Proc. Annual Symposium on Research & Industrial Training, 03(2016) 273-277
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AUTO TRANSFER SWITCH TO PROTECT UNINTERRUPTED POWER SUPPLY FROM PHASE UNBALANCING

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ABSTRACT

Auto Transfer Switch (ATS) is used to fulfill the requirement of switching one source of power to another source of power automatically without interfering of human. The main objective of the ATS is to transfer the power. Apart from this objective it provides a protection towards to the electrical loads as well as to the generator if one or both power sources are generators. Aththidiya branch had problems of phase unbalancing due to the loads it carry by 3 phases are not matching. The Miniature Circuit Breakers (MCB) are always try to break due to the unbalanced phases. To address this problem, special ATS was designed and implement by using contactors, delay timers, auxiliary relays and the most important component the Phase Fault Relay (PFR). After implementation and construction of the ATS the problem was significantly reduced. The similar kind of designs can be successfully used to address similar kind of problems exists in similar type of places.

Keywords: Auto transfer switch (ATS), Phase unbalance, Uninterrupted power supply

1. INTRODUCTION

Many UPSs have been replaced because an uneven power draw gave the appearance the UPS was near overload. An unnecessary overnight replacement of big UPS wastes money disrupts an entire data center and exposes it to potential catastrophe [1].

All electrical networks suffer from power quality issues in varying degrees and frequencies. Brief sags and surges are common but networks can exhibit voltage supply irregularities that may be present for prolonged periods of time, or are constantly present on the network. Where a voltage imbalance exists on a supply network, it is usually due to generation faults unmatched impedance on transformer banks, or large single phase loads on the three phase network [2].

In cases where the UPS capacity has been provisioned for the maximum load of the DC, the UPS will always suffice for the part of the load, even when it is phase imbalanced. However, if a setup has under-provisioned UPS, more servers can be powered if the load is balanced [3]."

2. METHODOLOGY

The designing of the ATS panel was done after analyzing the functional requirements of the special featured ATS panel. As the first step the metal boards of enclosure frame was drilled in order to make holes to hold indication lamps as well as drilled the steel bard which will hold all the components of the ATS panel. Wiring ducks were placed in suitable places to do the wiring to avoid getting mess in the ATS panel. Relay holders and components of the ATS panel were placed in the suitable places of the ATS panel.

2.1. The components placed in the constructed panel were;

Contactors, Delay timers, Power relays and MCBs

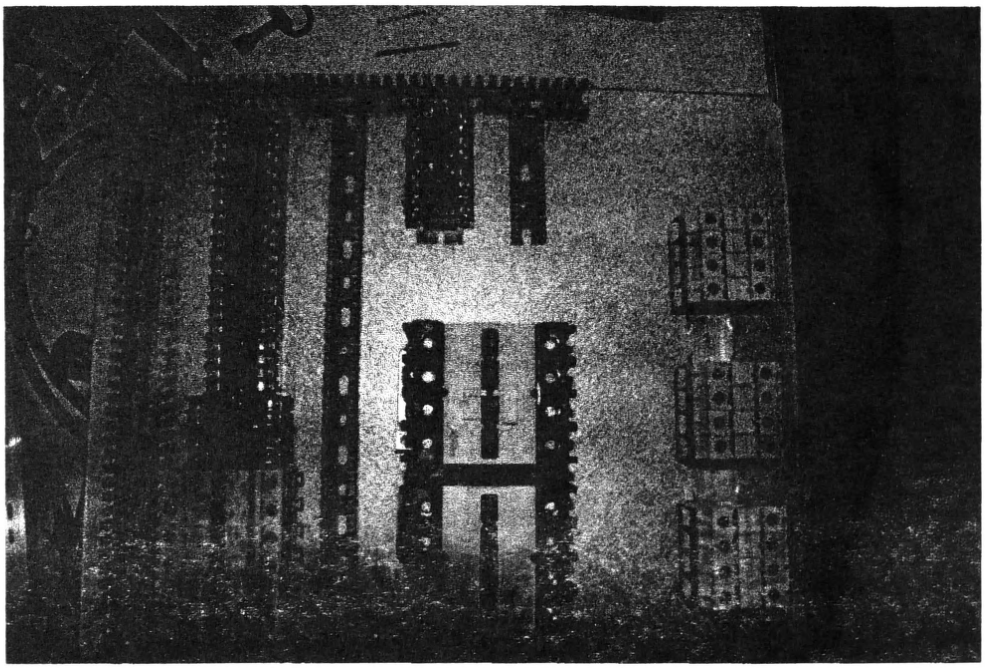

Figure 1: Wire duck locations and components location

Wiring was done according to the designed circuit through the wiring ducks and all the time delays, relays and PFR were installed.

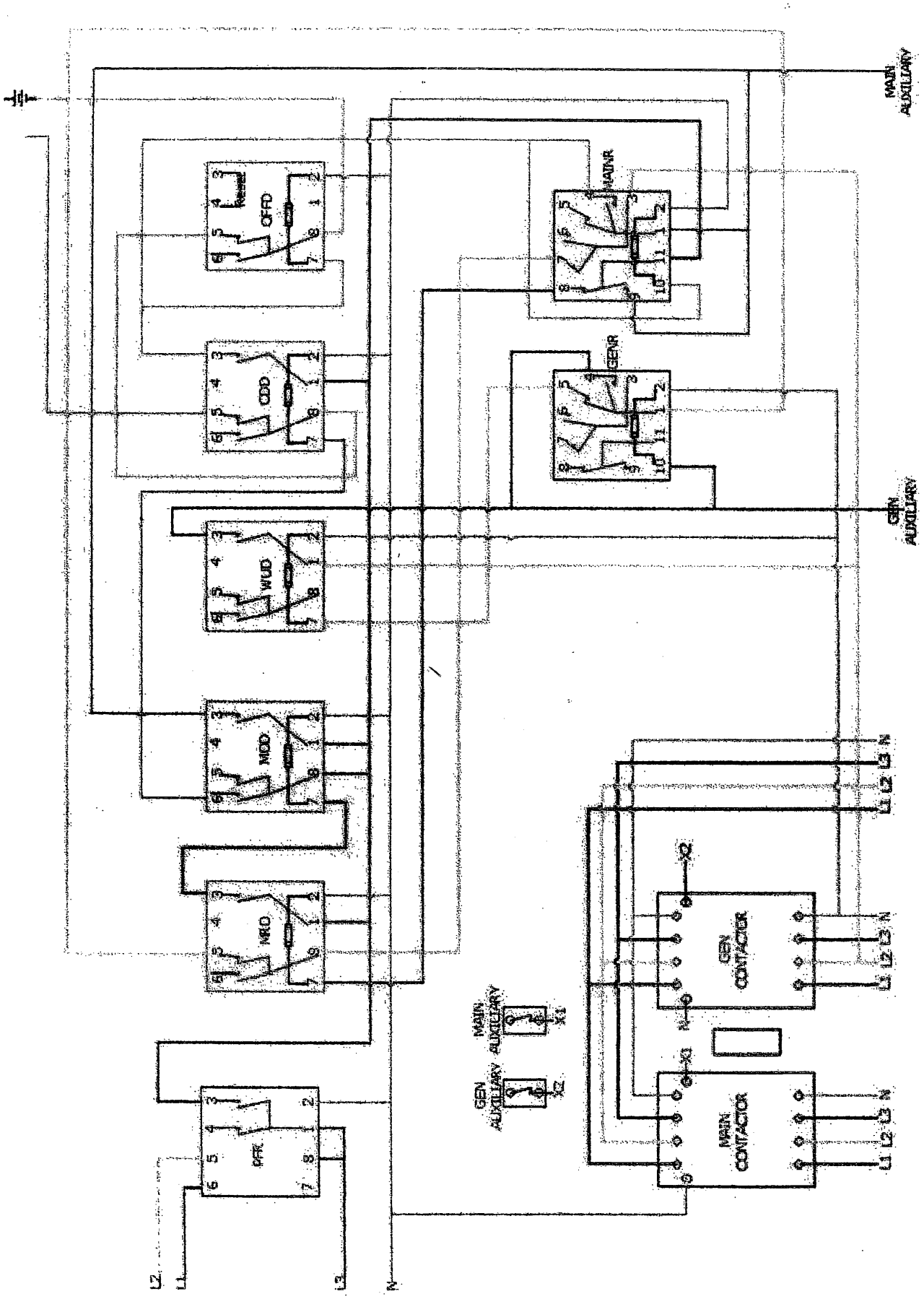

Figure 2: Finalized circuit diagram designed by AutoCAD

PFR = PHASE FAULT RELAY
MRD = MAIN RETURN DELAY
MOD = MAIN ON LOAD DELAY
WUD = WARM UP DELAY
CDD = COOL DOWN DELAY
OFFD = OFF DELAY
MAINR = MAINS RELAY
GENR = GENERATOR RELAY

PFR out path
MRD out path
MOD out path
OFFD out path
CDD out path
GEN out path
WUD out path
NUTRAL

Figure 3: Colour code and the meanings of the abbreviations used in the Circuit

Wiring was done with respect to the standards and there were mechanical and electrical interlocks as well.

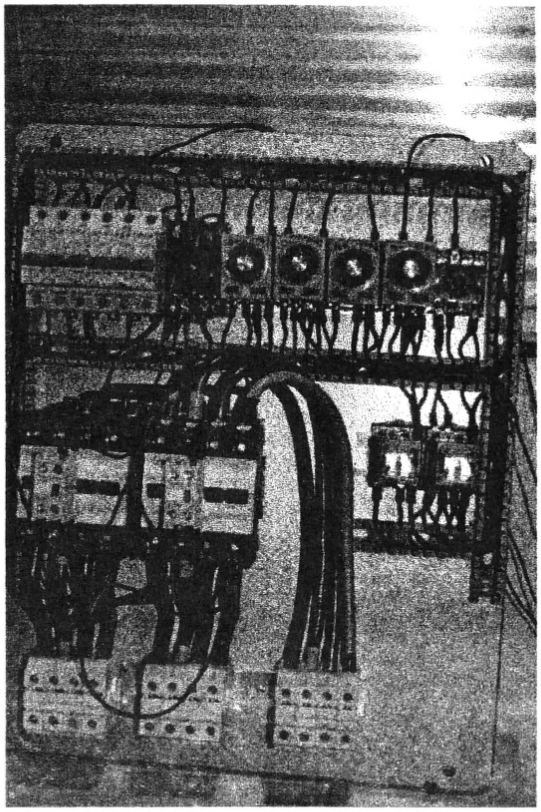

Figure 4: Final Product without the Enclosure

After the wiring process was done a demonstration was done by providing a single phase to all the phase inputs as well as the generator input. The circuit was successfully constructed and the system was functioned as required. After the panel tested with the single phase the panel was also tested with 3 phase supply.

3. RESULTS AND DISCUSSION

Once there is a generator it is essential to have an ATS panel for the security as well as reduce the overhead work of the working personnel. Most of the industries required generators for do

their day today activities seamlessly. For this purpose ATS panel is very important. The most important factor is that the electrical equipment used in a building should be protected from the notarial electrical states. In order to fulfill this requirement the ATS panel will do a major job.

4. CONCLUSION

The main reason for installing an ATS panel is to reduce breakdowns of UPSs by keep the barrier for power until 3 phases get stabilized. Apart from the major requirement of the ATS panel there were other few requirements.

One of the requirements was to reduce the work load of the banking staff while a power cutouts. The existing system has to be operated manually by a responsible person by starting the generator after all the loads were disconnected. Whenever a human error would occur in this process it would be harmful for the generator as well as the loads in the building. The other requirement could be identified as the safety of the data in servers which could be called as the heart of the bank or the branch. All the information about customers is holding in these servers. By installing an ATS panel it facilitates a high security for the servers by reducing the risk of data corruptions during power losses.

ACKNOWLEDGEMENTS

The authors would like to thank all the staff members of Premises Maintenace Department of Seylan Bank PLCAssistant to the support gave us throughout the research. Also would like to thank for the guidance given by all the staff members of Premises and Maintenance Department

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