

White Paper

**Transfer Switch Solutions for
Service Entrance Applications**

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Manufacturers offer Automatic Transfer Switches (ATs) with integrated electrical service disconnect equipment. This paper explains the benefits of using these ATs at service entrance locations, reviews industry requirements for their design, and describes responding features of Service Entrance Automatic Transfer Switches (SEATS).

Benefits

In North America, the National Electrical Code® (NEC®) requires a means for disconnecting electrical service conductors where they enter a building.¹ This typically is satisfied by providing a suitable circuit breaker in an appropriate enclosure at or near the location where utility conductors enter a structure. This assemblage of equipment is commonly referred to as the *Service Entrance*, which is defined more precisely in NEC Article 100 as follows:

Service Equipment. The necessary equipment, usually consisting of a circuit breaker(s) or switch(es) and fuse(s) and their accessories, connected to the load end of service conductors to a building or other structure, or an otherwise designated area, and intended to constitute the main control and cutoff of the supply.²

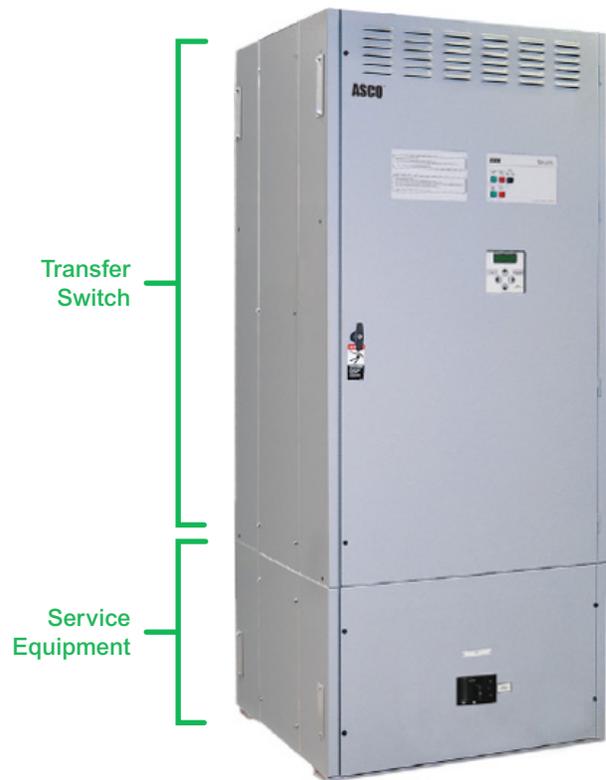


Figure 1: SEATS locate service equipment and a transfer switch in a single enclosure

For many facilities, it is ideal to locate the ATS at or very near the service entrance location. In addition, industry best practice is to use separate devices for the required functions; more specifically, a circuit breaker for disconnecting service and overcurrent protection, and a UL 1008 listed transfer switch for switching between two sources. Combining both devices into a single piece of service entrance equipment can offer several advantages.

First, a SEATS unit is a single, manufacturer-engineered product that conveniently meets the needs of both service entrance and automatic load transfer applications, thereby simplifying design, specification, and procurement processes. In addition, a SEATS is typically less costly and simpler to install than multiple devices and saves costly wiring time. Because the disconnect and switching equipment are integrated into one enclosure, the solution will often require less floor or wall space than separate equipment installations.

¹ National Fire Protection Association, *NFPA 70 - National Electrical Code, Fourteenth Edition, 2017*. Quincy, Massachusetts, 2016. Article 230.70

² *Ibid.* Article 100.



Requirements

Requirements for service entrance equipment are found in *UL 1008 Standard for Safety - Transfer Switch Equipment*.³ In that document, *Chapter 8 - Service Entrance Requirements* provides key requirements for transfer switches marked as service equipment:

- An externally operable disconnect for ungrounded supply conductors of both the normal and the alternate sources under any condition of the normal and alternate supplies, unless a single disconnect for the normal source can be provided when the alternate source is a feeder.⁴ In that case, the ATS must be marked “Suitable for use as service equipment – NORMAL source only” and the alternate source must be a generator that can readily be shut down.^{5,6}
- Provision for connecting the grounding electrode conductor to the grounded service conductor. When provided, it must be on the neutral.^{7,8}
- If the ATS has, but does not interrupt, a grounding load conductor, a means for disconnecting it must be provided.⁹
- Each ungrounded service conductor shall have overcurrent protection, and the service-overcurrent device shall be an integral part of the service disconnecting means or be located immediately adjacent thereto.¹⁰
- Three-phase, four-wire, wye-connected services exceeding 1000 amps and 150 volts shall be provided with ground fault protection that causes the service disconnecting means to open all ungrounded conductors of the faulted circuit.¹¹

Resulting Designs

Manufacturers offer ATS designs specifically intended for service entrance applications. ASCO offers a number service entrance models that comply UL 1008 requirements for the United States, Canada, and other locations. These models include circuit breakers located with service entrance equipment in a separate compartment, and are listed to both UL 1008 and *UL 891 – Standard for Safety – Switchboards*.¹²

³ Underwriter Laboratories, *UL 1008 – Standard for Safety – Transfer Switch Equipment, 8th Edition*. Northbrook, IL. 2014.

⁴ *Ibid.* Section 8.1.2.1

⁵ *Ibid.* Section 8.1.2.4

⁶ *Ibid.* Section 5.2.6.1.14

⁷ *Ibid.* Section 8.1.3.1

⁸ *Ibid.* Section 8.1.3.2

⁹ *Ibid.* Section 8.1.4.1

¹⁰ *Ibid.* Section 8.1.5.1

¹¹ *Ibid.* Section 8.1.6.1

¹² Underwriter Laboratories, *UL 891 – Switchboards, 11th Edition*. Northbrook, IL. 2005.



These designs comply with UL 1008 in the following ways:

- They provide an externally operable circuit breaker that serves as a disconnect for ungrounded supply conductors of both the normal and the alternate sources. Alternately, a SEATS can provide a single breaker for the utility where a generator is served by another disconnect that complies with NEC requirements.
- Their service entrance compartments contain a means for connecting the service neutral to the premises neutral.
- The service entrance compartments contain equipment that provides a removable neutral-to-ground bonding jumper and means for disconnecting the service neutral from the premises neutral. SEATS are also available with an additional pole to automatically switch the neutral conductor between power sources.
- A SEATS integrates the service equipment and disconnect into a single, compartmented, UL-listed enclosure that also houses the transfer switch.
- For applications exceeding 1000 volts and 150 volts to ground, SEATS are furnished with ground fault detection that will trip the service disconnect device.

Figure 2 shows key features within an ASCO SEATS. Figures 3 presents a schematic for an open transition SEATS. Figure 4 depicts a SEATS equipped with ground fault protection. If a ground fault is detected, the breaker will open. Figure 5 presents a diagram of SEATS equipped with a switched neutral for isolating separately-derived grounds. For additional information regarding switched neutral applications, read our paper entitled [Switching the Neutral Conductor](#).

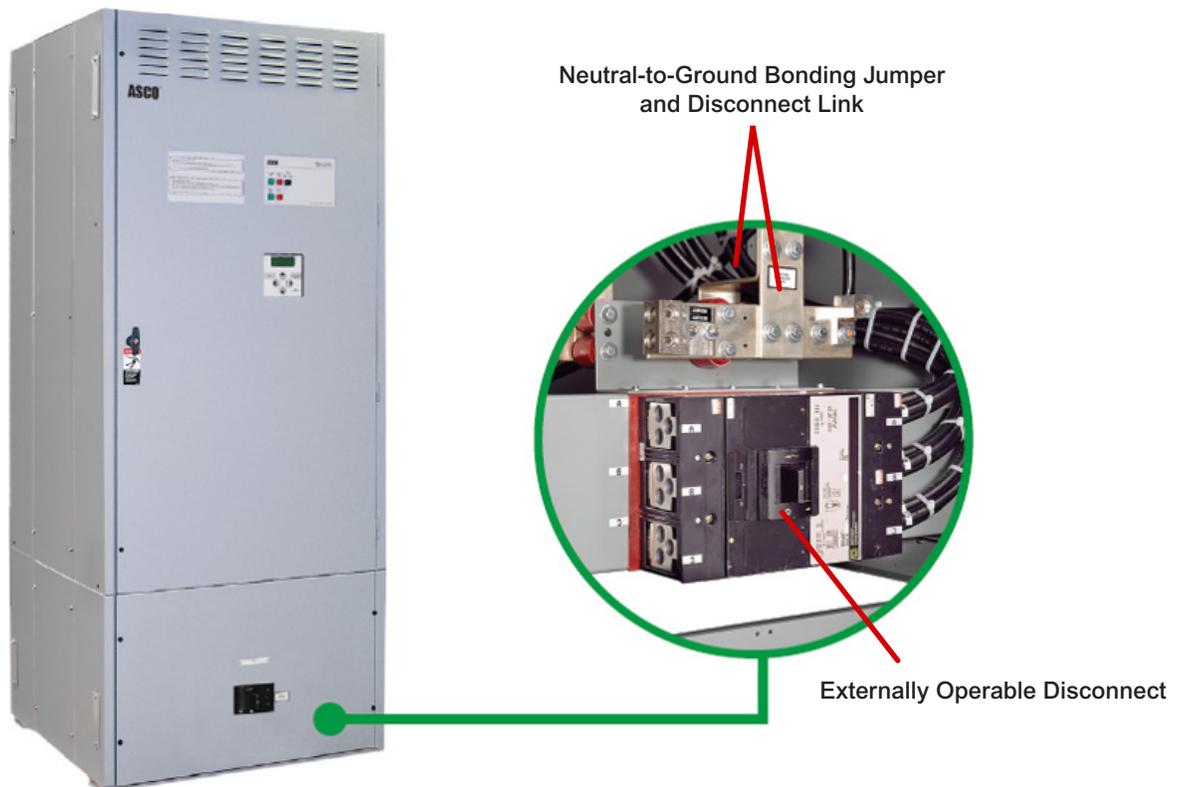


Figure 2: Provisions for disconnecting the ground and neutral

ATS

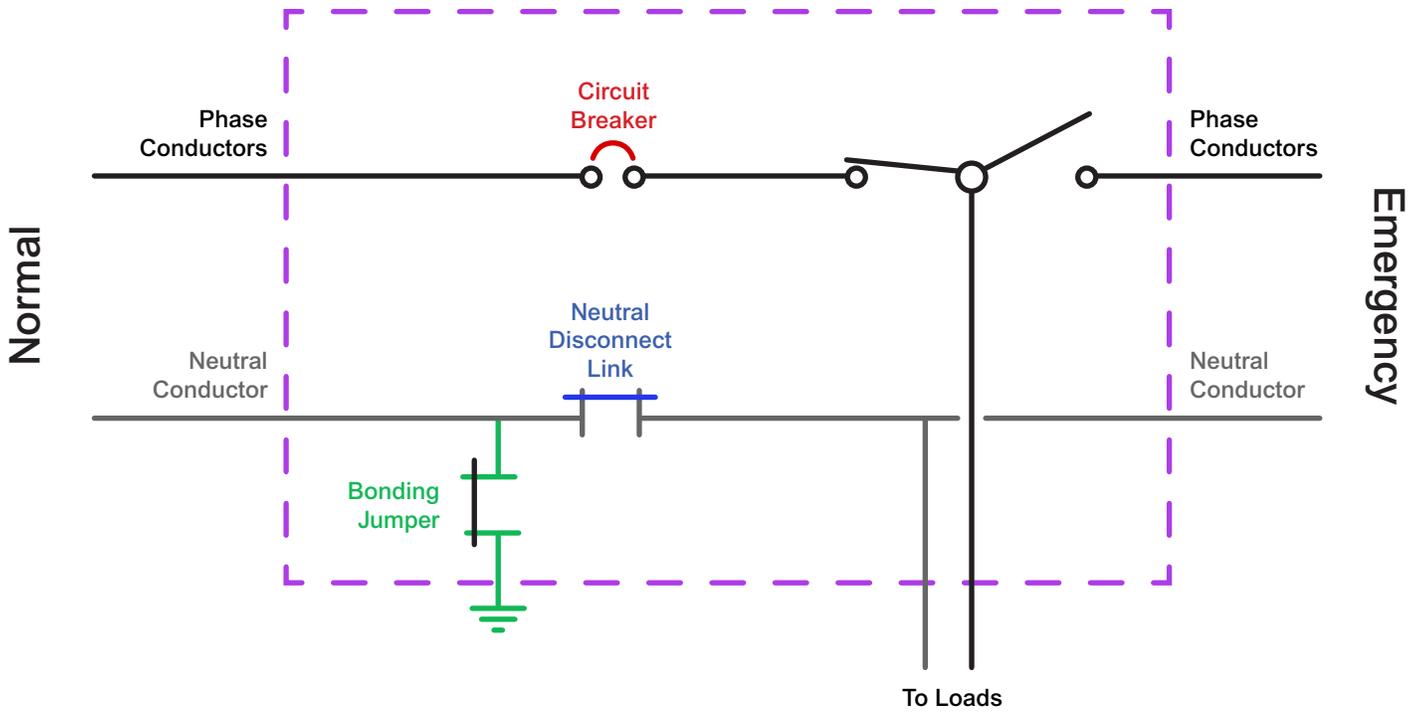


Figure 3: Open Transition SEATS with a solid neutral

ATS

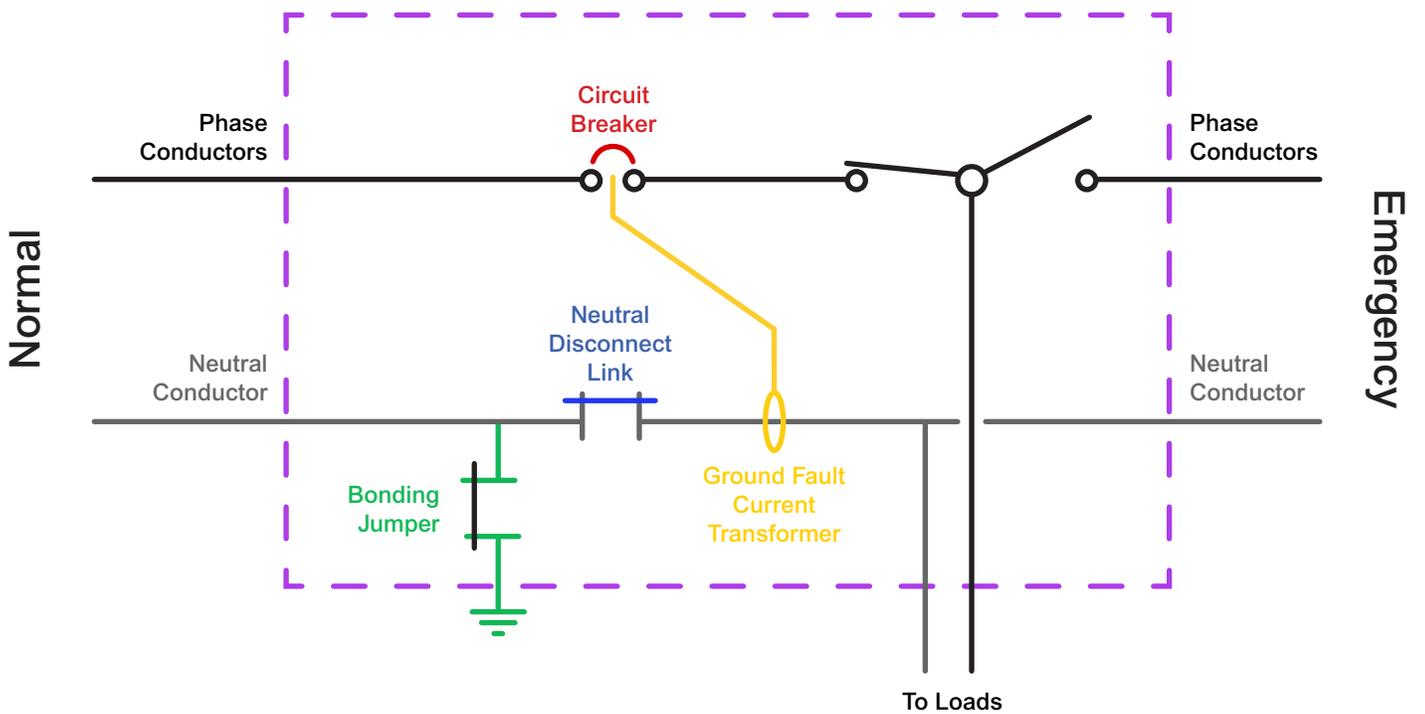


Figure 4: A SEATS equipped with ground fault protection that can open the breaker

ATS

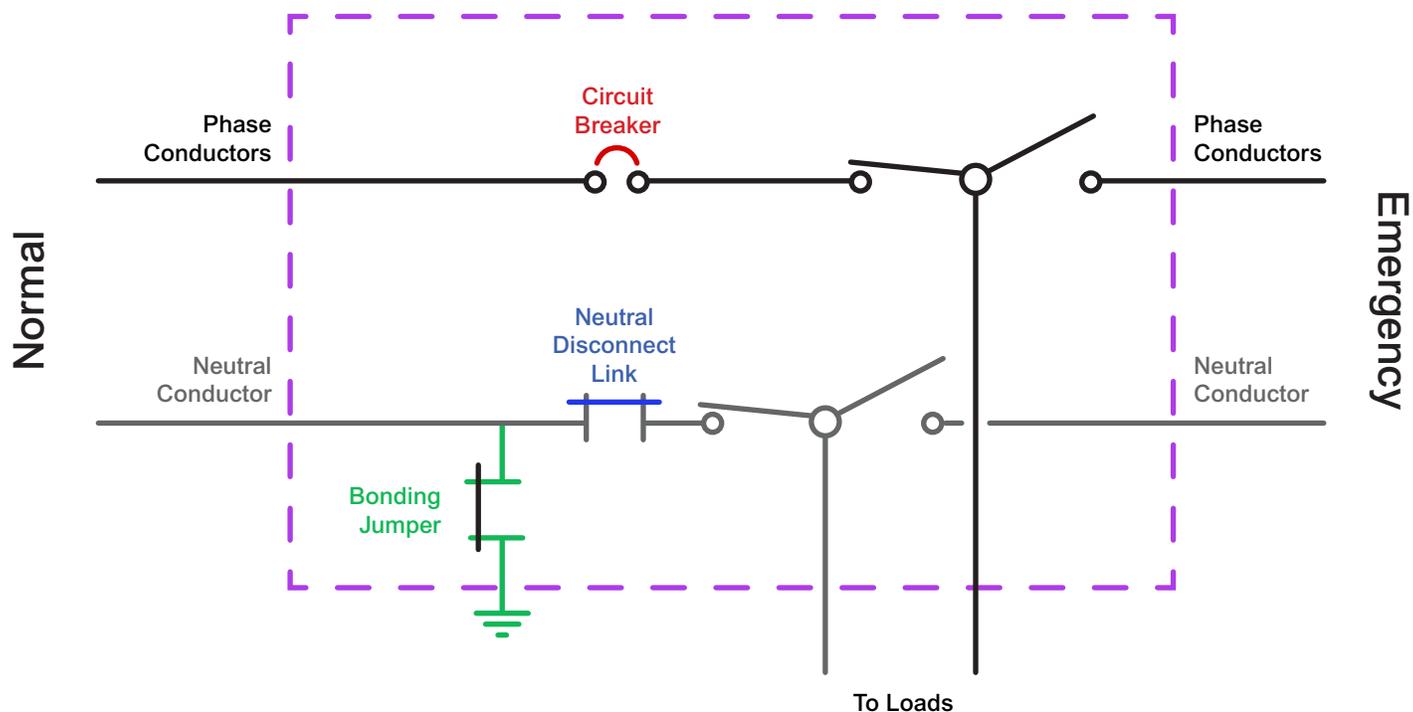


Figure 5: A SEATS with a switched neutral

Optional Features

Service Entrance ATSS can be configured with additional equipment to further streamline engineering, procurement, and installation processes. For instance, ASCO routinely supplies dual-service entrance rated transfer switches as well as service entrance switches with an additional breaker on the generator source. ASCO also offers service entrance transfer switches with breakers feeding the ATS loads, a solution commonly used in agricultural applications. For telecom facilities, ASCO supplies service entrance-rated Power Transfer Load Centers. These consolidate service entrance, power source switching, and a distribution load center into a single enclosure. This arrangement has proven useful at cell sites, where power outages could quickly result in communication failures and profound losses.

Likewise, service entrance ATSS are an ideal location to provide surge protective devices to mitigate the effects of transient overvoltages. More information about surge protective devices can be viewed at [ASCO's Surge Protection Devices](#) webpage.

Service Entrance ATSS are also available with an integrated isolation-bypass switch. These allow for service personnel to route current around an ATS so that the switch can be disconnected for testing or drawn-out for service without interrupting power to load circuits and equipment. For more information about the function and benefits of bypass ATSS, read [Part 1](#) and [Part 2](#) of our paper entitled *Application and Design Factors for Automatic and Bypass-Isolation Switches*.

Because ATSS are located between power sources and equipment loads, they can be equipped to offer optimal visibility into the real-time status and historical performance of other critical power equipment. By equipping SEATSS with communication interfaces, they can communicate with power meters, power quality meters, annunciators, power and building management systems, and even ASCO's Critical Power Monitoring Systems. These tools offer extensive capabilities for real-time monitoring and communications, local and remote control, forensic assessment of power events, and streamlined compliance with industry and regulatory standards. Information about ASCO's own power monitoring and control solutions are available by viewing ASCO's [Power Monitoring and Control](#) webpage.



SUMMARY

Combining transfer switching mechanism and a service disconnect into a single piece of equipment provides advantages that include simplified design, specification, and installation as well as lower overall costs. UL 1008 and the NEC provide specific requirements for the configuration and use of this type of transfer switch. Manufacturers offer responding models that offer easily accessible disconnect mechanisms, integrated overcurrent protection, and ground fault and switched neutral options. For more information, consult the ASCO [transfer switch webpage](#) or contact ASCO [Customer Care](#).

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