GRID CONNECTED OPERATION OF SINGLY EXCITED INDUCTION GENERATOR

Aim: Determination of the performance characteristics of a grid-connected Induction generator.

Theory:

A singly-excited induction machine connected to an ac source of appropriate voltage and frequency can operate either as a motor or as a generator. Regeneration is possible, if the rotor of the induction machine is made to rotate above synchronous speed decided by the supply frequency and the pole number of the machine. The terminal voltage applied to the machine maintains the excitation by supplying lagging magnetizing current, which in turn results in rotating magnetic field for both the motoring, and generating mode of operation.

The grid-connected induction generator (GCIG) takes its excitation from the lines and generates real power via slip control when driven above the synchronous speed. The operation is relatively simple as voltage and frequency are governed by the grid voltage and grid frequency respectively. The GCIG results in large inrush and voltage drop at connection, and its operation makes the grid weak. The excessive VAR drain from the grid can be compensated by the shunt capacitors, but it causes large over voltage during disconnection. Therefore, the operation of GCIG should be carefully chalked out from the planning stage itself. The performance of the GCIG under balanced and unbalanced faults should be thoroughly investigated to ensure good quality and reliable power supply.

Procedure:

1. Connect the circuit as per the circuit diagram.
2. Note down the frequency of the supply and thereby calculate the synchronous speed (N_S).
3. Make sure that the DPST which connects DC armature terminals and DC supply should be kept open. Moreover, be ensure with the DPST internal connections.
4. Now give DC supply to field circuit of DC machine only (not to the armature. SPST should still kept open)
5. Start the induction motor. Make sure that 3-ph variac is varied in smooth steps at initial stage so as to allow the measurement instruments not to exceed their ratings due to sudden inrush current.
6. Note down the voltage generated along with the polarity at the DC machine terminals at one end of DPST terminals.
7. Compare the above value along with polarity with the other end of DPST.
8. If both match each other, then close the DPST.
9. Now increase the speed of machine above synchronous speed (N_S) and note down the wattmeter reading and corresponding speed.

Exercise: Plot the graph of power delivered by IM against speed.

CIRCUIT DIAGRAM: