

The ultimate solution for maintaining your nationwide generator network

## Service Entrance - Rated Transfer Switch

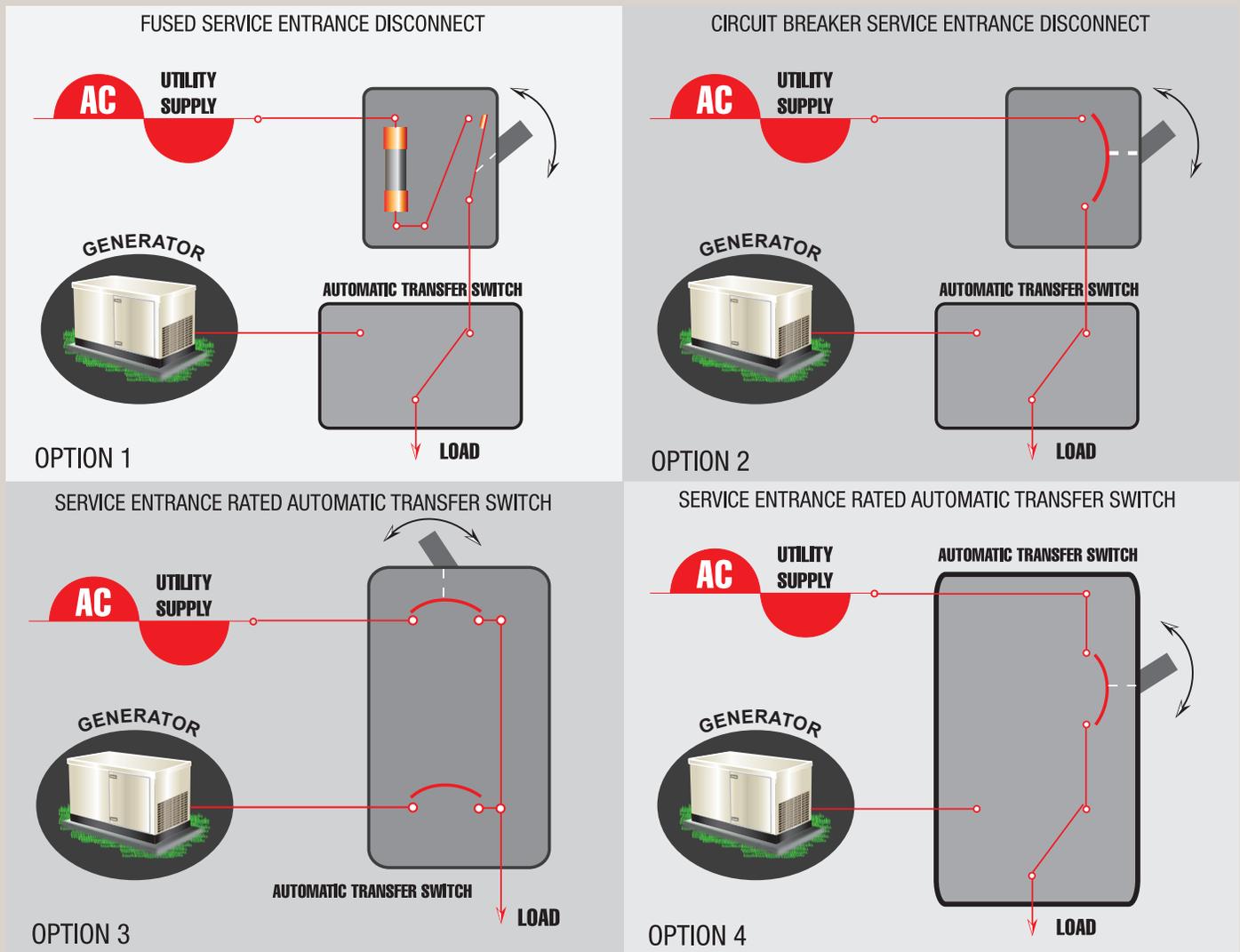
### 1.0 Introduction:

A service entrance disconnect is a device that interrupts excessive voltage and allows for manually disconnecting your home or business from the electrical utility.

*This information sheet discusses when to use a service entrance disconnect device and the requirements of National Electrical Code (NEC) and National Fire Protection Association (NFPA) 70.*

### 2.0 Definition of Service Disconnect Device:

Generally defined as a circuit breaker that either forms part of your utility meter base or the main panel, and is often called the 'main breaker'. (Continued over)



To fulfill our commitment to be the leading network service provider in the Power Generation Industry, the USA, Inc. team maintains up-to-date technology and information standards on Power Industry changes, regulations and trends. As a service, our **Information Sheets** are circulated on a regular basis, to existing and potential Power Customers to maintain awareness of changes and developments in engineering standards, electrical codes, and technology impacting the Power Generation Industry.

(Continued from previous page)

### 3.0 CB Characteristic Trip Curves:

These curves document how long it takes for specific CBs to trip depending on the level of current. For a typical thermo-magnetic CB, the manufacturer's published curves will indicate the time it takes CB to trip on overload. An overload condition will cause heat build-up around the current path within the CB, as well as along the power conductors. This heat (generated by the current flow) is actually what causes the CB to trip – not simply the magnitude of the current flow. This portion of the curve is said to have an inverse time characteristic, meaning that the CB will trip in less time at higher levels of current flow.

Since both the CB and conductor react to heat, the overall operating temperature of the equipment becomes a factor in sizing a CB in an enclosure. Other factors that may affect this operating temperature include:

- Size and location of the enclosure
- More than one current carrying device, housed in same enclosure
- Level of current that each device is carrying
- Environmental conditions in the area of the equipment

This means that simply designing a CB to hold 100% of its rated current only addresses part of the concern. The equipment must be able to safely sustain the heat generated by all the sources without exceeding the temperature limits in the product test standard. Both of these factors are accounted for by the sizing rules imposed by the NEC.

### 4.0 1996 NEC:

This recognizes that over-current protection devices are affected by the heat in the system. As such, it defines the concept of continuous loads and the 80% rule in order to try and offset the effects of heat in the system when sizing a CB.

### 5.0 Continuous Loads:

In Article 100, NEC defines a continuous load as “a load where the maximum current is expected to continue for 3 hours or more. It is therefore critical to understand that this is a load at its maximum current, uninterrupted for at least 3 hours. Office lighting typically meets this qualification.

OCPD size = 100% of non-continuous load + 125% of continuous load. Sec. 384-16 (c) has the same requirement except that it is stated in terms of loading of the OCPD. This rule states that an OCPD can be loaded to only 80% of its rating for continuous loads. We should remember that 80% is the inverse of 125% ( $0.80 = 1 \text{ divided by } 1.25$ ) and as such, the rules are indeed identical in their end requirement.

**Note!** Read the rule carefully - the 125% sizing of the OCPD (or 80% loading) is ONLY applicable when continuous loads are involved. CBs and other OCPDs can be sized at 100% of their rating for any NON-CONTINUOUS load applications.

### 6.0 100% -Rated Devices:

The NEC does not recognize complete assemblies (including OCPDs) that are listed for operation at 100% of their rating for continuous loads. This means that the equipment has undergone additional testing to verify that it can handle the additional heat rise associated with this level of operation. A 100%-rated CB and the end use equipment have been tested to verify that the additional heat generated by the 100% continuous loading conditions, is safely dissipated. Other equipment specifications also are driven by the need to dissipate the heat associated with the level of heat rise achieved during 100%-rated testing. Where the temperature at the CB wiring terminals exceeds 50°C during 100% rated testing. UL 489 requires the use of 90°C insulated wire (sized at 75°C ampacity with these CBs, and the CB MUST be marked as such by the manufacturer. UL489 also specifies minimum enclosure size and venting requirements if need for heat dissipation. A CB that has successfully passed these additional test is still not listed for applications at 100% of its rating for continuous loading unless it is marked as such by the manufacturer.

### 7.0 Summary:

A CB either carries a standard rating -80% or a 100% rating. The standard rating is subject to NEC sizing rules. 100%-rated CBs are permitted to be loaded continuously at their full rating as long as the assembly is listed and the conductors are properly connected.



Ultimate Service Associates, LLC.  
5514 South Lewis Ave.  
Tulsa, OK 74105

Ph: 918.836.8701  
Fx: 918.835.2748

[www.usa-svc.com](http://www.usa-svc.com)

