

## Ask the Engineer

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Welcome to “ask the engineer.” This issue’s question comes from Ron in Madison Wisconsin.

What is the difference between *interrupting ratings* and *withstand ratings*?

Good Question Ron!

First, we need to understand that the term ‘withstand rating’ is very broad in the power distribution arena and can refer to many things including current, voltage, and frequency. In this case, since the term is coupled with ‘interrupting ratings’ we’ll look at short-circuit currents.

The simple answer, of course, is that interrupting ratings generally apply to things that interrupt and withstand ratings generally apply to things that don’t interrupt. In fact, NEC 100-I has a very concise definition for interrupting rating (“The highest current at rated voltage that a device is intended to interrupt under standard test conditions”) and it provides article 110.9 to assure compliance for all equipment applied within a power system that are intended to interrupt fault currents. Though no definition is offered for ‘withstand rating,’ it is generally accepted to describe the fault current level which each device can safely handle, for a defined time, without failing. Even though the NEC offers no definition, it still requires compliance with this intuitive concept through NEC 110.10.

Well that was easy.....but wait! Lets explore a little further.

We know that all circuit breakers and fusible switches have an interrupting rating. But this rating may be dependent on additional factors that must be considered in an application. For example, a device may have a different interrupting rating when used in certain equipment assemblies than it does in other equipment assemblies or enclosures. Also, we find that a device can have a different rating when used in combination with another device (*series ratings*). In addition, non-interrupting devices may carry a withstand rating that is dependent on another element of the system. This is most commonly seen in switches and non-automatic circuit breakers which typically list a withstand rating when used in series with a fuse or circuit breaker. In these cases, the “non-interrupting” device has very little withstand capability by itself and relies on the series protector to open before a damaging level of current is reached. And just to confuse things even more, most manufacturers offer non-automatic devices that are actually automatic since they incorporate high level instantaneous trips in order to get a substantial interrupting rating, as well as non-automatic devices which have no such instantaneous overrides at lesser short circuit ratings. So, care must always be exercised in making such selections.

Most electrical equipment carries a *short circuit* rating that is a reflection of the components in that equipment. Switchboards and panelboards for example typically have a short circuit rating based on the series rating (where a series rating exists) or the lowest rated device (where no series rating exists). Automatic Transfer Switches have withstand ratings dependent on upstream protective devices, and feeder busway, which has no interrupting components, carries a *short circuit* rating, which is actually its withstand capability, based on testing for a specific length of time (typically 3 cycles). Switchgear and some specially constructed switchboards can handle fault currents for up to 30 cycles, and can therefore incorporate breakers with short time trip characteristics but without instantaneous trip characteristics.

Transformers have through-fault protection curves. These are *mechanical and thermal limits* that are plotted on a log-log plot as part of a coordination study to verify proper protection.

Well, there you go Ron. I hope this clears up the confusion.

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