

Design of new type auto transfer switch for protection of electric power facilities

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Abstract: In this paper, we propose a new Auto Transfer Switch (ATS) using only the magnetic contactor without relay unlike conventional ATS. In order to design the ATS, a triple power source is used such as a first power source, a second power source and an emergency generator power source. First power operation design conditions, second power operation design conditions and emergency generator design conditions are presented. The designed ATS did not use any relays and it was implemented with only the magnetic contactor. In the automatic mode, it is possible to solve the short circuit accident due to the phase difference between the different Distribution Line (D/L), and to solve the trip problem due to the neutral line problem between each D/L.

Keywords: Auto transfer switch (ATS), Magnetic contactor, Distribution line (D/L), Emergency generator. Short circuit.

I. INTRODUCTION

The main power facilities are installed and operated by Auto Transfer Switch (ATS) and auto load transfer switch (ALTS) in preparation for power failure. If power is supplied from a power company in a double, it will be divided into a main line and a backup line. ALTS accommodates the main line and the backup line simultaneously, and automatically switches to the backup line when mains failure occurs, minimizing the power failure time. And the ATS is a system that automatically switches the power supply to the generator within 10 seconds when the power supply of the utility company is out of order.

Nowadays, major power facilities are supplied with double power supply in addition to emergency generator facilities to prevent power outages. In the event of a power failure, the system is configured so that the power can be switched to the power supply to other distribution lines, and the UPS is used to prevent power outages [1].

When the power failure due to the operation delay of the ALTS and the ATS is prolonged, various problems may occur in the lighting equipment and the electric equipment as well as the main power equipment. Because of this problem, a lot of researches are being carried out to develop ATS for power supply changeover in a very short time [2-3]. Due to the phase difference between the power supply interchanges at a very short time, the automatic ATS developed up to now has a phase-to-phase fault occasionally. Also, due to the complicated design, maintenance problems of the system are continuously generated and it is not easy to apply in actual field [4-5].

In this paper, we propose a new type of ATS to solve these problems. The proposed ATS system uses triple power supply at the same time. ATS has been constructed to prevent power outages by switching the power source from the other power source to the load in about 15 (ms) and supplying it to a load using different power line power, when one power supply is cut off.

II. SYSTEM OVERVIEW

Fig. 1 shows the system configuration and operation status. As shown in Fig. 1, a triple power source is used such as a first power source D/L1, a second power source D/L2 and an emergency generator power source. The first power source D/L1 supplies power to LOAD 1 and the second power source D/L2 supplies power to LOAD 2 in order to ensure the reliability of the power supply at all times. And the second power source is automatically turned on at LOAD 1 during the first power failure. The first power source is automatically turned on at LOAD 2 during the second power failure. When the first power source D/L1 and the second power source D/L2 are simultaneously in a power failure, the emergency generator power can be automatically turned on. It is a system for securing power supply at all times by using a phase-to-phase short circuit accident prevention system due to the phase difference of each power source. In addition to the output terminal for general load on the first power supply D/L1, it is possible to use a UPS for protection of special lighting equipment and electrical equipment. It is a high speed three-phase 4-wire ATS system and always secure the power.

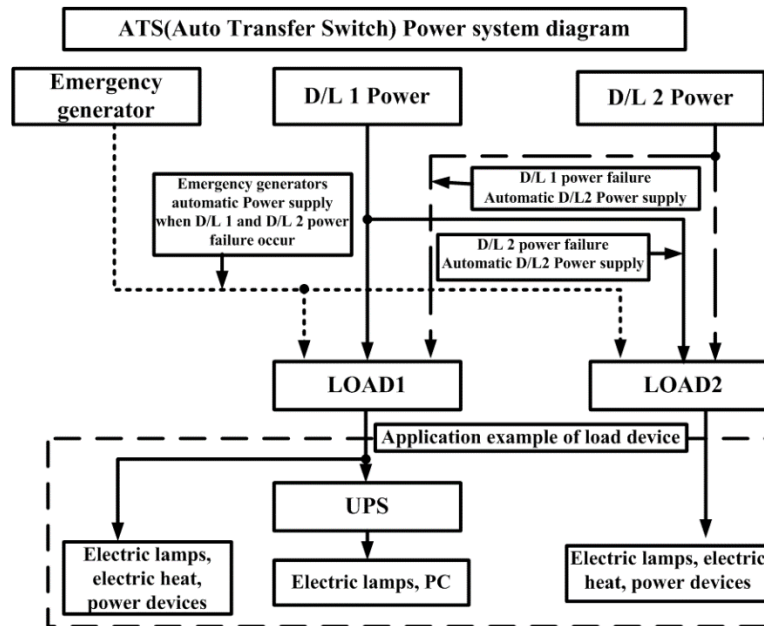


Fig. 1. The system configuration and operation status

III. ATS DESIGN AND TEST RESULTS

3.1 First power D/L1 operation design

Fig. 2 shows the power source control of load 1 by D/L1. It is possible to supply power to LOAD 1 terminal and UPS terminal through automatic and manual switch operation by using first power D/L1.

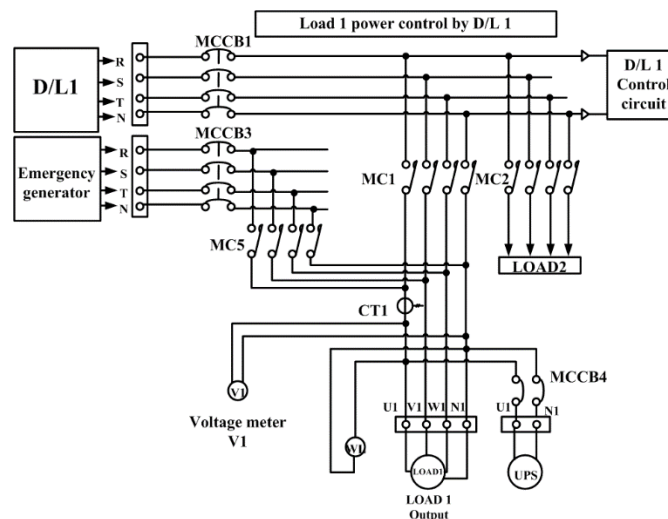


Fig. 2 Power source control of load 1 by D / L1

When the power input switch is set to the automatic mode, in case of outage of the first power source D/L1, it is automatically switched to the D/L2 power supply by LOAD 1 and supplies power to LOAD 1 at D/L2. Then, when the first power source D/L1 is restored and the manager disconnects the D/L2 power source and wants to supply power to the LOAD 1 using the first power source D/L1, pressing the first power D/L1 power recovery switch button automatically turns off the D/L2 power and reclose the first power D/L1 to supply power to LOAD 1. It is possible to prevent short-circuiting accident even if there is a phase problem between D / L due to mutual interlock setting. The first power D/L1 can be powered and shut off manually.

Fig. 4 shows the designed ATS control circuit including the D/L1 operation, the D/L2 operation, emergency generator operation and common operation.

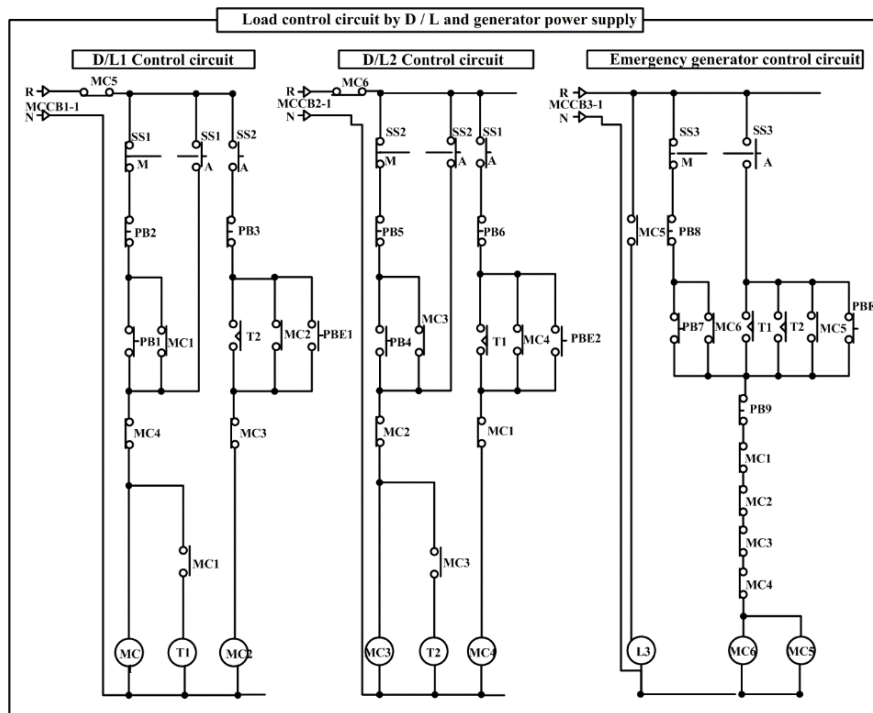


Fig. 4. Designed ATS control circuit

IV. CONCLUSION

In this paper, we designed and manufactured ATS that can supply power without outage to the main power equipment despite the power failure due to various accidents of power system. Conventional ATS is very expensive, complicated in structure, and very difficult to operate and maintain. However, the proposed ATS consists of only the magnetic contactor, its structure is very simple, it is very inexpensive and has more advantages than the conventional ATS. Since the proposed ATS does not use relay, it can prevent short circuit fault caused by time difference in relay on / off operation. The proposed system solves the problem caused by the neutral wire when the power is switched by using the quadrupole large capacity magnetic contactor.

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BIOGRAPHY



Hyun Hwa Chung received the M.S. degree in Electrical Engineering from Dong-A University in 2001. He is currently working for Dong-A Electric Control Technology Education Center from 2011. He has a master craftsman in electrical engineering. His research interests are the electric control technology and power system control.