



Presented by:
Ron Hotchkiss
EVP of Engineering
Surge Suppression, LLC / ILSCO

An Application Note for Surge Protective Devices (SPDs) on Automatic Transfer Switches

Supplemental information to the guidance provided in
IEEE Std C62.72™-2016

*Guide for the Application of Surge-Protective Devices for
Use on the Load Side of the Service Equipment in Low-
Voltage (1000 V or Less, 50 Hz or 60 Hz) AC Power Circuits.*

SPD Applications: Automatic Transfer Switch

- This presentation is intended to supplement the direction provided in IEEE Std C62.72TM-2016, *Guide for the Application of Surge-Protective Devices for Use on the Load Side of the Service Equipment in Low-Voltage (1000 V or Less, 50 Hz or 60 Hz) AC Power Circuits*.

SPD Applications: Automatic Transfer Switch

- The reliability of backup power systems is paramount
- Obviously, systems with backup power are expected to operate continuously – even when utility power is unavailable
- The use of an Automatic Transfer Switch, or ATS, is a common practice

SPD Applications: Automatic Transfer Switch

- The purpose of the ATS is to automatically start the generator and switch from the utility power feed to the generator feed when utility power becomes unavailable or reduces in voltage
- Over time, ATS systems have become more sophisticated and electronic in nature

SPD Applications: Automatic Transfer Switch

- The ATS is equipped with electronic circuits that:
 - Monitor the utility feed
 - Control the starting mechanism of the generator
 - Control the source transfer from the utility feed to the generator feed
- Further, when the utility feed comes back on-line and is stable, the ATS transfers the load back to the utility

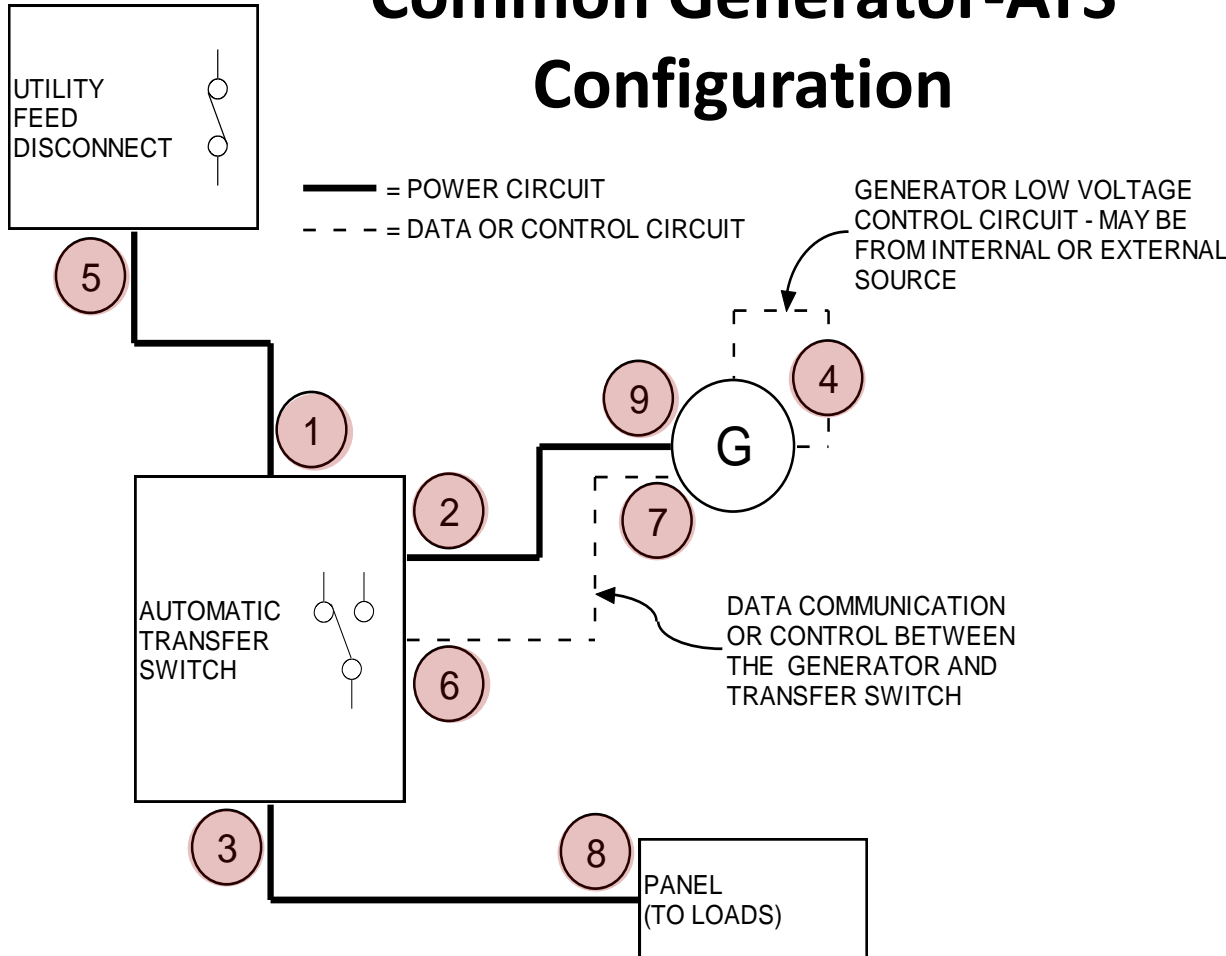
SPD Applications: Automatic Transfer Switch

- However, with the inclusion of the electronic circuitry needed to accomplish this purpose, the ATS is often susceptible to the expected surge environment
- Surges from the utility feed due to lightning, load switching, etc. can be detrimental to the operation of or even destroy the ATS - rendering the system useless.
- Properly applied and installed SPDs can aid in mitigating this surge activity

SPD Applications: Automatic Transfer Switch

- The figure on the next slide offers an overview of a common ATS configuration
- It points out potential installation locations for SPDs
- These locations are then detailed on the following slides

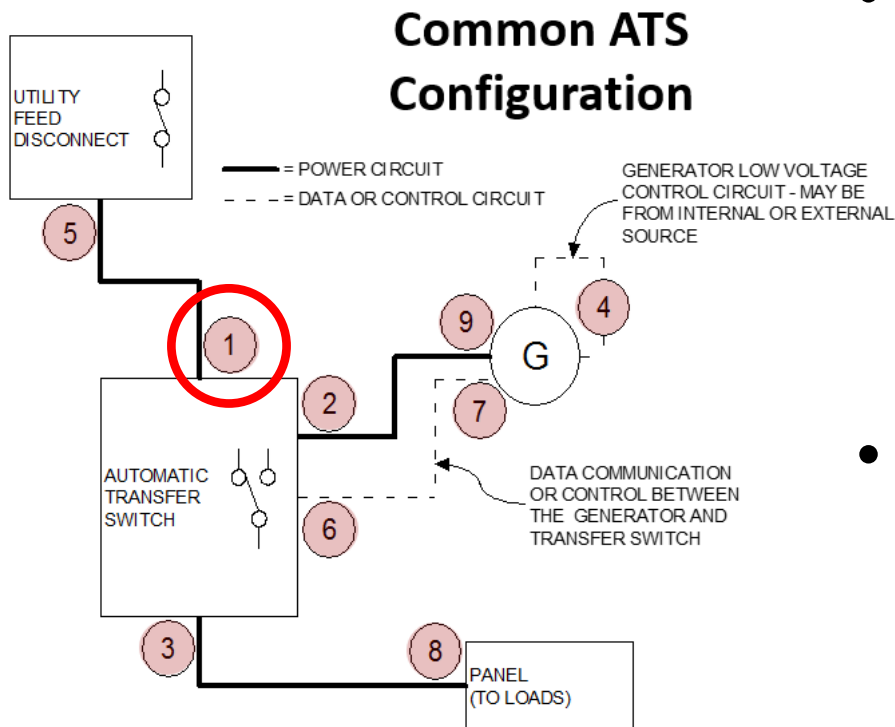
Common Generator-ATS Configuration



SPD Installation Location

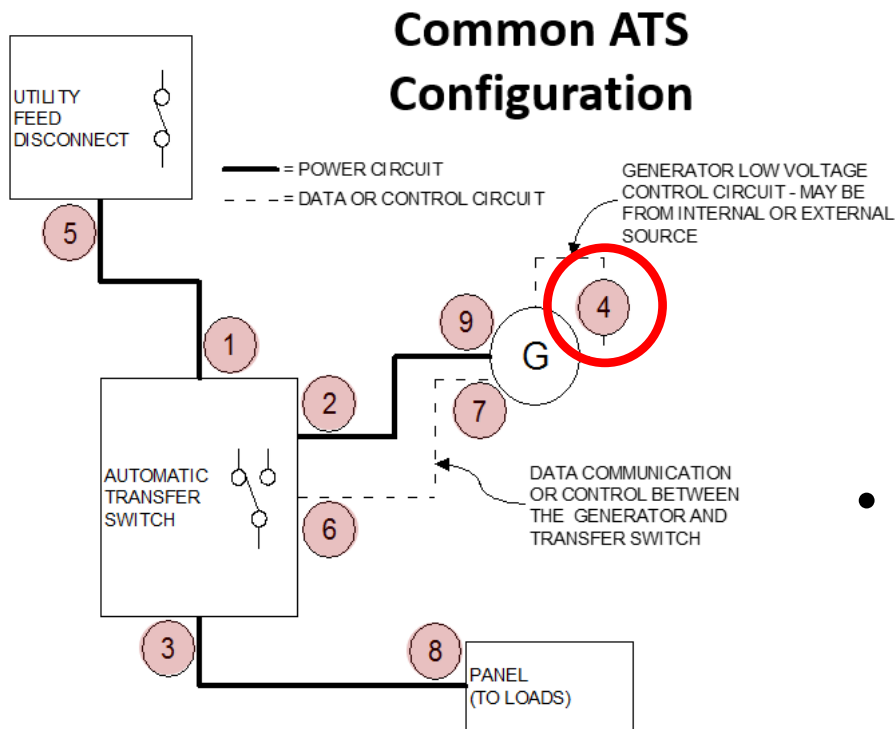
- 1 – ATS Utility Input
- 2 – ATS Generator Input
- 3 – ATS Load Output
- 4 – Generator LV Control
- 5 – Utility Feed Disconnect
- 6 – Data/Control to ATS
- 7 – Data/Control from Generator
- 8 – Panel (loads)
- 9 – Generator AC Power Circuits

SPD Applications: Automatic Transfer Switch



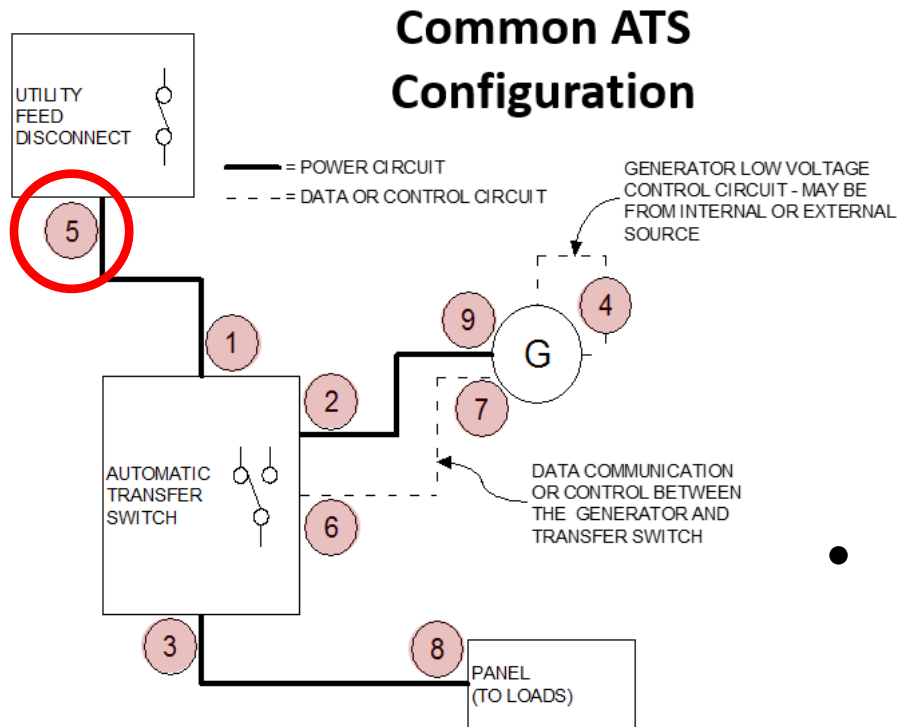
- Location 1 – Utility Feed
 - Critical protection location
 - Electronic in nature
 - Exposure to surges from the utility feed
- Recommendation
 - Parallel connected SPD with filtering to mitigate the effects of lightning and switching/ringing surges

SPD Applications: Automatic Transfer Switch



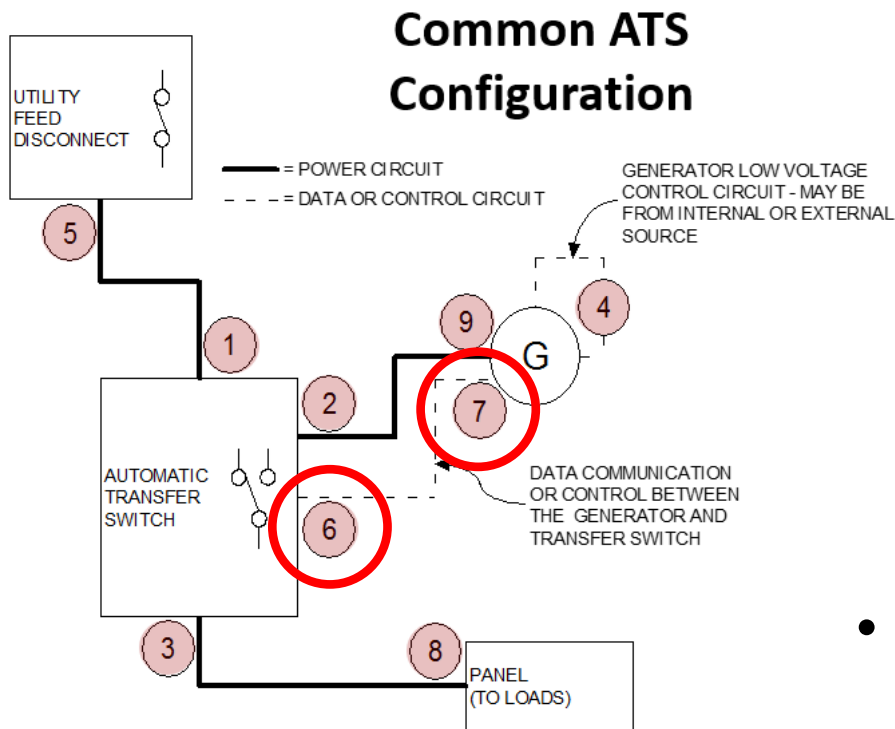
- Location 4 – Generator Low-Voltage Control Circuit
 - Critical protection location
 - Initiates generator startup
 - Exposure to induced surges from lightning
 - Often use external power source
- Recommendation
 - Two-port, series connected low-voltage power SPD with filtering

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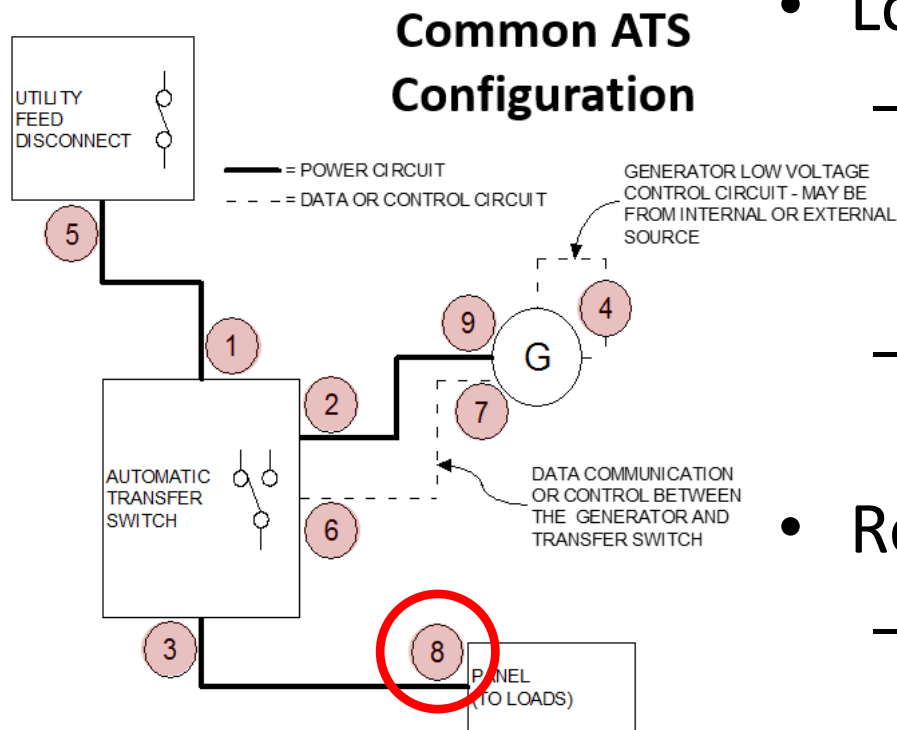
- Location 5 – Utility Feed Disconnect
 - Recommended, if present/available as first line of defense – layered protection
 - Exposure to surges from the wiring to the facility
- Recommendation
 - Parallel connected SPD to mitigate the effects of lightning and switching surges

SPD Applications: Automatic Transfer Switch



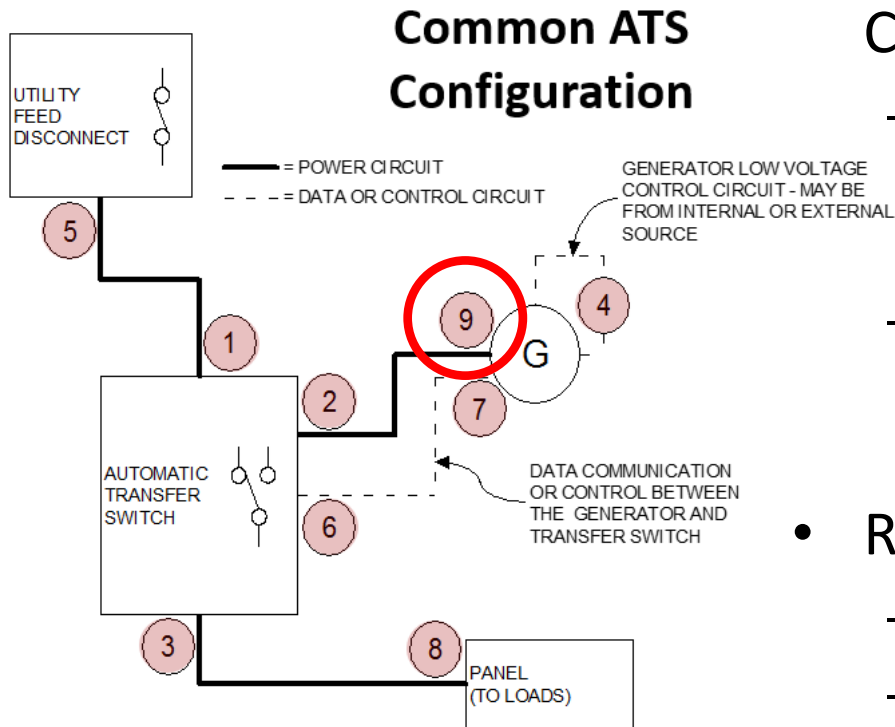
- Location 6/7 – Data/Control between the ATS and Generator
 - Critical protection location, if present
 - Monitors/reports status (often equipped with an annunciator panel)
 - Exposure to induced surges from lightning
- Recommendation
 - Two-port, series connected SPD
 - Could be a data or power circuit

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- Location 8 – ATS Feed to Loads
 - Critical protection location, particularly when the distance between the ATS and load is large
 - Exposure to surges induced between the ATS and load
- Recommendation
 - Parallel connected SPD possibly with filtering depending on the loads being fed

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- Location 9 – Generator AC Power Circuits
 - Critical protection location, particularly when the distance between the ATS and load is large
 - Exposure (output windings/battery charger) to surges induced between the ATS and generator
- Recommendation
 - Parallel connected SPD
 - Two-port, series connected SPD can be used depending on the current

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Location	Need for Protection	Type	Notes
1 – ATS Utility Input	Critical	Parallel with filter	ATS is electronic – exposure from utility feed
2 – ATS Generator Input	Critical	Parallel with filter	ATS is electronic – exposed wiring between ATS and generator
3 – ATS Load Output	Critical	Parallel with filter	ATS is electronic – exposed wiring between ATS and loads
4 – Generator LV Control	Critical	Series with filter	Typically low-voltage/power DC circuits
5 – Utility Feed Disconnect	Recommended, if present	Parallel	Provides layered approach, less stress at Location 1 specifically when the distance from Location 5 to Location 1 is large
6 – Data/Control to ATS	Critical, if present	Series with filter or Two-port/ Data	Control and Data lines are susceptible to induced surges, propagate surges
7 – Data/Control from Generator	Critical, if present	Series with filter or Two-port/ Data	Control and Data lines are susceptible to induced surges, propagate surges
8 – Panel (loads)	Critical/ Recommended	Parallel	Critical when the distance between Location 3 and Location 8 is large. Recommended to provide a layered approach and to protect all loads at this point.
9 – Generator AC Power Circuits	Critical/ Recommended	Parallel or Two-port	Critical when the distance between Location 2 and Location 9 is large. Recommended to protect output windings of the generator.

SPD Applications: Automatic Transfer Switch

- Bibliography

- *Guide for the Application of Surge-Protective Devices for Use on the Load Side of the Service Equipment in Low-Voltage (1000 V or Less, 50 Hz or 60 Hz) AC Power Circuits*, IEEE Std C62.72™-2016, URL: <https://standards.ieee.org/>
- *IEEE Recommended Practice for Powering and Grounding Electronic Equipment*, IEEE Standard 1100-2005, URL: <https://standards.ieee.org/>
- Hotchkiss, R.W.; "Surge protection of automatic transfer switches — Application note", *IEEE PES General Meeting, 2014*, doi: 10.1109/PESGM.2014.6939891 URL: <http://ieeexplore.ieee.org/document/6939891/>