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Discussion Questions:-

(1) Frequency of alternator is slightly higher than grid freq. So that angular speed of rotation of bus voltage and alternator terminal voltage is different. This ensures that the phase difference between 2 phasors keep changing from 0-360°. This helps in knowing when alternator terminal voltage and bus voltage are in phase. At that points, the lamp becomes dark. Then the breaker is closed and alternator terminals and grid is connected. This ensures alternator voltage doesn't suffer from sudden and large change in voltage phase.

(2) Wrong synchronisation can lead to potential damage to synchronous machine. When synchronous machine is connected to grid, electrical and mechanical systems are connected. Before closing breaker, angular velocity of rotating magnetic field and freq of voltage induced in stator are governed by rotor speed.

After switch is closed, angular velocity is governed by grid freq. Rotor and prime mover have to change speeds immediately to match the grid system. In wrong synchronisation this immediate change in speed leads to large transient torque on mechanical system. This leads to damage to synchronous machine.

(3). Decreasing value of field voltage. Supplied to DC machine, decreases field current. So DC machine field current is decreased, power generated by synchronous machine increases and at some point, synchronous machine power goes from -ve to +ve. Then synchronous machine is working as a generator supplying power to the grid.

(4) Max. voltage seen by bulbs is the sum of output voltage of alternators. This happens when voltages are 180° out of phase. So voltage rating of bulbs should be 800V.