



## **Electrical equipment is often overlooked during Shutdowns, Turnarounds, and Outages (STO).**

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The mechanical equipment is the focus because of the large volume of mechanical equipment verses electrical equipment at the facility. Electrical equipment can be very deceiving. It appears to be functional, the lights have been on, the motors have been operating, so why spend money on something that is operating?

To keep from having a failure the electrical equipment's insulation must be healthy to keep the electricity from shorting phase to phase or phase to ground and all current carrying parts must have low resistance connections. Having reliable protective and mechanical devices to open equipment when a fault occurs is just as important. Limiting the amount of time required to clear a fault is key to limiting equipment damage and possible large outage times due to expensive repairs or unnecessary equipment interruptions.

There are some on-line tests that can be performed on electrical equipment to give indication of the health of the insulation and current carry parts, but in depth maintenance can only be performed during a facility site outage. NETA-MTS-2019 specifications provides recommended tests to verify reliability of electrical gear including insulation, current carrying connections, protective functions, and opening of equipment during fault conditions.

The mechanical part of the electrical system requires just as much maintenance as the mechanical equipment in the plant. Typically, breakers and fuses are used to interrupt faults. For large industrial sites the breakers can be used for both medium voltage and low voltage. Medium voltage breakers can be rated to 1200-3000 amps and low voltage breakers can be rated to carry up to 5000 amps of current. This is a very large amount of power and these breakers are typically designed to open in 3-5 cycles. Any mechanical issue with these breakers can cause the breakers to open slower, which will lead to more damage, and possibly upstream breakers or fuses clearing instead of the breaker closest to the fault. If an upstream breaker opens, this will de-energize a larger portion of the facility, or possible the entire site instead of isolating the fault at the local level. Even more concerning is that Arc Flash Studies are based on the assumption that the breakers will operate within the manufacture's specifications, and the Arc Flash labeling at the site will not be valid if the breakers are slow to operate. This make regular maintenance and repair of issues extremely important to employee safety.

ANSI/NETA-MTS-2019 recommends tests be performed to verify the operation time of these breakers. However, if a breaker has contaminated or degraded grease the operating time of a breaker might improve as the breaker is operated. If just operating the breaker improves the time that it takes to open, then the breaker is not reliable. A breaker must be able to meet its required operating speed when it has been sitting there for months at a time closed and called upon suddenly to open a fault. Often the breaker has been operated several times before test technicians perform the timing test. There are different types of timing tests that can be performed during the first opening of a breaker, but

these types of test require a lot of setup time and coordination that might slow down the progress of shutting down the facility.

A breaker is a mechanical device and the service required to keep it operating properly is very similar to all other mechanical devices. Grease is very important and over time the grease will degrade. The amount of time a breaker can be expected to operate per design without new grease depends on the environment. High heat, gases in the air, humidity, etc. all play a large role. Also, how often the breaker is opened and closed can play a role in the longevity of the grease. Unfortunately, no amount of field maintenance can repair the grease. When the grease starts to become contaminated or degrade the only option for a reliable breaker is to tear it down, remove the old grease, and replace it with proper grease. Breakers can work reliably for 20+ years in a good environment, but they can also be unreliable due to degraded grease in under 5 years in a bad environment. Many in the industry have gone to having climate controlled pressurized electrical rooms to help improve reliability.

Often during maintenance testing breakers are found to be sluggish, or not operating properly until the breaker is opened and closed several times. There are oils or grease that can be sprayed in the pivot points to get them operating, but this can cause more harm than good. The mixing of different types of lubricant can cause more problems than the solve. If the different types of lubricants are not compatible, the grease can become hard and ineffective. Penetrating oils should never be used, because they are designed to breakdown grease and they will basically clean out (or contaminate) the grease that is there, and the breaker will be left with no lubricant as the penetrating oil dries out.

If a breaker will not open or close properly, the only way to repair it to a reliable state is to take the breaker apart and replace the grease per the original manufacture's specifications. If you have a breaker that will not open or close, adding oil or spray lubricant can be used to get the breaker to function, but this is only a short-term fix. There is not way to tell how long this temporary fix will last, and odds or it will be unreliable if the breaker is called on to trip. This can be a way to keep the site running, but a long-term plan must be developed.

Typically, once the issues are identified with one breaker the other breakers in the same switchgear will start experiencing the same types of issues in the near future. Since the breakers are all exposed to the same environment with the same type of lubrication. In order to have a reliable electrical system, breaker rebuilds should be part of the long-term strategy. Field testing can help identify the time frame of when this is becoming an issue, but no amount of field maintenance can fix a lubrication issue once it starts occurring. It is very important that a qualified testing company is documenting any mechanical issues found with a breaker, even if they correct themselves after operating the breaker several time, because this is the first sign that the breaker may not be able to clear a fault properly.