

## Automatic Transfer Switches

### Basics of Automatic Transfer Switches

An automatic transfer switch (ATS) forms the interface between the genset, utility power and the consuming electrical equipment. It performs three functions:

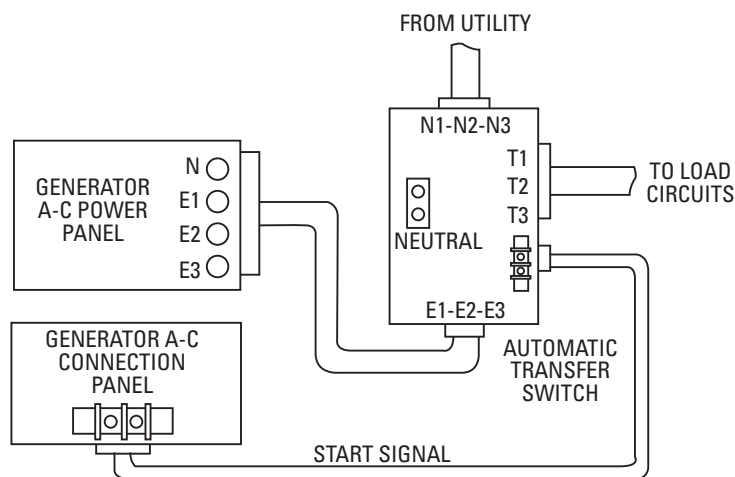
1. It monitors power sources for failure.
2. It transfers load from one power source to another.
3. It can and should be used to exercise the genset.

Proper transfer switch operation is critical to the whole power system. It provides safety to the genset operator and protects the electrical service and the utility.

This switch must handle overloads for a short period of time while the proper protective relay begins operation.

Many considerations affect ATS selection. The unit must be sized correctly for the loads it serves as well as have the correct protective devices.

Occasionally, genset applications require paralleling of generator power with the utility power. Utilities require that customer connected equipment (including gensets) does not cause disturbances or degrade the quality of service to other customers. The customer also cannot degrade the safety interlocks and protection devices on the power network.



*Typical ATS Interconnection*

### ATS Sizing Factors

Switchgear sizing is determined by four factors: continuous current, inrush current, interrupt current, and withstand current. The main consideration is continuous current, but inrush and interrupt currents are often overlooked.

Type of load determines the inrush current. Motors starting can consume 6 to 10 times normal continuous current, so can tungsten and fluorescent lights.

Resistive heating loads can consume from three to five times rated currents. Provisions must be made for these short duration overloads in the ATS and protective equipment.

Motors, when disconnected from power sources, temporarily generate voltage because magnetic flux continues to be produced by the spinning rotor. They need time for the flux to decay, eliminating the possibility of genset or motor damage or nuisance breaker tripping. Conversely, equipment such as computers with uninterruptible power supply (UPS) systems must also be backed up in case outages exceed the UPS capacity. However, switchover from utility to genset need not be done immediately. In these cases, an optimum time must be decided upon, depending on the various loads.

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### ATS Types

There are two basic types of automatic transfer switches, circuit breaker and contactor. The circuit breaker type has two interlocked circuit breakers, so only one breaker can be closed at any anytime.

The contactor type is a simpler design that is electrically operated and mechanically held. It operates faster than circuit breaker transfer switches, which reduces transfer time.

The breaker type is slightly slower in terms of transfer (3-12 cycles vs. 3-6 cycles for contactor-types), but have higher withstand ratings. They are excellent if service entrance rating is needed, as overcurrent trip units can be incorporated into the switches.

The ATS provides several control functions for genset operation. It senses when voltage on the utility falls below predetermined limits, then initiates genset start-up after a delay (Time Delay Engine Start or TDES – typically set at 1.5-2 seconds). It transfers loads to the genset when the generator has reached operating voltage and frequency. Most also have a time delay to warm up the engine, if necessary (Time Delay Normal to Emergency or TDNE). It then returns the load to the utility line when utility power is restored after a time delay (Time Delay Emergency to Normal or TDEN – also referred to as retransfer). It then allows a cooldown period for the engine (Time Delay Cooldown or TDC). Both the delays and the utility and generator voltage and frequency minimums and maximums can be adjusted by the operator or fully pre-programmed at the factory.

### Bypass Isolation

This type of switch is a system designer's choice for mission-critical loads which cannot be interrupted for any reason, including service and maintenance. These switches have all the same functions as a typical ATS, but also have a bypass isolation circuit path. A customer can "rack out" the automatic transfer switch while still supplying the load from whichever source was previously feeding it. Some newer types can be manually transferred while in the bypass mode. Further, a new type actually utilizes two ATS sections. This allows the operator to remove either ATS mechanism and the switch will still operate normally – even if there's an outage during the service. In any case, bypass isolation switches allow for maintenance and repair without disruption of the customer's operations and are recommended for critical operations.