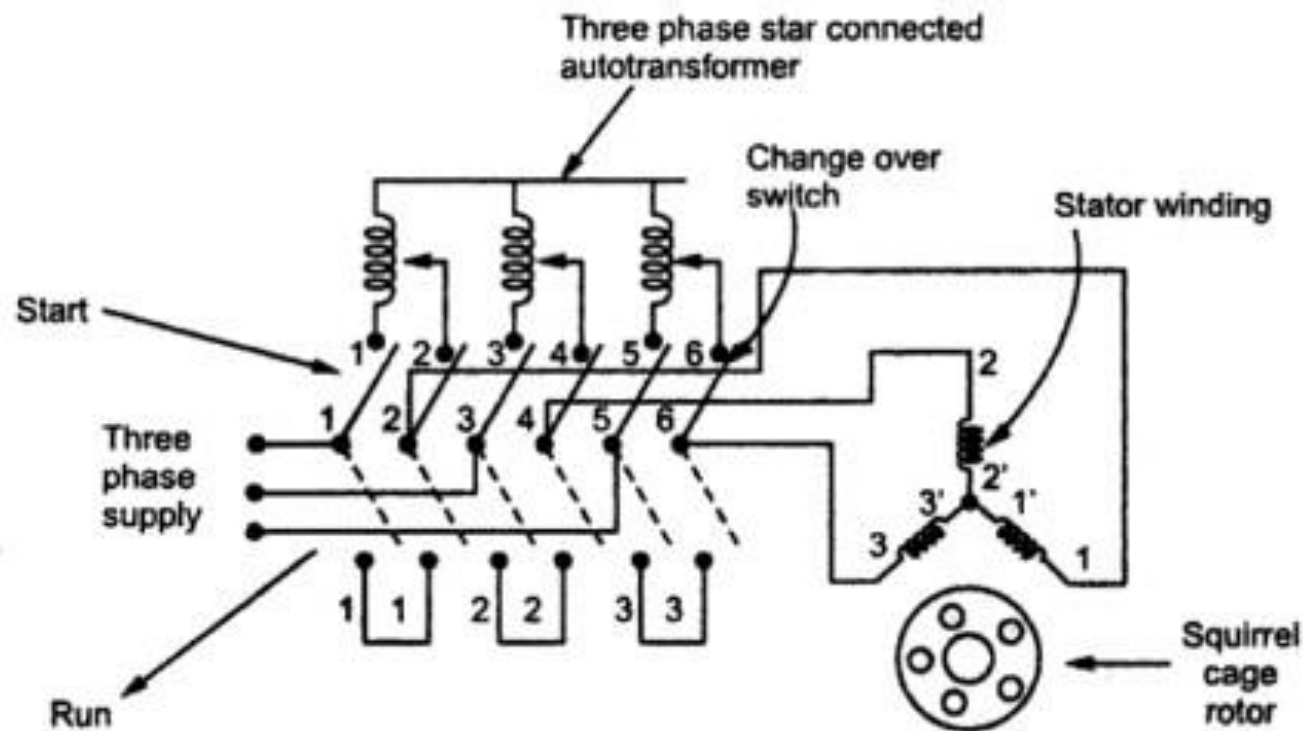


Fig. 7.2 Autotransformer starter



ADVANTAGES

less voltage is obtained by transformation.

Higher torque per armature current.

Starting voltage can be adjusted.

Suitable for longer starting periods.

Motor current is larger than supply current.

Low power factor

Higher cost in case of low power output rating motors.

DISADVANTAGES