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A REVIEW ON DESIGN OF AN ADVANCE AUTO SWITCHING OF THREE PHASE GENERATOR AT DES's COET DHAMANGAON RLY

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Abstract

The basic needs of human beings are food, clothes and shelter but now a day's money and electricity plays a vital role in human life. Electric power plays very important role in lifeline of any country and its continuous availability at minimum cost certifies the country's growth. The power failure is the major issue. Public, private sector and domestic users cannot handle the power outage. The discontinuous power supply introduces the loss in business, official work and domestic life. Because of the unstable electric supply, the optional source of power supply is use to meet up with the demand of energy.This paper involves the idea of advance auto switching of three phase generator at DES's COET Dhamangaon Railway. It provide the mechanism of automatic switching that transfer the consumer load to a power source side form a generator in case of power failure in the main supply. Its holds an important key in the provision of continues power supply through a near seamless switching between the main supply and an alternative standby sources like the generator set. It reduces the human efforts to start and stop the generator automatically.

Index Terms: *Change-over Switch, Generator, Load, Power Supply, Relay, Timer Delay.*

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1. INTRODUCTION

Today's electricity is one of the basic needs of human life which plays a important role in economic development of the nation. The role of electric power in everyday life increases. Due to unstable Electric energy it gives rise to the frequent use of alternative sources of power supply to meet up with the energy demands. The alternative sources of supply brings smooth switching and timely between the mains supply and the alternative sources whenever there is a failure on the mains source. There is also the need to reduce drudgery from switching between the two sources on the human side. This paper solves the problem of manually switching the generator. The Automatic Changeover switch, automatically switches over to the alternative source of power supply (generator) when there is a power outage. It equally switches over to the mains supply when power is restored and turns off the generator automatically.

The device which links the load and mains power supply or the alternative supply is called automatic change over switch. There is the use of the mains supply or an alternative source when there is failure in the mains source. This can either come in with single phase or threephase. Automatic changeover switch maintains constant power supply to the load by activating the generator automatically when there is need of generator.The user might not always be in need of the generator,hence the arrangement has been made to prevent the generator from starting should an outage occur.

Firstly, these switches were designed for manual operations, but automatic transfer switches were created because of increase in the technological advancement of electrical power control and automation. It reduces the interaction between the manpower in starting a generator and changing power supply from one source to another. An Automatic transfer switch (ATS) is an electrical/electronic switch. The function of automatic transfer switch is to sense the mains or public utility supply when interrupted and automatically starts up a secondary supply (i.e. a generator) if the utility remains unavailable. "Generator Transfer Switch" is term as ATS.

One cannot go on and on to emphasize the importance of power supply to our home and industries, but it is important to mention that the failure of power supply can bring discomfort in our homes and loss of revenue due to down time in the industries. Therefore in view of these considerations, this paper gives an idea of

designing and constructing a workable automatic changeover switch with generator starting and shut down functions. This switch turns ON the generator automatically in cases of mains power failure and connects the load to the generator output, alternatively it switches OFF the generator automatically when mains power is restored and returns the load to the mains power.

2.DESIGN METHODOLOGY

2.1 AC Power Source

The main power supply has a nominal three phase or phase to phase voltage level of 415V AC under normal condition and the single phase to neutral nominal voltage 240V. The main power supply of 415V, 44A is used in the DES's COET.

2.2 Generator

The device which converts the mechanical energy into electrical energy is called as generator. The stand-by generator set is commonly used to supply emergency power to most of the power consumers where the mains supply is unstable. The generator using in the DES's COET is nothing but the alternator. The generator which converts the mechanical energy into electrical in the form of alternating current is called as alternator. Initially, the generator at DES's COET has the manual switching and it is diesel generator.

Finally, it is important to determine the rating of the generator for the minimum capacity necessary of supply the selected load. Here the generator we are using is of 30 KVA. The generator is the diesel generator.

2.3 Automatic Transfer Switch

An ATS is used to switch the load between two power supplies are down of any one of them connected to the load. It makes sure the supply of power to the load with minimum small gap between the power failure and reconnecting the load to secondary power supply. The ATS is connected between load and the power supplies. Its function is to transfer the load from primary source of electricity or public utility power supply on its failure to secondary source of electricity orgenerator and then transfer the load back to utility mains supply when it restores.

Automatic changeover system designed for 3-phase 30KVA generator operates at 50Hz with a power factor of about 0.8.

ATS is also known as "Generator Transfer Switch", its main function is to detect the unavailability of utility mains supply and switch the load to the secondary supply and vice versa, potential transformers and current transformers are used tomeasure the current drawn by the load so that the energy can be managed. Temperature and fuel level sensing of generators can also be used to turn off the generator if temperature exceeds or fuel level drops below the predetermined level.

2.4 Load

Electrical load is an electrical components or portion of a circuit that consumes electric power. The examples of load are appliances and lights etc.

3. CALCULATION

The rating of the contactor and cable is calculated by the availability of the main supply and the rating of the generator at DES'sCOET

If the changeover is to be applied on a 220V/415V, 30 KVA generator operating at 50Hz and a power factor of about 0.8

To determine rating of contactor to be used as well as cable size

Apparent powers = 30 x 1000 VA (30 KVA)

Line voltage = V_L = 415 V

Phase voltage = V_{ph}= 220 V

Active power = P = Apparent power x power factor

= 30 x 1000 x 0.8

= 24 KW

Assuming a balanced load is being used,

P = 3 IP Vphcos$\emptyset$

24000 = 3 x IP x 220 x 0.8

I = 24000/ 3 x 220 x 0.8

I $\approx$ 45.45 A

The contactor required will have a minimum current rating of 45.45 A

For increased efficiency a tolerance of about +25% will be given

Thus contactor rating will be

= 45.45 A + (25 x 45.45 A) /100

= 56.82 A

Thus, the contactor of rating 56.82 A and nearest to the calculated value is allowable.

I = 45.45 A deduced is current per phase. Thus any cable used should be capable of

carrying about 1½ times the current. The environment will also play a major role in the rating of cable

:. Required cable should carry a current of at least

= 45.45 A + (50% x 45.45 A)

= 68.18

However, if the operating environment is very hot, a larger cable size will be required.

4. CIRCUIT DESCRIPTION

Fig. 4 shows the circuit diagram of system. In this circuit diagram there are various components and their connections are given.

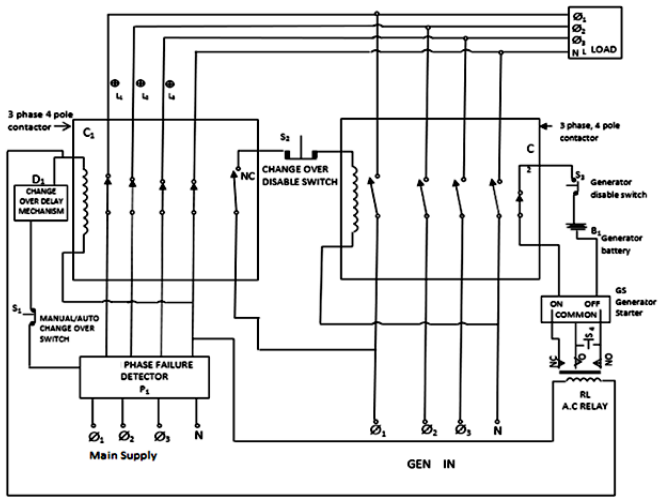

Fig -1:Circuit Diagram of Three Phase Auto switching Changeover with Generator Control

In this case, the selection is between main power supply and a generator. The system monitors the mains supply and checks for complete failure and phase failure upon which it changes over to the generator supply starting the generator automatically and switching it off automatically when proper mains supply is restored. The circuit diagram shows the circuit condition when mains supply is available.

The main supply is fed through a 3 phase failure detector P1.The phase failure detector monitors all three phases to ensure appropriate supply of mains power. If all three phases are powered, the phase failure detector connects them to C1, a 3 phase four pole contactor, whose output is connected to the load. Simultaneously, it also feds appropriate voltage to the coil of C1 via a delay mechanism, D1. Once contactor C1 has been energized, it feeds power to the load. Contactor C1 has an "normally closed" contact (NC) in it. This contact opens when contactorC1 is energized and also controls the voltage to the coil of contactor C2. As long as this contact is open, C2 which controls the generator output stays de-energized.

Thus separating the generator output from the load, hence, preventing a clash between main supply and the generator source. Also, the output voltage from delay switch D1 is used to energize a 220V AC relay (RL) which controls the generator starting mechanism. As long as AC relay(RL) is energized, the generator is made to stay in the off position. Thus, with proper mains supply, the generator remains off and only the mains supply is connected to the load.TheDC relay can be used in the absences of the AC relay but with appropriate rectified voltage been fed to it. If however, a phase failure or complete power failure occurs in the main line, the phase failure detector P1 will cut off power thus de-energizing C1 and RL. As a result of this, the normally close contact of C1 closes, connecting the coils of C2 to the generator output. In like manner, the main supply is disconnected from the load. C2 is not yet energized because the generator is yet to start. However, the time for which this occurs is small as RL, once de-energized, connects the generator starter to the battery causing the generator to start. Once it has gathered momentum and has built up sufficient voltage, the contactor C2 becomes energized and the coil of contactor C2 is energized by the generator output. This cause contactor C2 to activate and connects the load to the generator output, thus, restoring power automatically.

The normally closed contact of contactor C2 is used to disconnect the battery from the starter to prevent it from running down when the generator is running. Once power is restored, the delay mechanism of the delay switch D1 prevents change over back to main supply from occurring until after a preset time. This time is kept to ensure that the mains power supply is stable. Once the time elapses, the delay switch D1 energizes contactor C1 and AC relay (RL) simultaneously. This causes the normally close contact of contactor C1 to open and thus de-energizing contactor C2 and disconnecting the load from the generator supply. At the same time, contactor C1 being energized connects the load to main supply. In like manner, RL switches the generator ignition to its off position.

The switch S1 is used to make a manual change over when pushed open. It does so by disconnecting power from the coil of contactor C1 thus de-energizing it as though there were power failure; hence, the change over process as explained above takes place as.

The switch S2 is used to prevent change over to generator by disenabling contactor C2. Thus, whether the generator is running or not its output is not fed to the load. This is necessary when it is required to steam the generator engine.

The switch S3 is used to keep the generator off even when change over occurs. This is useful when the user does not want the generator to be used.

The switch S4 is used to turn the generator off when in use but power has not been restored. It is not a push and hold switch. The pilot lamps areL1, L2 and L3 used to monitor the output voltage. The rating of the change over depends on the rating of the contactors. In addition, a sound and functional generator with battery starting ability is recommended.

5. CONCLUSION

Automatic changeover switch with generator starting and shut down facility can be design to reduce the stress and loss of time associated with the starting and shutting down of the alternative sources of supply (generator). Due to the change over switch, it minimizes damages to lives and equipment since it has its own monitoring system and its switching requires no human contact with the switch, thus eliminating human error, it reduces change-over time to a minimum and due to its fast response to power restoration. It maintains high quality of service through its fast and prompt response.

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