© April 2018 | IJIRT | Volume 4 Issue 11 | ISSN: 2349-6002

An Improved Method of Three Phase Induction Motor/Generator

[1]Ashish Kumar Singh, [2]Sumer Chand Prasad
[1] *Student, Department of Electrical & Electronics, PSIT Kanpur*
[2] *Assistant Professor, Department of Electrical & Electronics, PSIT Kanpur*

Abstract- **The Proposed System gives a brief review of Induction Generator theory. In the paper, we have covered the equivalent circuit along with performance characteristics. According to the process requirements, the relaying of Induction Generators can be done in various ways and it may vary from being a simple to very complex technique. For example - Induction Generator can be connected to natural gas system for minimum relaying and it can be used as a motor to function as accelerator and brake for a multi element train making it as a complicated connection. In this paper, a new scheme is suggested for low cost and reliable protection of induction motor against Under Voltages, Over Voltage, short circuit and Overheating.**

Index Terms- **Induction Motor, Protection**

INTRODUCTION

THE INDUCTION machine is a rugged simple machine consisting of a stator and caged rotor. The stator establishes a magnetic field which rotates at synchronous speed around the air gap. The flux of this field links the rotor, and the relative motion of the rotor, with respect to the rotating field, determines whether the induction machine acts as a motor or generator.

The induction machine does not know whether it is a motor or generator.

It will function as either, depending only on the machine speed relative to its design synchronous speed. If the rotor speed is less than the rotating magnetic field, the induction machine is motoring. When the rotor speed is greater than the magnetic field speed, the machine is acting as a generator.

As a motor, the directions of the real and reactive components of current are into the stator, and the transfer of energy across the air gap is to the rotor.

As a generator, the transfer of energy is from the rotor to the stator. The reactive component of current is still into the stator, and the real component of current has reversed and is out of the rotor. Use is made of this concept in the relaying. The real component of current is into the stator as a motor and out of the stator as a generator.

PROCESS DESCRIPTION

The block diagram in Fig. 2 illustrates the process flow. It is a boots and strap operation where air is compressed and supplied to the regenerator of a fluid catalytic cracker unit (cat cracker). In the regenerator coke is burned off the catalyst (cat cracker). In the regenerator, coke is burned off the catalyst exhaust flue gasses or hot gasses are normally wasted by venting to the atmosphere.

The first attempts to recover this wasted energy through hot gas expanders failed because the dirty flue gas destroyed the expander blades after only a few hundred hours. With the development of the third stage . separator to remove the catalyst, the hot gas can now be run through the separator and conditioned by water to a temperature suitable for the hot gas expander.

The energy recovered from the hot gasses through the expander now drives the compressor and in most instances supplies more horse power to the drive train than required by the compressor. The extra horsepower (energy) of the expander now drives the train to a new speed and is braked by the induction motor/generator acting as a generator. In this operating mode kilowatts are delivered to the system through the motor/generator.

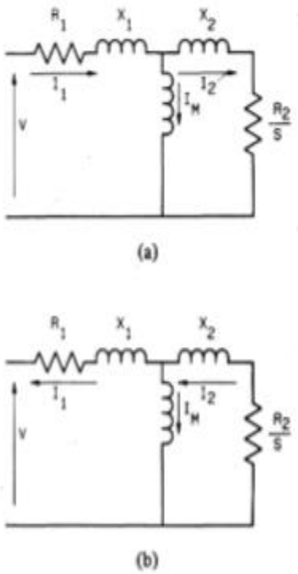

Fig. 1. The induction machine equivalent circuit illustrating direction of current flow. R_1, X_1, I_1: stator resistance, reactance, and current. R_2, X_2, I_m: rotor resistance, reactance, and current. X_m, I_m: magnetizing branch reactance and current. V: terminal voltage. (a) Motoring mode. (b) Generating mode.

To have the hot gasses available for the expander it is necessary to have the train in operation in order for the air compressor to supply air to operate the regenerator. To get the mechanical system up to speed, a steam turbine used and in most instances the induction machine is brought on line at somewhere around 80 to 85 percent orated speed , and acting as a motor helps to accelerate the train During the acceleration time standard locked rotor relay protection is

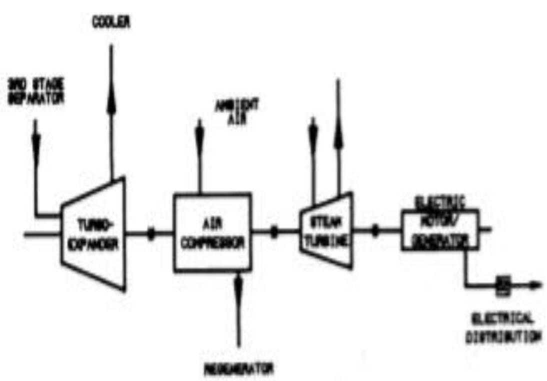

Fig. 2. Block diagram for energy recovery drive train.

required, and the timer permits tripping the circuit breaker if problems are present. Until the cat cracker is in operation and the expander is furnishing power to the train, the machine is required to serve as a motor to maintain the speed of the train. When the process has stabilized and the expander is supplying the mechanical energy required by the air compressor, excess energy may be delivered as kilowatts to the electrical system. Some plants may have excess steam which is supplied to the steam turbine, and the mechanical energy is delivered through the motor/generator as kilowatts to the electrical system. The conditions mentioned previously,

1) The expander supplying power to the compressor
2) The excess expander power and some excess steam through the steam turbine delivering kilowatts to the power system by way of the motor generator could constitute normal operation. An upset to the normal operation of the system can be caused by the ignition of the flue gasses called an afterburner. When an afterburner occurs, excess energy through heat will be introduced into the expander and eventually to the system through its motor/generator as kilowatts. This is accomplished by the speed of the drive train increasing and the motor/ generator acting as a brake on the drive train by introducing kilowatts into the electrical system. This is an abnormal condition and the steam turbine governor controlling the throttle valve takes corrective action. The motor/generator acting as a brake is critical to the entire train in preventing over speed. Therefore, the relay protection that is installed should consider protection to the motor/generator and consider the problem of mechanical damage to the train if over speed occurs due to feeder circuit breaker opening. Likewise, if the output of the expander drops-off the speed of the train will decrease causing the steam turbine to supply the power to maintain compressor speed. The decrease in speed will unload the motor/generator. In some instances, the steam turbine is rated to supply 67 percent of the compressor power requirements with the motor making up its difference. In this mode, the expander is usually out of service. The largest unit of this kind was recently installed in the Phillips Refinery in Old Ocean, TX. Mr. Tom Shaw of Bartlesville, OK, discussed this unit at the IEEE Petroleum and Chemical Industry Conference at Houston in 1980. The expander will develop 35 000 hip with the potential of45 000hp under upset conditions. The compressor requires 33 000 hip with the 15 000-hp motor serving as a brake for the additional 2 000 horsepower under normal operating conditions and as a restraint to the train

during the upset conditions. A 22-000hp steam turbine is utilized for start-up purposes. By utilizing both the steam turbine and the motor, the air compressor can be operated at full capacity without the expander.

CONCLUSION

To offer the best protection for 'the induction motor/ generator, the first step is to determine the process involved and how it affects the induction machine. An attempt has been made in this paper to list some of the options that are open for protection of the machine and some of the restraints that must be considered. This paper does not imply that the protective schemes shown here are the only protection that can be used. They reflect an operating philosophy and also the dictates of the process involved. The protectivescheme here has been over simplified and many statements are obvious to the design or application engineer. The intent is to cause further dialogue on the subject of the protection of the induction machine.

REFERENCES

[1] M. Cuka, R. AK kaya, A. Oz Turk. "Protection oak motors by means of microcontrollers", 10. Mediterranean Electro technical Conference, Helicon 2000, Nicosia, Cyprus, 3, pp. 1093-1096.

[2] A. Siddique, GS. Yadav, B. Singh, "A review of stator fault monitoring techniques of induction motors", IEEE Transactions on Energy Conversion, vol.20(1), 2005, pp. 106-114.

[3] Y. Zhongming, W. Bin, "A review on induction motor online fault diagnosis", The Third International Power Electronics and Motion Control Conference, PIEMC 2000, 3, 15-18 Aug. 2000, Beijing, pp. 1353-1358.

[4] M. Pelota, "Slip oak induction motors and how to minimize it", ABB Drives Press Releases Technical Paper, 2003, pp. 1-7, ABB, New Berlin.

[5] I. Cloak, H. Celia, I. Sofa, $. Demibra, "On line protection system for induction motors", Energy Conversion and Management, vol.46 (17), 2005, pp. 2773-2786.

[6] MEH. Benbouzid, "Bibliography on induction motors faults detection and diagnosis", IEEE Transactions on Energy Conversion, vol.14(4), 1999, pp. 1065-1074.

[7] W.A. Farage, M.I. Kamal, "Microprocessor-based protection system for three-phase induction motors", Electric Machines and Power Systems, vol.27, 1999, pp. 453- 464