

**Information Sheet # 06**

Three Cycle vs. Series Rated Automatic Transfer Switches

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Power Solutions*

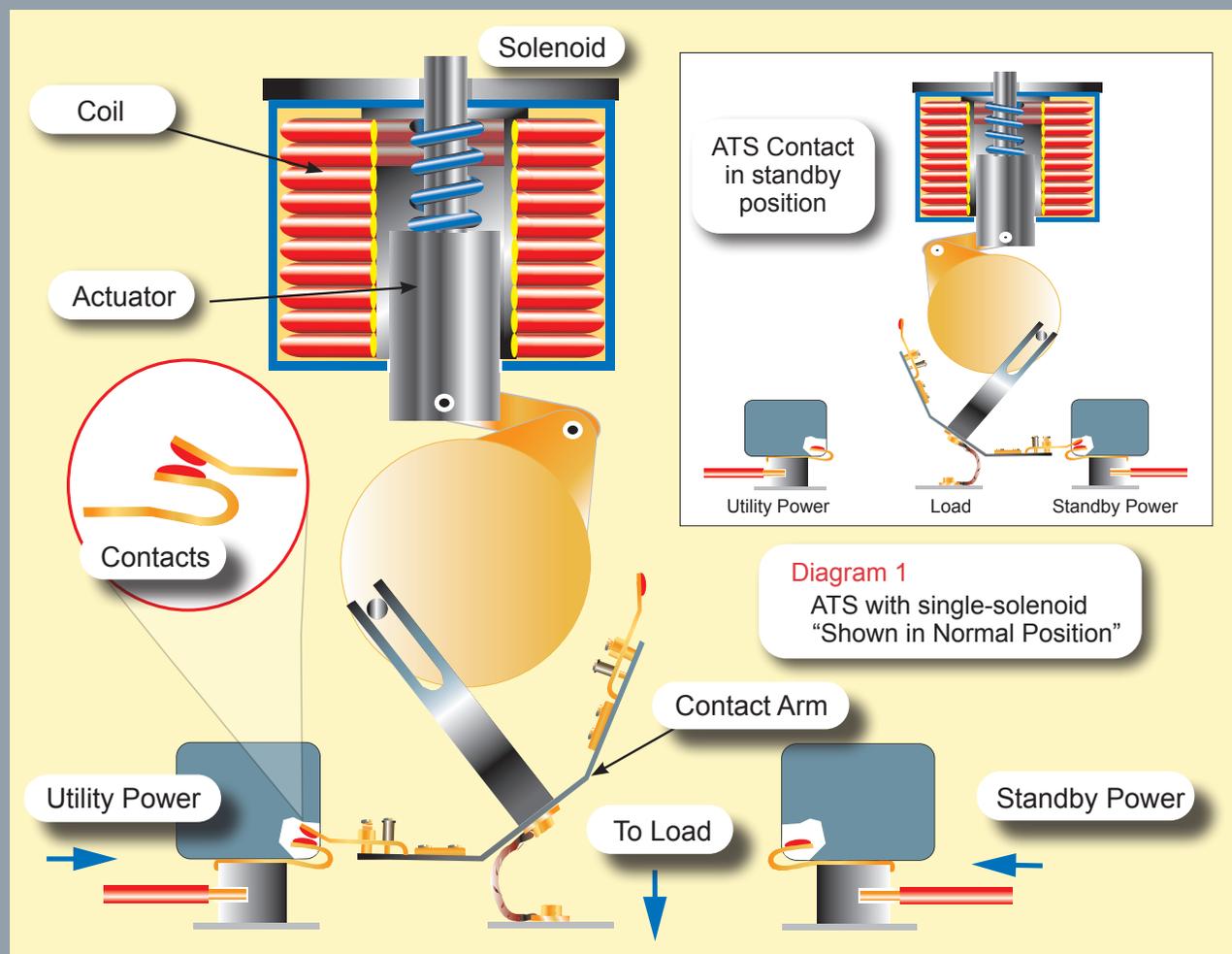
**1.0 Introduction**

Automatic transfer switches (ATS) are a set of contactors (See Diagram 1) that enable the load to be switched between the primary and back-up power sources, usually a diesel or gas-driven generator set. Most importantly, these contactors are mechanically and electrically interlocked to ensure the two power sources are isolated with no current flow possible from one to the other. One set of contactors will always break before the other makes contact.

*This information sheet discusses the issues a system designer must take into account when selecting a 3-Cycle rated over a Series rated ATS and the merits of one type over the other.*

**2.0 Selecting a Transfer Switch**

When selecting the size of ATS, two amperage loads have to be taken into account. The first is the load amperage the ATS contactors will bear under normal conditions. The second is the contactor's ability to withstand an amperage spike induced by an overload or short circuit fault.



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Diagram 2 - Typical Ratings Given by a Transfer Switch Supplier for UL 1008 ATS Tested 3-Cycle and Series					
Amperage Rating of Transfer Switch	UL 1008 Tested Withstand and Close-on Ratings @ 480 Volts				
	Current Limiting Fuse Rating	Max. Fuse Type		Specific Breaker Series Rated Amps	Any Breaker 3-Cycle Rated Amps
		Amps	Grade		
30	100,000	60	J	10,000	10,000
70, 100, 150	200,000	200			
230	100,000	300			
260, 400		600			
600, 800, 1000, 1200	200,000	1,600	L	65,000	50,000
1600, 2000		3,000		100,000	100,000
3000		4,000			
4000		6,000			

**Notes:**

- 1) For ATSs in the 70 to 400 amp Series tested allows twice the "withstand" amps on the contactor
- 2) The Series rated ATS is only offered when a circuit breaker is the trip device
- 3) When a 3-Cycle tested breaker is selected the user knows the contactor is more robust for fault induced amps

*(Continued from page one)*

To be code compliant, all circuits must include either a fuse or circuit breaker that will trip out the power source in the event of an overload or short circuit. Of concern is the time an ATS's contactors are exposed to the fault amps before the trip device operates. For the system designer to select an ATS, the industry offers two levels of rating, 3-Cycle and Series.

**3.0 Assigning a Rating for an ATS**

Assigning a rating for the maximum amperage the ATS contactors can withstand under load without damage is straight forward to specify and test for. However, the contacts' ability to withstand a fault induced amperage spike is a factor of the time the contact is exposed to the amperage spike. The longer the trip time, the more robust the contactor has to be.

The ATS industry, along with UL, developed the UL 1008 test that assigns a robust and lighter duty rating. Robust is the 3-Cycle rating and lighter duty the Series rating. In testing a contactor, its "withstand rating", the maximum amperage a contactor will carry over a defined time period before it is destroyed, is determined.

*(For further details visit UL site <http://ulstandardsinfontet.ul.com/scopes/1008.html>)*

**4.0 UL1008 Pertaining to ATS's**

UL 1008 approvals are provided using two specific tests. They are:

1. 3-CYCLE: Withstand and closing rating for 3 electrical cycles.
2. SERIES: Withstand and closing rating for specific breakers.

**5.0 3-Cycle ATS**

This is the most demanding of the UL 1008 tests. In the 60hz system, 3 cycles represents 0.05 seconds. (This is a long period for a trip device.) An example of a 3-Cycle rating would be a 100 amp contactor (continuous rated) that has a withstand rating of 10,000 amps for 3 cycles. *(See diagram 2 for sample ATS ratings)*

**Characteristics of 3-Cycle rating - for normal emergency application**

- UL tested with the slowest interruptive device
- Allows fault current to flow for 3 cycles
- More severe test than Series rated test allowing both fuses and circuit breakers
- Contactors are more robust

In selecting a 3-Cycle rated switch, the system designer is getting an ATS with contactors rated to manage any current spike before a manufactured-to-code fuse or circuit breaker operates. If the full details of the trip devices are not known the designer should choose a 3-Cycle rated ATS.

**6.0 Series ATS**

The Series rated ATS assumes contactors rated for lighter duty with a much faster trip. For example a 100 amp contactor (continuous rating) is rated to manage a withstand/closing rating of 22,000 amps with a specific circuit breaker. *(See diagram 1 for sample ATS ratings)*

**Characteristics of Series rating - for light duty residential and small business application**

- UL tested with a specific (quick to interrupt) breaker
- Fault current only allowed to flow for a short period of time (Less than 3-Cycle)
- Less severe test than a 3-Cycle test
- Design may require a "Short Circuit and Coordination Study" to ensure system is adequately protected and trip devices will operate as required
- More economic (Usually 15 to 20% less than the 3-Cycle cost)

A Series rated ATS should only be selected when trip devices are well defined and trip times are known to be within the UL 1008 testing for a Series rated ATS. Series rated ATSs are seen more in residential than industrial applications.