AUTOMATIC TRANSFER SYSTEM (ATS)

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Abstract

Electrical loads can be classified according to its importance as; normal loads, important loads & emergency loads. Normal loads are the loads from which the power can be switched off for a period of time; this period may be short or long depending on the case itself. Important loads are the loads which can be switched off for a very short time. Emergency loads are the loads which cannot be switched off at all such as hospitals. Normal and emergency loads are out of the scope but important loads will be discussed in some details. Important loads are usually supplied using two sources of power. The two sources are usually the transformer of the utility and a stand by generator used in case of the power of transformer is gone. If the main power has been activated again, the generator will be switched off and the load will be supplied from the transformer. This process is organized and performed using a device (Circuit) called Automatic Transfer Switch (ATS).

Keywords

ATS (Automatic Transfer Switch) System, Automation, Three phases

Synchronous Industrial generator, automatic switching, delay timer relays, multi-input power source.

1. INTRODUCTION

It is very important to provide reliability during the process of feeding loads. This can be achieved using many different ways. One of these methods is the parallel operation of two generators or transformers after satisfying the parallel operation conditions in each case. Another method is to use a stand by generator. During the normal operation the transformer feeds the loads and the generator is out. If the main supply is gone, the generator is built up-manually or automatically- and feeds the loads. In case that the main supply has been came back, the generator is switched off and the transformer feeds the loads. The operation of connecting and disconnecting the generator and transformed can be scheduled using a system (control circuit) called ATS which stands for Automatic Transfer Switch.

2. Automatic transfer switch components

There are three (3) basic components of a transfer switch:
1- Power switching device to shift the load circuits to and from the power source (contactors, changeover, or Circuit breakers).
2- Transfer Logic Controller to monitor the condition of the power sources and provide the control signals to the power switching device.
3- Control power source to supply operational power to the controller and switching device (battery).

3. Modes of (ATS) operation

Manual Mode: The module is placed into Manual mode by pressing hand/auto button. Manual mode is used for control the ATS manually and to start & stopping the generator engine.
Auto Mode: The module is placed into auto mode by pressing hand/auto button. If a mains failure on any phase is detected after the mains failure delay timer expires, the load is switched off from the mains and the ATS unit will automatically issue a start command to the genset controller by using the parameters settings. When the generator operates within the limits the load is transferred to the generator by the ATS module. When the mains supply has been restored after the mains transition delay timer expires, the ATS module will transfer the load back from the generator to the mains supply and remove the start command from the genset controller after the cooling time. In case of a failure while operating, the unit will stop the generator automatically. A clear mimic diagram and LEDs provide information about the load status and voltages.

4. Design Goals of (ATS)

As with any design, a set of goals need to be outlined. The design goals for an ATS are listed in a general order of importance:

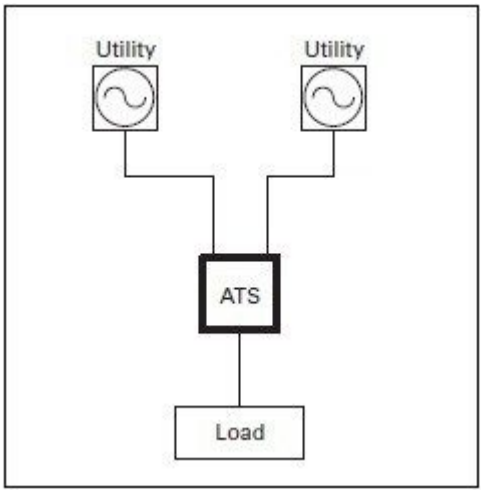
1. Safe and reliable automatic transfer of power between supplies
2. Decide which transfer operation suits the lead type (open/closed tranisition etc.).
3. Ensure the electrical protection offered by switchgear is optimal for the installation.
4. Offer safe and straightforward emergency operation.
5. Cost effective solution with minimal maintenance.

Each ATS solution needs to be measured against these goals to measure how effective it is.

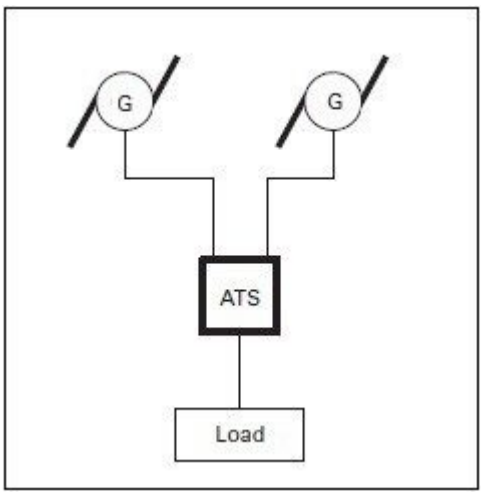
5. Operation Areas of (ATS)

The principal purpose of an ATS is to ensure the continuous delivery of electrical power from one of two power sources to a connected load circuit (electrical equipment – lights, motors, computers, etc.).

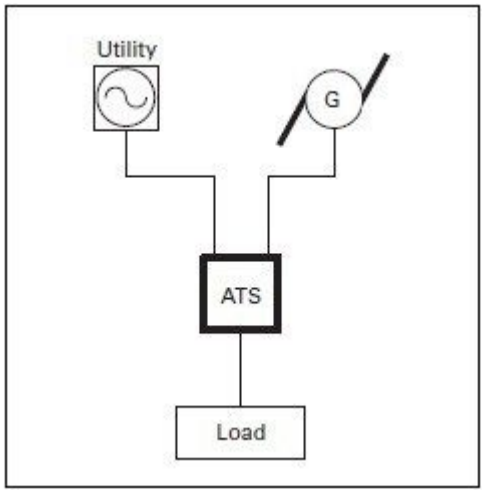
Utility to Utility: Dual utility applications are becoming more common, in facilities with zero interruption of power, but no standby generator. If one utility feed fails, the transfer switch automatically connects the load to the second utility feed.



Generator to Generator: (using multiple on-site generators) If the primary generator fails, the transfer switch sends a start signal to the second generator and then transfers the load.



Utility to Generator: If the supply from Utility fails/ interrupted, the transfer switch will send a start signal to the generator automatically and connect the generator supply to the load. Standby power system to two utility feeds.



6. Description of (ATS) Technology

In a backup, standby, or emergency power system, an ATS is used to provide continuity in the supply of power between an electrical grid and the designated critical loads served by the backup system. Because the ATS is connected to both primary and backup power, it serves as an intermediary between the load and the sources of power.

The functional elements of the ATS detect a power disruption or failure of the primary source and initiate the process to start a generator, allow it to achieve steady-state operation, verify that requisite voltage and/or frequency has been achieved, and then connect the load to generator power.

There are three general ATS types:

- **Open transition:** (break-before-make): This interrupts the load during the transition between primary and backup power. This is the most common type of ATS, and it is often found with standard backup and standby systems.
- **Closed transition:** (make-before-break): When the load is critical, this type of ATS allows a transfer between two live sources of power without disruption in the critical load during the transition from backup to primary power. This type of ATS is

usually found in applications such as data centers, health care, or utility load curtailment systems.

- **Delayed transition:** This type of ATS operates similarly to the open transition type but affords a delay in load transition and is typically used in situations where residual voltages on inductive loads can dissipate before transition.

7. Why You Need An Automatic Transfer Switch

Losing electricity is a big problem especially if you work in the office or at home, have a business, or simply rely on electricity for your daily needs. You would need to have at least one backup power source in case the main one fails. But how can you switch from your main to a backup power source? This is where an Automatic Transfer Switch comes in.

Main Reasons Why You Need An ATS

- Ensuring Power Reliability

Nowadays, we are continuously getting more reliant on electrical devices. This means that having a reliable power supply is necessary.

ATS ensures you have a constant supply of electricity by automatically switching to a backup source whenever needed.

- Emergency Preparedness

Power systems are especially vulnerable when we need them the most: during emergencies and disasters. ATS ensures that critical systems stay operational during these situations.

- Convenience and Automation

Switching to a backup power source can be a hassle, especially during critical situations. Having an ATS eliminates the need for manual intervention during power outages.

- Protecting Sensitive Equipment

Power fluctuations can damage sensitive electrical equipment such as appliances.
ATS continually monitors the power supply to determine whether a backup source is needed.

- Cost Savings

An unstable power supply can hurt businesses badly as it can drive away potential customers. It can also reduce the lifespan of electrical equipment and make repair more frequent.
The investment you can make in a good ATS system far outweighs the potential costs of an unreliable power supply.

Main Considerations When Choosing An ATS System

- Amperage

Amperage refers to the electrical current measured in amperes.
Switches come in a range of amperes, typically from 50 amps to 6000 amps.
The amperage of the transfer switch should match the size of the electrical panel's main breaker to ensure efficient and safe operation.

- Ratings

There are various types of ratings used for transfer switches. One of the most commonly used is the ingress protection or the IP code.
The IP code indicates the device's protection capability against water and dust. Generally speaking, the higher the numbers are in the code, the more well-protected the device is.

- Voltage

An ATS is a device that can connect to two different power sources. Therefore, it must be able to handle the increase in voltage.
Investing in an ATS is the best choice not just for convenience but also for the profitability of businesses and for safety during emergency situations.

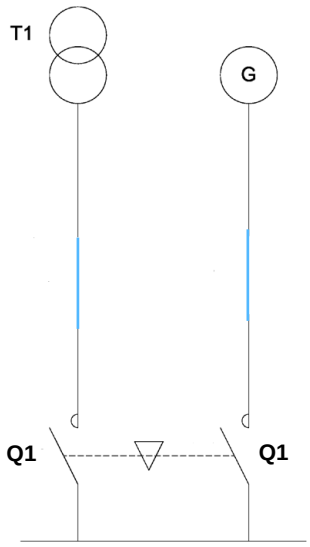
Main- Source with diesel generator set

Operational principle

The electrical circuit for the main-Source power sources configuration consists of the following components:

- Voltage monitoring relays KV
- Circuit breakers for power circuit Q1 and Gen. Q1
- Circuit breakers for VT circuit F3
- Time relays T1 and T2
- Selector Switch Manual/Auto

The priority source for this scheme is source T1.



Operation logic main- Source and Gen

T1 (Source)	G (Generator)	Q1 INC.	Q1 GEN.
0	0	0	0
1	0	1	0
0	1	0	1
1	1	1	0

CONTACTOR-BASED AUTOMATIC TRANSFER SWITCH SOLUTIONS (ATS)