

## Your Reliable Guide for Power Solutions

To fulfill our commitment to be the leading supplier in the power generation industry, the Total Energy Systems, LLC. 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.

### 30-Cycle Rated Transfer Switches & Withstand Ratings

#### 1.0 Introduction

The demand for 30-cycle transfer switches had increased due to recent changes in 2005 and 2008 editions of the National Electrical Code (NEC), which calls for the requirement of selectively coordinated systems at hospitals and other mission-critical facilities.

*This Information Sheet discusses the criteria in the selection and consequences of 30-cycle rated transfer switches and withstand ratings, for distribution equipment. Proper selective coordination minimizes the impact of faults.*

Typical Automatic Transfer Switch to UL 1008 Withstand & Close-on Ratings

Transfer Switch Amp Size	Current-Limiting Fuse Rating	Max Fuse Amps Type	Specific Breaker Rating	3-Cycle Rating	Short-Time Withstand Rating	Short-Time Duration (Cycles)
125/150 225/260	200,000	400	42,000 30,000	25,000 18,000	25,000 N/A	10 N/A
300/400/600	200,000	1200	65,000 50,000	35,000 22,000	30,000 N/A	30 N/A
800	200,000	2000	85,000 65,000	65,000 65,000	42,000 N/A	30 N/A

Chart One

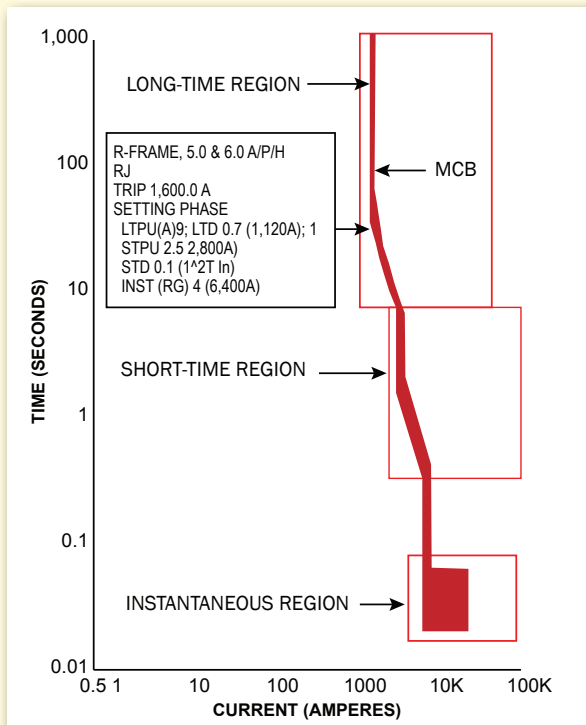
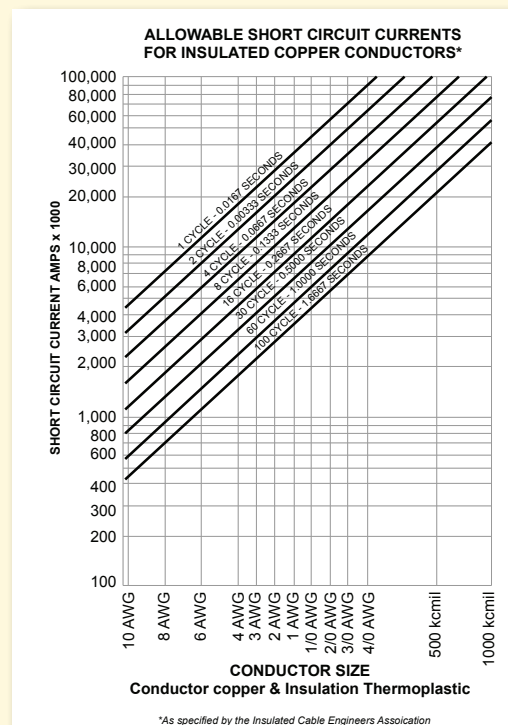


Chart Two



## 2.0 NEC Articles referred to:

The NEC codes referred to that effect selection of 30-cycle rated transfer switches are

- **NEC Article 700** - Requirements for emergency systems
- **NEC Article 701** - Legally required standby systems
- **NEC Article 701** - Critical Operation Power Systems

These requirements have led electrical designers to pursue selective coordination for many other electrical systems.

## 3.0 Selective Coordination:

NEC Article 100 defines selective coordination (SC) as the “localization of an over-current (OC) condition to restrict outages to the circuit or equipment affected, by the choice of OC protective devices and their ratings or settings”. Such a system simply implies that the OC device closest to the fault or overload, will open the circuit before any upstream OC device. When designing a selectively coordinated system, the minimum time level must be considered as well as the maximum fault level at each piece of equipment in that system. The most common time levels for selectively coordinated systems are 0.001 and 0.01 seconds.

NEC Articles 700.27, 701.18, or 708.54 do not provide a definition for SC, nor indicate preference for one or the other selectivity level. This selectivity requirement is generally, but not always, interpreted that the SC must extend throughout the instantaneous region (0.001 seconds) of the device’s trip curve. Other standards by certain states mandate SC for time delays beginning at 0.1 seconds. This will allow some overlap in time bands for the devices in the instantaneous time region, and is an good engineering compromise between benefits of SC and associated increase of arc flash hazard levels resulting from time delays, which occur at higher fault levels.

When instantaneous SC for main distribution equipment is desired for time levels of 0.01 seconds and greater, selectivity is easily achieved throughout this instantaneous range by using conventional low voltage switchgear, incorporating main devices without an instantaneous trip function. However, switchboards must be provided with an internal bus that is braced for available fault current for 30-cycles, and not just the 3-cycles as defined in UL 891 standard for switchboards. Without an instantaneous trip to isolate severe faults to a 3-cycle clearing time, the bus withstand needs to be rated for 30-cycles. This is the maximum time delay permitted by adjustment ranges of short-term and ground fault protection provided on fully adjustable UL 1066/ANSI rated low voltage power circuit breakers (LVPCB).

## 4.0 What is a 30-Cycle Withstand Rating:

This term can be defined as the ability of distribution equipment to withstand mechanical and thermal stresses associated with a rated fault, for a time period of 30-cycles (0.5 seconds). Long a requirement for low voltage switchgear designed and tested to ANSI C37.20.1 and labeled to the UL 1558 standard, with short circuit ratings based on two 30-cycle withstand tests with a 15 second interval between tests performed at 15% power factor at 635VAC maximum. Switchboards however are only required to pass a single 3-cycle (0.05 second) short circuit test a 20% power factor and 600VAC maximum (see figure 1). UL 891 does not address a 30-cycle rating but some switchboards are available with the higher withstand rating and can be tested to ANSI standards and witnessed by UL – which can be labeled as suitable for applications requiring a 30-cycle withstand rating. (see chart two)

## 5.0 When is a 30-cycle Withstand Rating required:

The reason ANSI standards for switchgear require the 30-cycle withstand rating is that this equipment is designed to accept UL 1066/ANSI C37 circuit breakers which are not required to have an instantaneous trip function. Hence any OC device mounted in a traditional UL 891 switchboard with a 30-cycle withstand rating must have an instantaneous trip. (see chart one)

## 6.0 How does meeting selectivity affect Arc Flash Hazard risk categories:

An arc flash is a violent event which releases thermal and mechanical energy from an arc. In 2002, NEC published instructions requiring arc flash warning labels to be attached on equipment likely to be worked on or maintained while energized. This calls for appropriate personal protective equipment to be worn by workers.

## 7.0 Summary:

If selectivity is desired at 0.1 seconds, traditional switchboards can be used with careful selection and specification of the OC devices. True 30-cycle rated switchboards are now available. However, safety aspects of design must also be considered such as arc flash hazards. All downstream equipment, including cables, must be rated to withstand the available fault current for the full duration of the protective devices time delay trip setting. We suggest that the designer work with the owner, architect and the corresponding local authorities with jurisdiction.



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