

Achieving an Electrically Safe Work Condition When Disconnects Have Viewing Windows

The Chairman of the Electrical Safety Subcommittee related that questions have come up during 70E training concerning disconnects that have viewing windows. Such disconnects are common at the Laboratory and operate at system voltages that range from 13.8 kVAC to 208Y/120 VAC. Many new installations have utilized such disconnects as an engineered means to mitigate hazards associated with electrical work. (One is reminded that NFPA 70E classifies operation of all disconnects, with door or cover closed, as having an arc-flash Hazard/Risk Category of 0 for voltages less than 1 kVAC, and as HRC 2 for voltages of 1 kVAC and above when suitably bounded by the notes of Table 130.7(C)(9)(A).) Observation of all blades being in the open position has often times been considered as a sufficient means of verification that hazardous energy has been isolated and that the circuit is de-energized and in an electrically safe work condition. Such observation is central to numerous procedures, especially as related to the access of accelerator and beamline enclosures. How do the requirements of NFPA 70E apply to this situation?

NFPA 70E Article 120.1 “Process of Achieving an Electrically Safe Work Condition” is considered by the ESS to govern this activity. This Article was reviewed, as well as the explanatory statements provided in the associated NFPA Handbook for 70E.

It is informative to note that Step 3 of the process requires “Whenever possible, visually verify that all blades of the disconnecting devices are fully open or that drawout-type circuit breakers are withdrawn to the fully disconnected position.” The Handbook discussion suggests “the worker should open the door or cover and observe the physical opening in each blade of the disconnect switch” with the worker protected from discussed hazards by PPE. However, viewing the blades through a viewing window is functionally equivalent to the observation afforded by opening the door or cover without the attendant hazards to the worker. The second paragraph in the Handbook under Step 3 provides guidance when the physical (blade) opening is difficult or impossible to observe directly. “In those instances, the worker should verify the physical opening by measuring voltage on the load side of the device after the handle has been operated.” But for the case where the physical opening has been observed directly, there is no statement relative to conditions that apply. In summary, there is no discussion of disconnects with viewing windows that would allow one to safely observe that all blades are withdrawn *without* opening the cover or door, although as stated above, viewing through a viewing window is functionally equivalent to verification by opening the door or cover and avoids exposing the worker to the live side of the disconnect.

The ESS has concluded that NFPA 70E does not adequately address the issue. The 70E requirement to, whenever possible, visually verify by opening the door or cover to observe the blades, with the worker protected from discussed hazards by PPE, can actually present an additional and unwarranted risk to the worker. This is especially true for 13.8 kVAC disconnects where exposure to this level of voltage presents significant shock and arc-flash hazards. Direct observation of disconnected blades is essentially and functionally equivalent to observing a plug

disconnected from a receptacle or to observing that a piece of equipment is not physically wired to a source of power. To demand personal protection from shock and arc-flash hazards for such situations defies reasonable logic. Such a demand can serve to actually undermine the importance and application of NFPA 70E guidance for electrical safety in the workplace.

The ESS concludes that direct observation of disconnect blades being in the open position is considered to be a sufficient means of verification that hazardous energy has been isolated and that the circuit is de-energized and in an electrically safe work condition. The following additional conditions and precautions are requisite to this conclusion.

- The connection between the disconnect and equipment is known with certainty
- The position of all blades in the normal open position is observed with certainty
- There is no observation of carbon tracking between the line and load connections
- The disconnect's load side has no capability of being backfed from other sources of power
- There must be at least one additional observation that the source of power has been removed
- As described below, voltage testing is still required prior to any work activity on normally energized conductors or circuit parts unless waived by written procedure

The additional observation is considered case specific and may include observation of meters, the equipment going to the off state, etc. If there is a potential for stored energy, such energy must be dissipated and so verified as per written procedure (ref. FESHM 5120).

If the above additional considerations are satisfied, good work practice continues to indicate that voltage testing be performed prior to work activity on normally energized conductors or circuit parts. Such testing activity is to be considered as having an arc-flash HRC of 0. Requirements for shock protection, normal to the voltage testing activity, shall continue to apply. Exceptions to this testing requirement, especially as related to accelerator or beamline enclosure access, may be waived by written procedure approved by the Division/Section Head after Subject Matter Expert review and the concurrence of the Electrical Safety Subcommittee.