SYNCHRONIZING PANEL FOR ALTERNATOR TO LINE

Vaibhav Upare[1], Sachin Bhute[2], Pratik Kadu[3], Harshad Bhoyar[4], Rakshit Janwe[5], Sandip Chahande[6]

[1]*Student, Department of Electrical Engineering, PJLCOE, Nagpur, Maharashtra, INDIA*

[2] *Student, Department of Electrical Engineering, PJLCOE, Nagpur, Maharashtra, INDIA*

[3]*Student, Department of Electrical Engineering, PJLCOE, Nagpur, Maharashtra, INDIA*

[4]*Student, Department of Electrical Engineering, PJLCOE, Nagpur, Maharashtra, INDIA*

[5]*Student, Department of Electrical Engineering, PJLCOE, Nagpur, Maharashtra, INDIA*

[6]*Assistant Professor Dept. Of Electrical Engineering,Priyadarshini J.L. College Of Engineering, Nagpur*

ABSTRACT

Connecting a group of alternator to a bus-bar and the alternator must have same voltage and frequency as that of bus-bar. This is called as synchronization of alternator. There are some conditions which have to be satisfied by the alternator which have to be connected parallel to bus-bar to be in synchronization. Synchronizing means matching the frequency, voltage, phase angle and phase sequence of two power sources.

An alternator cannot send power to electric power system until its voltage, frequency, phase sequence and other parameter matches with the network to which the alternator is connected. The case of synchronization rises because we are connecting many alternators in parallel to supply the demanded load. So we need to match all the parameter of connected alternators with bus-bar to deliver power to load.

Keywords: *Phase sequence meter, Frequency meter, voltmeter*

INTRODUCTION

Synchronization of alternator means the connecting an alternator into grid in parallel with many other alternators that is in a live system of constant voltage and constant frequency. Many alternators and loads are connected into a grid, and all the alternators in grid are having same output voltage and frequency. It is also said that the alternator is connected to infinite bus-bar.

THEORY OF SYNCHRONIZING:-

If two like alternators having the same wave form are running with their electromotive force waves in uniform and are generating the same voltage they may be made to operate in parallel. This is due to the reversibility of the alternators that is the ability of either to operate as a synchronous motor in the same direction of rotation if its driving power be removed.

NECESSITY OF SYNCHRONIZATION:-

- An alternator cannot deliver power to electric power system until its voltage, frequency, phase sequence and other parameters matches with the network to which the alternator is connected.
- The case of synchronization arises because we are connecting many alternators in parallel to supply the demand load. So we need to match all the parameter of connected alternator with bus-bar to deliver power to load.
- By synchronization we can match all the other parameters of one alternator with the other alternator and also with the bus-bar and deliver the required power to load.
- Synchronization of alternator is also called as paralleling of alternator

METHODOLOGY

Alternator:-

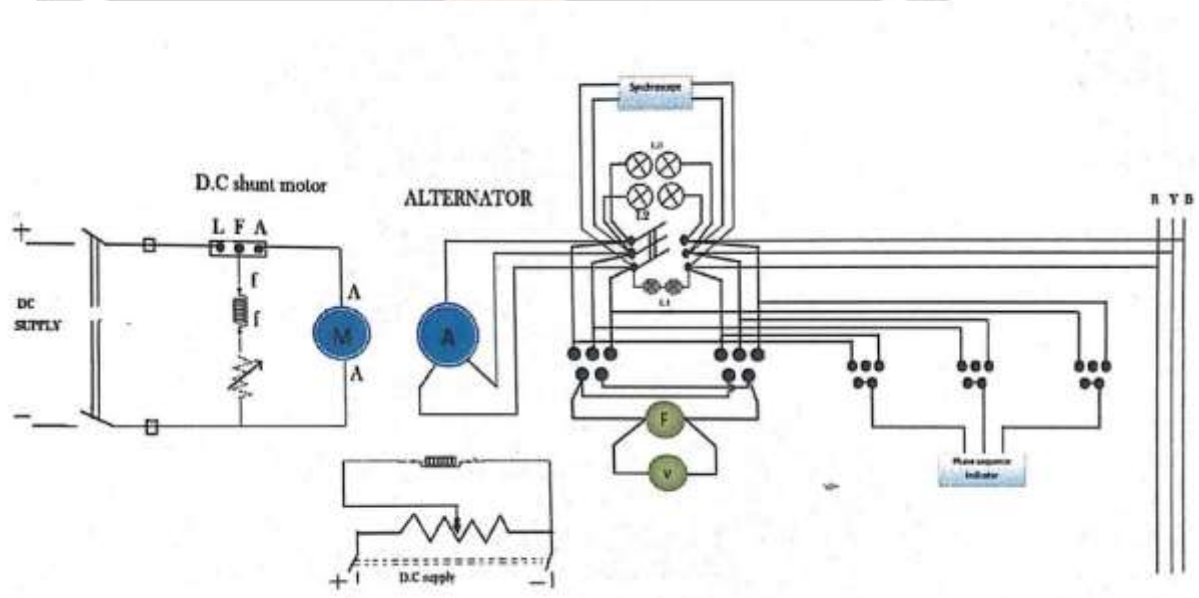
An alternator is an electrical device that coverts mechanical energy to electrical energy in the form of current. Some alternator are rotating magnetic field because of cost and simplicity of alternator. Occasionally, a linear alternator with a stationary magnetic field is used. In principle, AC electrical generator can be called an alternator, but usually the term refers to small rotating machines driven by automotive and other internal combustion engines.

History of Alternator:-

In the 1971s, alternator current generating station were known by in simple form of magnetic induction of electric current. Rotating generators naturally produced alternating current but, since there was some use for it, it was normally converted into direct current via the addition of a commentator in the generator. The early machines were made by pioneers such as Michael Faraday and Hippolyte Pixii. Faraday makes Rotating Rectangle. Lord Kelvin and Sebastian Ferranti also made early alternators, producing frequencies approximately 100 and 300 Hz.

The late 1872s saw the introduction of first large scale electrical systems with generation stations to power Arc lamps, used to light whole streets, factory yards ,or the interior of large warehouses. Some, such as Yablochkov arc lamps introduced in1879, ran better on alternating current, and the development of these early AC generating systems was accompanied by the first use of the word "alternator". Supplying the proper amount of voltage from generating stations in these early systems was left up to the engineer's skill in "riding load". In 1884 the Ganz Works invented the constant voltage generator that could produce a stated output voltage, regardless of the value of the actual load. The introduction of transformers in the mid-1881s led to the widespread use of alternating current and the use of alternators needed to produce it. After 1892, poly-phase alternators were introduced to supply currents of multiple differing phases. Specialized radio frequency alternators like the Alexanderson alternator were developed as long wave radio transmitters around World War 1 and used in a few high power wireless telegraphy stations before vacuum tube transmitters replaced them.

BLOCK DIAGRAM



PRINCIPLE OF OPERATION

A conductor moving relative to a magnetic field develops an emf in it (Faraday's Law). The polarity reverses when it moves under magnetic poles of opposite direction. The field cuts the conductors, generating an induced emf, as the mechanical input causes the rotor to turns.

In the stator winding ac voltage apply across the rotating magnetic field . Since the currents in the stator windings vary in step along with position of the rotor, an alternator is a synchronous generator.

The rotor's magnetic field may called a permanent magnets, or by a field coil electromagnet. Automotive alternators use a rotor winding which allows control of the generated voltage by varying the current in the rotor field winding. Permanent magnet avoids the loss due to magnetizing current in the rotor, but is restricted in size, due to the cost of the magnet material. Since the permanent magnet field is constant, the terminal voltage vary directly with the speed of the generator. Brushless AC generators are larger used in automotive applications.

RESULT

Synchronous alternator must be connected to the power system only when the slip (speed difference), voltage difference, and angle difference are within acceptable parameters. Faulty synchronizing can damage the electrical and mechanical generating system, cause disturbances to the power system, and cause the unit to trip offline. Synchronizing systems include to controls the frequency and voltage of the incoming generator to the running bus and instrumentation to allow operators to monitor the critical synchronizing measurements to determine when to close the breaker. The synchronizing process can be manual or automatic or some combination of both. In many cases, when an automatic system is installed, the manual system is maintained as a backup to the automatic system.

CONCLUSION

Synchronous alternators must be linked to the power system merely when the slip (speed difference), voltage difference, and angle difference are within adequate bounds. False synchronization may harm the electrical and mechanical generating system, cause conflicts to the power system, and cause the unit to trip offline. Synchronizing systems comprise controls to regulate the frequency and voltage of the arriving alternator to the consecutively bus and equipment to allow operators to observe the critical synchronizing measurements to decide when to close the breaker. The synchronizing process can be either manual or automatic or several grouping of both. In several circumstances when programmed system is installed, the manual system is preserved as a backup to the automatic system. Thus, we have studied the element any ideas of synchronization. The inward generator will be coupled to the running system only when the voltage, frequency, phase angle and phase sequence of the alternator is exactly same as that of the bus bar supply. Synchronization panel gives the measurement of all the quantities required to consider while closing the synchronization switch.

FUTURE SCOPE

Modern microprocessor components and advanced technology, such as synchrophasors, can revolutionize the way generator synchronizing systems are designed. Many items touched upon in the preceding discussion of fundamental concepts. This information discusses how reliability, flexibility, and improved performance can be obtained using the new technologies.

Eliminate Voltage Signal Switching An advanced microprocessor automatic synchronizer (A25A) with six isolated and independent single-phase voltage sensing inputs can eliminate the need to physically switch voltage signals. This can greatly simplify issues with isolation of instrument transformer circuits and hidden failures in complex synchronizing switch circuits. For the example system illustrated in Fig. 6, the two generator VTs and the two bus VTs could be wired to four of the six inputs on the A25A. If the generator breakers between the two generators it is not share common connections across all synchronizing breakers, each generator may require three VT signals for a total of six. This is just one of many examples. Synchronizer can be used to operate the synchronizing process without a synchronizing panel. But this design has the automatic synchronizer as a common device for both the operator indication needed for manual synchronizing and the hardware needed for automatic synchronizing.

For this reason, this type of synchroscope is limited usefulness. B. Synchrophasor-Based Synchroscope To fully eliminate additional voltage and control signal switching circuits and allow complete computer human machine interface (HMI) integration, a computer-based synchronizing panel using information from sources independent of the automatic synchronizer is required. It is necessary to manually independent synchronization of system, low latency is important. When the operator sees the angle approaching 0 degrees and initiates the close command, the synchroscope must not be displaying old information. In the following discussion, the term "synchroscope" is used, but it is important to understand that the synchroscope includes all of the indications found on a complete synchronizing panel. Delays in real-time computer systems result from polling latency, processing time, and the screen update rate.

REFERENCES

1) IEEE Standard for Salient-Pole 50 Hz and 60 Hz Synchronous Generators and Generator/Motors for Hydraulic Turbine Applications Rated 5 MVA and Above, IEEE Standard C50.12-2005.

2) IEEE Standard for Cylindrical-Rotor 50 Hz and 60 Hz Synchronous Generators Rated 10 MVA and Above, IEEE Standard C50.13-2005.

3) IEEE Guide for Operation and Maintenance of Turbine Generators, IEEE Standard 67 - 2005.

4) IEEE Guide for AC Generator Protection, IEEE Standard C 37.102-2006.

5) W. M. Strang, C. J. Mozina, B. Beckwith, T. R. Beckwith, S. Chhak, E. C. Fennell, E. W. Kalkstein, K. C. Kozminski, A. C. Pierce, P. W. Powell, D. W. Smaha, J. T. Uchiyama, S. M. Usman, and W. P. Waudby, "Generator Synchronizing Industry Survey Results," IEEE Transactions on Power Delivery, Vol. 11, Issue 1, pp. 174–183, Jan. 1996.

6) R. A. Evans, "A Manual/Automatic Synchronization Circuit for a 37.5 MVA Steam-Turbine-Driven Generator," IEEE Transactions on Industry Applications, Vol. 26, Issue 6, pp. 1081–1085, Nov./Dec. 1990.

7) G. Benmouyal, E. O. Schweitzer, III, and A. Guzmán, "Synchronized Phasor Measurement in Protective Relays for Protection, Control, and Analysis of Electric Power Systems," proceedings of the 29th Annual Western Protective Relay Conference, Spokane, WA, October 2002.

8) K. Koellner, C. Anderson, and R. Moxley, "Generator Black Start Validation Using Synchronized Phasor Measurement," proceedings of the 60th Annual Conference for Protective Relay Engineers, College Station, TX, March 2007.

9) K. C. Behrendt, "Relay-to-Relay Digital Logic Communication for Line Protection, Monitoring, and Control," proceedings of the 23rd Annual Western Protective Relay Conference, Spokane, WA, October 1996.