DETERMINATION OF X_d AND X_q OF SALIENT POLE SYNCHRONOUS MOTOR

AIM:

To determine the direct axis reactance X_d and quadrature axis reactance X_q by conducting a slip test on a salient pole synchronous machine.

APPARATUS REQUIRED:

Sl. No.	Equipment	Type	Range	Quantity
1	Voltmeter	MI	(0-300)V	1 no
2	Ammeter	MI	(0-5)A	1 no
3	Rheostat	Wire-wound	400 Ω /1.7A	1 no
4	Tachometer	Digital	*****	1 no
5	Connecting Wires	*****	*****	Required

NAME PLATE DETAILS:

DC Motor (prime mover)	3- ϕ Alternator
KW :	Power Rating:
Voltage :	PF :
Current :	Line voltage:
Speed :	Speed
Exctn : Shunt	Exctn Voltage:
Voltage :	Rated Current :
Field current::	

3- ϕ Auto transformer Details:

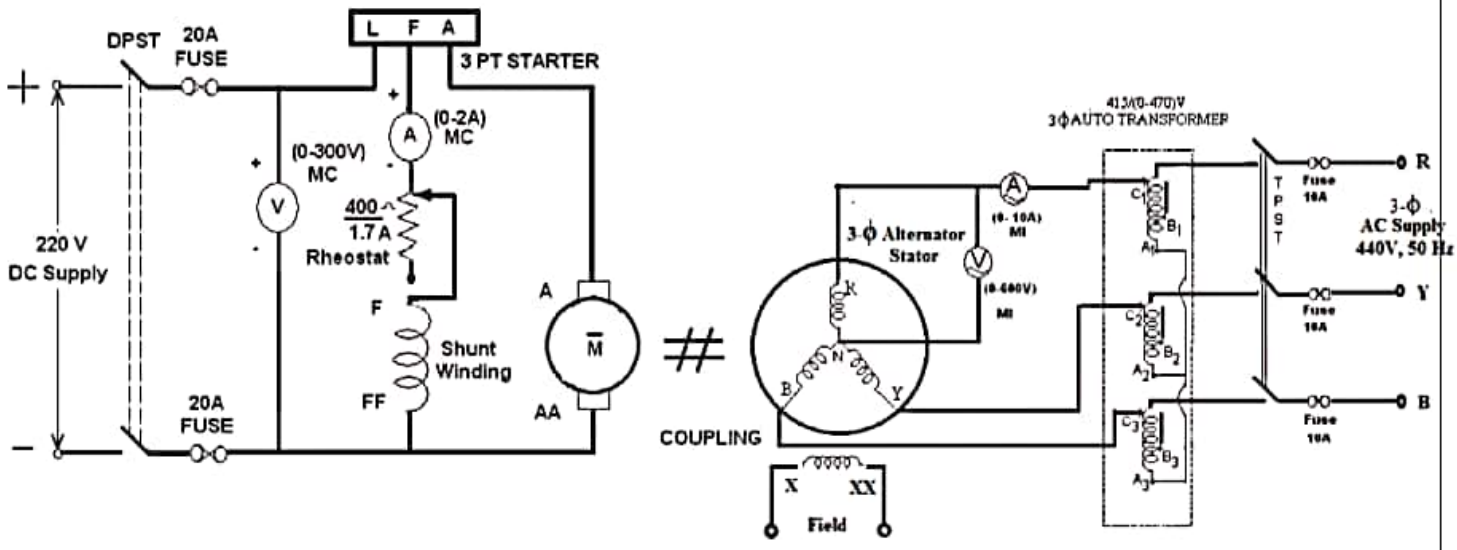
Input Voltage: _____(Volt)

Output Voltage: _____(Volt)

Current:_____(Amp.)

Frequency: _____(Hz)

CIRCUIT DIAGRAM:



PROCEDURE:

1. Connections are made as per the circuit diagram.
2. Initially set field regulator, 3-ϕ variac at minimum position and TPST switch open.
3. The DC motor is started slowly by sliding starter handle and it is run at a speed slightly less than the synchronous speed of the alternator.
4. Close the TPST switch.
5. With field winding left open, a positive sequence balanced voltages of reduced magnitude (around 25% of rated Value) and of rated frequency are impressed across the armature terminals.

6. The prime mover (DC motor) speed is adjusted till ammeter and voltmeters pointers swing slowly between maximum and minimum positions.

7. Under this condition , readings of maximum and minimum values of both ammeter and voltmeter are recorded

CALCULATIONS:

$$X_d = \frac{\text{maximum armature terminal voltage per phase}}{\text{minimum armature armature current per phase}}$$

$$Xq = \frac{\text{minimum armature terminal voltage per phase}}{\text{maximum armature current per phase}}$$

Note:

1. When performing this test, the slip should be made as small as possible.
2. During Slip test, it is observed that swing of the ammeter pointer is very wide, whereas the voltmeter has only small swing.

TABULAR COLUMN:

Sl no.	Speed	Vmax (V_L)	Vmin (V_L)	Imax (I_L)	Imin (I_L)	X_d	X_q

RESULT: