Reliability

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A key ingredient in selecting equipment for any application is reliability. Users of power switchgear are especially sensitive to this because when switchgear goes down, the lights go off or the process stops and these type of events can cost the owners millions of dollars. With this in mind, the purchasing agent’s check list now has line items for Mean Time Between Failure (MTBF) and/or Mean Time To Repair (MTTR) and they expect the manufacturer to have measurements on file with supporting data.

Unfortunately, this is not the case for most power circuit breaker and switchgear manufacturers. There are some who offer values based on factory test results or based on data from other markets where the business climate is different from the United States, but the majority simply don’t have enough reliable data to make any real claims about reliability. They are not hiding problems or trying to limit information to the marketplace. They simply cannot get the data from clients. Here’s why:

First off, the expected service life of power switchgear is 40 years. While that isn’t always the case and there is no test in any standard to prove it, 40 years is the generally accepted time. Keeping track of thousands of pieces of equipment over such a period is a daunting task. The use of computers makes this somewhat easier for new equipment, but older equipment records exist on paper or microfilm, making record updating and retrieval difficult. But even with the records keeping problem solved, there are still many difficulties.

Power switchgear is intended to distribute electricity to multiple loads in a power system. The circuit breakers provide switching to determine the circuit path and protection against overload conditions. They are not used like light switches and often remain open or closed for extended periods of time; sometimes that period can be years. Manufacturers recommend maintenance after any short-circuit interruption and a periodic or routine maintenance program that is based on the number of mechanical operations, influenced by the environmental conditions at the site, or a specified time period (typically annually).

The routine maintenance is often performed at greater intervals than recommended because shutting down the equipment means shutting down revenue for that period of time. Further, when that maintenance is performed, many clients have their own maintenance team or hire a third party (not the original manufacturer) to perform the work. Thus, the opportunity for inspection and the gathering of data that could be used in a reliability study is lost. In these cases, there is little chance that any information gathered would find its way back to the equipment manufacturer.

Even if the equipment manufacturer is called upon in the event of a failure, the owners of the equipment are not likely to share any equipment failure information because their processes are usually proprietary. The service call is typically for an “as fast as possible” repair and not a forensic investigation.

For these reasons, most manufacturers have very little opportunity to compile any reliability data. In Europe things are a bit more relaxed and there have been reliability studies made for some types of equipment. One example is for vacuum interrupters where numerous interrupters of various ages were pulled from the field and inspected for wear. The conclusions in these studies were very favorable; showing that vacuum interrupters have a life expectancy far in excess of anticipated 40 year life of the switchgear. It is a very safe assumption that vacuum interrupter failures are most commonly caused by mis-handling the interrupter during maintenance and not from age and wear.
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One can make similar assumptions about the entirety of the metal-clad switchgear housing the circuit breaker. Operating within its ratings and specified service conditions, it can be expected to remain functional through its entire recommended maintenance cycle. So there is a Mean Time Between Maintenance, if such a concept exists, stated by the manufacturer and proven by ANSI/IEEE mechanical life design testing. This time may be further extended by the user, based on the service conditions and operating history. The time between maintenance may also be negatively impacted by the site environmental conditions and require a reduction from the value provided by a manufacturer as that value will almost certainly be optimistically based on ideal service conditions.

While anecdotally, the general assumption is that power switchgear is quite reliable, obtaining specific statistical evidence has proven to be much more difficult. There is limited information in the IEEE Gold Book that discusses reliability of equipment using data collected from the 1970’s and 1980’s. The data gathered supports the expectation that switchgear has a high level of reliability. Modern day manufacturers providing such information are very likely using design test records or very small sample sizes to produce their statistics, and that really isn’t a fair representation of actual reliability.

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