TYPES OF ATS'S AND APPLICATION IN GENERATOR SET SYSTEMS

Buckeye Power Sales
Reliable Power Professionals Since 1947

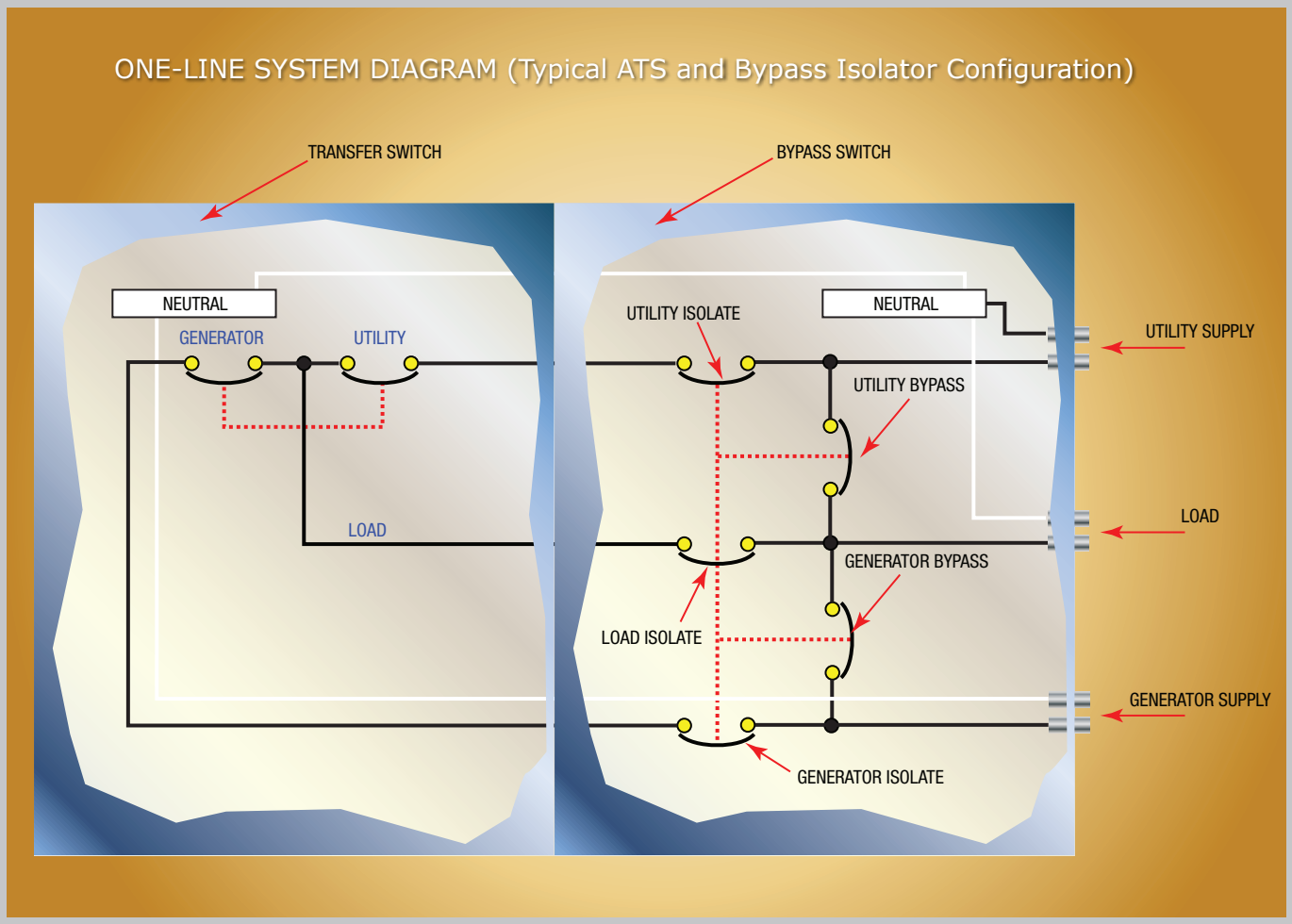
There are four principal configurations of Automatic Transfer Switches (ATS). Most manufacturers of commercially available ATS are virtually identical in their basic functions and operation, no matter which type is considered. This information sheet discusses the four types and where the different designs are frequently found in the US systems.

1.0 OVERVIEW OF THE ATS FUNCTION:

The principal function of an Automatic Transfer Switch is to automatically transfer a power source from one (principal) to another (secondary), while maintaining total isolation of each power source. It also serves to monitor the incoming utility or principal power for anomalies such as voltage droop, failure (due to brownouts, etc.), spikes or surges. With an ATS, no manual intervention is required to iniate the transfer.

An ATS is an important component of a generator set system and is normally specified by system designers. Even a small loss of electrical power can result in major major negative issues within the system that is normally being powered by the utility supply, or should incoming voltage and/or frequency fall outside the required limits or parameters.

Typically a standby or emergency generator set is used to provide temporary electrical power to cover such occasions and this important and often vital service needs to operate immediately, without any loss of time or delay. Many applications and installations require the standby set to be running "on-line" and producing its full power rating within 10 seconds or less of sensing failure or voltage or frequency fluctuations.
Once the utility or mains supply has been reestablished and proper voltage and frequency attained, the ATS transfers the load back to this source and shuts down the standby unit, often after a cooling-down period with no load on the generator. It then is ready start-up automatically to meet any future emergency or power outage without any human assistance or action.



2.0 CONTACTOR DESIGN:

Switches can be supplied as 'contactor type', whose actuation is by individual solenoids included in each contactor. These contactors are electrically held, unless furnished with optional mechanical latches. These contactors may drop out if the voltage dips and contacts may 'chatter' at lower than rated voltages and frequencies. NFPA standards require mechanical latching in use for emergency systems. Because contactors have relatively short circuit ratings, a contactor type transfer switch will require external upstream overcurrent protection and current limiting fuses, or special circuit breakers to achieve higher withstand and closing ratings.

3.0 CIRCUIT BREAKER DESIGN:

Circuit breaker-type transfer switches typically employ a pair of electrically and mechanically interlocked molded case switches (MCS) or circuit breakers (CB). Mechanical interlocking can be omitted for closed transition operation, which then requires electrical controls to prevent out of phase paralleling. These circuit breakers and molded case switches have quick make and break contacts and over-center mechanisms. However, transfer time for CB type transfer switches can be relatively slow, particularly in larger equipment. If MCS's are used, an external upstream overcurrent device for short circuit protection is required.

4.0 DEFINITE PURPOSE DESIGN:

The definite purpose-type has a switching mechanism construction which is designed specifically for switching between two power sources, which may be 180° out of phase with twice rated potential across the contacts. These mechanisms can be either single or double throw. Single throw mechanisms are inherently interlocked to prevent source-to-source interconnection, and also provide fast, open transition contact transfer time only. Double throw mechanisms can provide fast or slow contact transfer time, open or closed transition, and load shedding capability. Integral overcurrent protection is not included and so external upstream overcurrent is required. The contact transfer time from one source to another can be fast – six cycles or less, depending on the size of the equipment.

5.0 SOLID STATE DESIGN:

Solid state switches are available in several configurations and sizes and use Silicon Controlled Rectifiers (SCRs) or transistors as the switching means. These are used in solid state UPS equipment and are available as dedicated and listed transfer switches. They are considerably more expensive (up to 4 times higher) than equivalently sized mechanical switches.

6.0 FOUR TYPES OF THE TRANSFER SWITCH AND APPLICATIONS:

The transfer switch can be set up to provide standby electrical power to feed only certain critical circuits or the entire switchgear panel. Some transfer switches can allow for load shedding or prioritization of optional circuits, such as heating or cooling equipment.

- ***Open Transition ATS.*** The open transition transfer switch is also often called a "break before make" transfer switch. A break before make switch breaks contact with one source of power before it makes contact with another with a momentary interruption (called Contact Transfer Time) of power. This prevents any possibility of back-feeding from the emergency source to the utility line which could damage utility equipment or hurt/kill any utility workers. During the split second of the power transfer process, the flow of electricity is interrupted. A good example of this would be a 3-position manual circuit breaker where the utility power is on one side and the generator on the other – with "off" in the middle. This requires the operator to switch through the full disconnect or "off" position before making the next connection. Most automatic transfer switches have a pair of electrically and mechanically interlocked contactors to simulate such practice. *(Continued over)*
- ***Closed Transition Transfer Switch.*** The closed transition transfer switch is also called a "make before break" transfer switch. In typical emergency systems, there is an inherent momentary interruption of power to the load when it is transferred from one source to another. In most cases this outage is inconsequential, particularly if less than 1/6 of a second. Some loads however, are affected by even the slightest loss of power. There are also operational conditions where is may be desirable to transfer loads with zero interruption of power when conditions permit. For such applications, closed transition transfer switches can be provided. When transferring loads in this manner – during a test or when re-transferring to normal after the primary power has stabilized, the switch will operate in the make-before-break mode, providing both sources are acceptable and synchronized. Typical parameters determining synchronization could be: voltage difference less than 5%, frequency difference less than 0.2HZ, and relative phase angle between sources of 5 electrical degrees. As the maximum frequency difference is 0.2HZ, the engine will certainly be controlled by an isochronous governor. The closed transition or overlap time is generally required to be less than 100 milliseconds. If either source is not present or not acceptable, the switch must operate in a make-to-break mode to ensure no back-feeding occurs. This type of switch may also be referred to as a Static Transfer Switch, as opposed to an Automatic Switch. In this system, the generator runs in parallel with the utility power supply for a certain period of time. This enables the generator to take up the load while the power supply remains uninterrupted.

  Soft Loading Transfer Switch. This a version of the Closed Transition Switch (CTS). The only difference is that the amount of load accepted by the generator is actively changed with this method, offering a more dynamic version of the CTS method of transfer of the electrical power source.
- ***Bypass Isolation ATS.*** This switch is designed for applications where maintenance, inspection and testing must be performed while maintaining continuous power to the load without interruption. Typically, this is required in such cases as critical life support systems, and where electrically-powered essential services are needed e. g. air traffic control, telecommunications, etc. Normally it comprises of two transfer switches - bussed in parallel – one automatic with the other for manual operation, with two redundant paths from each source to the load. These are mechanically and electrically interlocked to prevent accidental closure of both sources. In isolation mode, the ATS can be withdrawn from all power sources for inspection, testing and maintenance. The load is served by the bypass Manual Transfer Switch.
- ***Service Entrance Rated ATS.*** This category of transfer switch was covered in a prior Information Sheet.

7.0 STANDARDS AND CERTIFICATIONS:

The principal industry standard in the US for automatic transfer switches is Underwriters Laboratories standards UL 1008 and 1066. In Canada, the relative standard is CSA Spec 178.

For emergency systems and in accordance with Articles 517,700 and 702 of the National Electrical Code (NEC), American National Standards Institute (ANSI) and National Fire Protection Association (NFPA) cover such applications with Standards 70 and 76A respectively.

In legally required standby systems, such as hospitals and large buildings with numerous personnel, NFPA 110 covers emergency and standby power systems, while in health care facilities, NFPA 99 applies. Periodic field testing is required both under NFPA 99 and 110 standards.

To fulfill our commitment to be the leading supplier in the power generation industry, the Buckeye Power Sales team ensures they are always up-to-date with the current power industry standards as well as industry trends. As a service, our Information Sheets are circulated on a regular basis to existing and potential power customers to maintain their awareness of changes and developments in standards, codes and technology within the power industry.

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