

GENERAL:

The scope of this document is to provide requirements for fuses, enclosed switches and circuit breakers.

DESIGN GUIDELINES:

1. Fuses
 - 1.1. Renewable fuses will not be used.
 - 1.2. As much as possible, equipment should be specified with fuse holders that will accept fuses dimensionally the same as Class H fuses.
 - 1.3. A box to store fuses will be required for fuses over 400 amps. The box shall be a metal box, designed to store fuses, mounted in a highly visible location, and labeled appropriately.
2. Enclosed Switches
 - 2.1. All Enclosed Switches shall be NEMA Type HD (Heavy Duty) quick-make, quick-break disconnect switches with dual cover interlock to prevent door opening when switch is closed. An operator override will be provided to allow the door to be opened without having to open the switch. Switch shall be pad lockable in 'closed' and 'open' position and the disconnect switch shall be provided with an external indication of 'on' and 'off'.
 - 2.2. When utilized as a service disconnecting means, enclosed switches shall be U.L. listed as service equipment.
 - 2.3. Motors and other equipment not within sight of their feeder over current protection devices will be fed from disconnect switches located at the motor or equipment. All enclosed switches shall have a durable label permanently attached to the inside of the cover describing the fuse size, type, current limiting ability and devices controlled.
 - 2.4. All enclosed switches intended for use on circuits where current limiting fuses are required will be specified with rejection clips designed to permit installation of Class R fuses only.
 - 2.5. All enclosed switches shall have a grounding bar.
 - 2.6. All enclosed switches utilized in circuits with a neutral conductor shall have a neutral bar.
 - 2.7. Enclosed switches in mechanical rooms and potential wet locations (i.e. animal rooms, greenhouses, etc.) will have NEMA 3R enclosures unless the environment or usage requires a more restrictive enclosure.
 - 2.8. Enclosed switch is required on the line side of a variable speed drive. The switch must be located near the VFD and motor per the VFD guidelines [262923 Variable Frequency Motor Controller] and typical [262923 VFD Mounting Detail.dwg].
 - 2.9. Enclosed switches shall only be located on the load side of a VFD in special circumstances and will require approval by the project manager or University Engineer. If an enclosed switch must be provided on the load side of a VFD it shall be provided with auxiliary contacts hardwired to the VFD safety circuit to shut down the VFD if the enclosed switch is open.

3. Circuit Breaker

- 3.1. Bolt-in breakers shall be used. Plug-in breakers are not allowed. Square D I-Line and GE Spectra Series are acceptable.
- 3.2. Two and Three pole circuit breakers shall have an internal common trip and all circuit breakers frame sizes rated 200-amp and larger shall have interchangeable trips.
- 3.3. Only one conductor shall be connected to each circuit breaker, unless the circuit breaker is designed and Listed for multiple conductors.
- 3.4. No piggy back breakers will be allowed.
- 3.5. All general purpose power circuits will be a minimum of 20 amps.
- 3.6. All breakers shall be lockable for lockout procedures. Either external device or integrated methods may be used. All electrically operated breakers shall have integrated method of locking.
- 3.7. Circuit breakers 200 amps and larger shall have adjustable trip settings. Breaker shall include a true RMS sensing electronic trip unit with; adjustable long time pickup, adjustable long time delay, adjustable short time pickup, adjustable short time delay, I_{2tin} and I_{2tout}, adjustable instantaneous pickup, and targets to show cause of breaker trip. Where ground fault trip function is used it shall be part of the circuit breaker electronic trip unit and include; adjustable pickup, adjustable delay, I_{2tin} and I_{2tout}.
- 3.8. Where the breaker frame size is 1,200 amps or larger, NEC requires arc energy reduction by one of listed methods. The preferred method is the energy reducing maintenance switch. Maintenance switch shall be a two position, lockable device with a locally mounted blue strobe beacon enabled when in maintenance mode. System shall have one spare set of contacts for future use. A label shall be provided for beacon stating "Breaker in Maintenance Mode When Flashing". Alternative methods may be considered on a case by case basis.
- 3.9. When breakers are equipped with ground fault protection, ground fault sensing shall use individual phase sensing and a neutral current sensor (such as a current transformer). Single unit (zero sequence) sensors shall NOT be used.
- 3.10. Draw out breakers may be used for increased reliability and maintainability if required for the type of loads and breaker duty. The use of draw out breakers needs approval of project manager.