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RAJAT

TECHNICAL MANUAL
FOR

EFFECT OF CAPACITOR ON STARTING & RUNNING OF SINGLE PHASE INDUCTION MOTOR

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EFFECT OF CAPACITOR ON STARTING & RUNNING OF SINGLE PHASE INDUCTION MOTOR

EXPERIMENT

To study the effect of capacitor on the starting and running of single phase Induction Motor and the method of reversing the direction of rotation.

OBJECTIVE

To investigate the need of the capacitor in the auxiliary winding circuit of a single phase induction motor, both in starting and running condition and to determine the method of reversing the direction of rotation.

THEORY

When single-phase supply is applied across one single phase winding on the stator of a single phase Induction Motor, the nature of the field produced is alternating and as such the rotor will not develop any starting torque. It has however been observed that once the motor is given an initial rotation it continues to rotate.

In a single-phase motor, to provide starting torque, an additional winding is provided, which is called the auxiliary winding. The main and the auxiliary windings are connected in parallel across a single-phase supply. The impedance of the two windings are made different so that currents flowing through these windings will have a time phase difference as shown in Fig '1'.

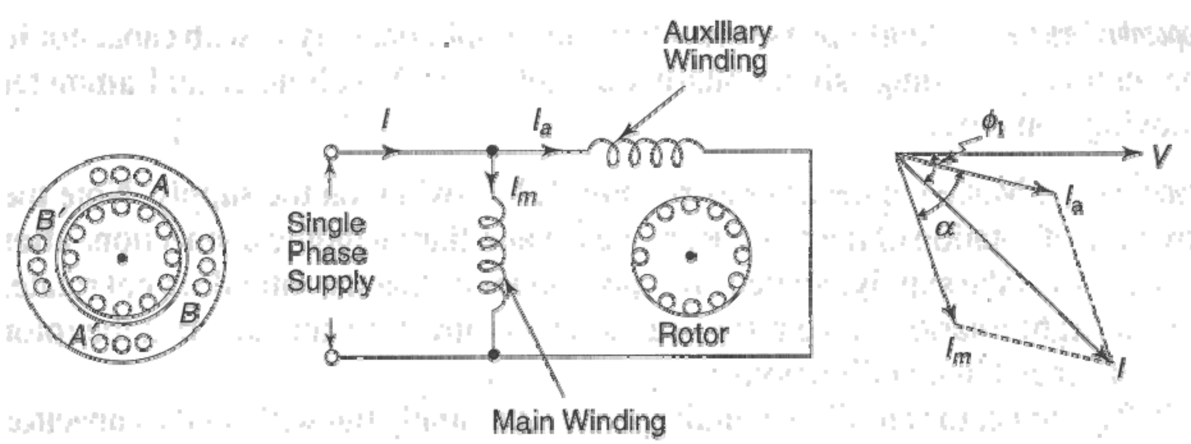


Fig-'1' : Single Phase Induction Motor winding carrying currents which have a time phase difference of α degree.

(a) Need of a Capacitor in the Auxiliary Winding Circuit

A single phase motor having a main winding and an auxiliary winding fed from a single phase supply can be considered as equivalent to a two phase motor having a single phase supply.

Since the two windings are not identical, the two currents Im and Ia will have a time phase displacement. Now if by any means the time phase displacement between the two currents Im and Ia flowing through the two windings can be made 90^O, a single phase motor will behave exactly like a two phase motor. The time phase displacement between Im and Ia can be increased by using a capacitor in the auxiliary winding as shown in Fig -'2'. The capacitor will also improve the overall power factor of the motor. From the phasor diagrams of Fig –'1' & Fig –'2' it will be observed that the power factor of the motor is improved when a capacitor is introduced in the auxiliary winding circuit. If a capacitor is to be used only for achieving high starting torque, then the auxiliary winding can be switched off when the motor picks up speed.

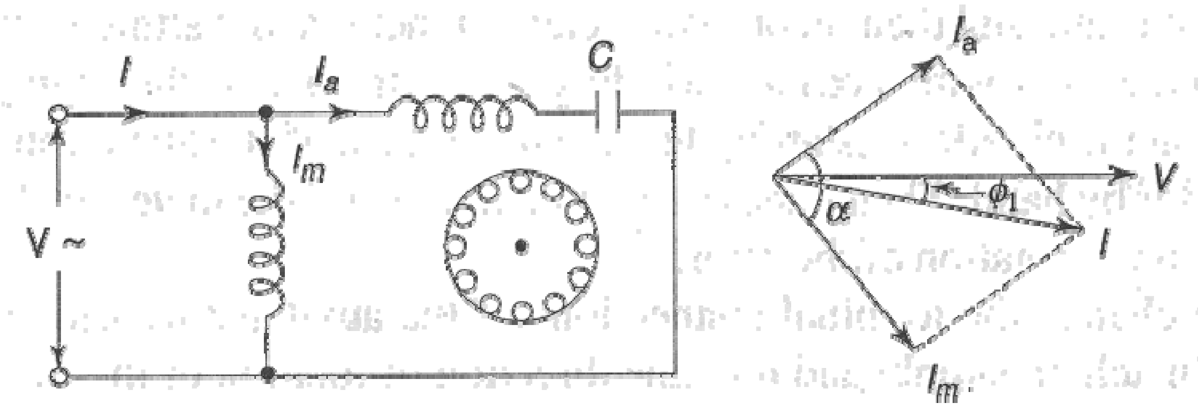


Fig-'2' : Time phase difference of nearly 90O between the main and auxiliary winding current is achieved by using a capacitor in the auxiliary winding circuit.

(b) Method of Reversal of Direction of Rotation

The direction of rotation of a split phase type induction motor having main and auxiliary winding, gets reversed if the current direction in any one of its windings is reversed. This is done by reversing the two terminal connections of the auxiliary or main winding across the supply. The leads of the main and auxiliary winding can be differentiated from each other (if lead marks are not labeled) by measuring resistances of the two windings. The resistances of auxiliary winding for motors of 1/16 kW and more are generally greater than the resistance of the main winding.

APPARATUS REQUIRED

Single-phase induction motor split phase type with capacitor in the auxiliary winding. Single-phase wattmeter (one), voltmeter and ammeter (MI type).

CIRCUIT DIAGRAM

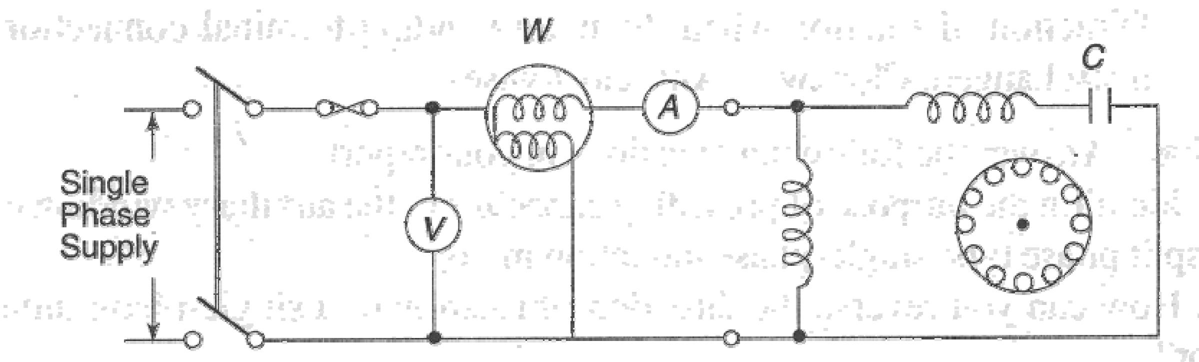


Fig-'3' : Connection diagram for determine the effect of capacitor on the performance of a single phase induction motor.

PROCEDURE

1. Make connections as per Fig –'3'. Switch on the supply through variac. Note the direction of rotation of the rotor. Remove the auxiliary winding connections after switching off the supply. Switch on supply and note that the rotor does not rotate. Give a slight rotation to the rotor in a particular direction and note that the rotor picks up speed in that direction.

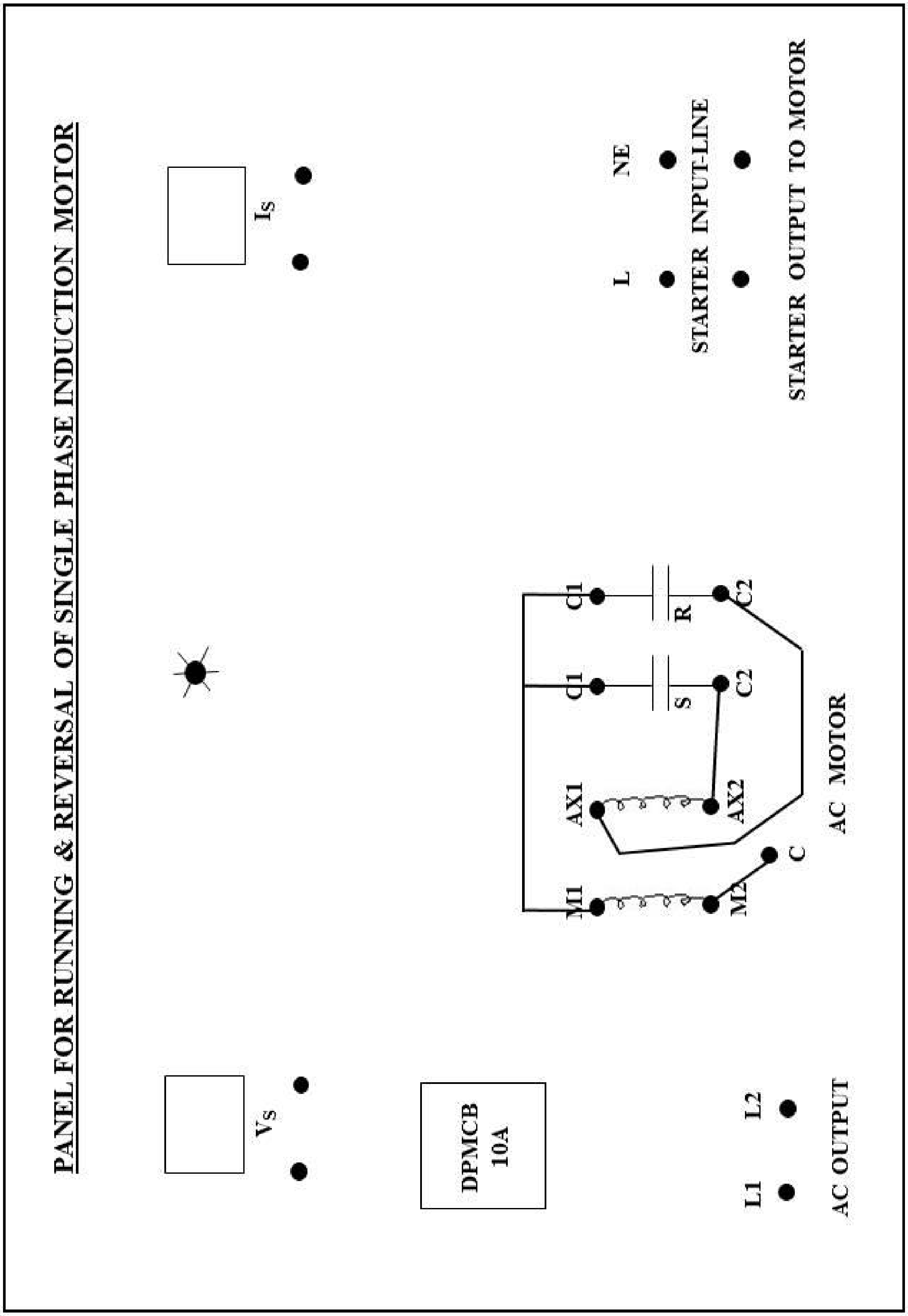
2. Reconnect the auxiliary winding across the supply but without the capacitor in the circuit (short the two terminals across which the capacitor was connected). Switch on the supply and observe if the rotor starts rotating. In case the rotor rotates, feel the magnitude of starting torque by holding the shaft by hand. Allow the rotor to rotate and then record voltmeter, ammeter and wattmeter readings.

3. Run the rotor with auxiliary winding connected across the supply with the capacitor in the circuit. At starting feel the magnitude of starting torque by holding the rotor by hand. Then release the rotor and record the meter readings. Not the direction of rotation of the rotor.

4. Interchange the terminal connections of the auxiliary winding across the supply. Switch on supply and note the direction of rotation of the rotor. Repeat this for the main winding also.

OBSERVATIONS

Ser No.	Input Power (W)	Input Voltage (V)	Input Current (I)	Power Factor Circuit Condition cos ϕ
1				Without capacitor in the auxiliary winding with capacitor in the auxiliary winding.
2				
3				
4				
5				


PANEL FOR RUNNING & REVERSAL OF SINGLE PHASE INDUCTION MOTOR
I_S
V_S
DPMCB
10A
M1
M2
AX1
AX2
C1
C2
S
C1
C2
R
C
AC MOTOR
L
NE
STARTER INPUT-LINE
STARTER OUTPUT TO MOTOR
L1
L2
AC OUTPUT