Solenoid Electrical Safety Review

Concerns & Comments

- **Date of review: 01/14/97**
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Committee's Concerns:

- **Lock & tag location**
- **350 MCM cable**
- **Controlling access to end rack**
- **Single device failure analysis of quench protection system - Including documentation of redundancy**
- **Ground fault current setting**

Lock & Tag Location

Concern: Lockout is provided in utility room and on power supply; but no separate convenient adjacent safety switch for lock out of power supply.

Comment: We have installed a 400 Amp safety switch on wall adjacent to power supply.

350 MCM Cable

Concern: Conductor size too small for specified 400 Amp circuit breaker (350 MCM = 350A@90C in raceway, 570A@90C in free air).

Comment: Circuit breaker respecified to 300 Amps Note - operating phase current of supply expected to be ≈ 138 Amps AC at 15V, 5000 Amps DC (H970123A).

Controlling Access to End Rack

Concern: All system electrical connections (interlocks, controls, voltage taps etc.) are routed through end rack terminals). End rack should be padlocked to discourage unqualified tampering with connections.

Comment: Have installed padlock on the end rack door.

Single device failure analysis of quench protection system - Including documentation of redundancy

Concern: The whole quench protection system should receive a single device failure analysis with respect to its critical functions (detecting quenches and turning off power supply). Mechanisms should have redundant paths to ensure that single device failures does not result in damage to solenoid.

Comment: Done - Document H971203B available at http://d0sgi0.fnal.gov/~hance/solenoid

Ground fault current setting

Concern: Documentation states that ground fault current will be limited to less than 40 Amps. Reviewers recommend < 50 milli-Amps.

Comment: Ground fault current now limited by 2500 Ohms resistance in GFD circuit at center tap of dump resistor. 250V max across solenoid, 125V to gnd at CT. 125V/2500Ω = 50 mA max.