V. Design, Application, Maintenance & Operation Technical Requirements

V.E PJM Design & Application of Circuit Switchers

1.0 General Requirements

The nominal and maximum operating voltages of the effectively grounded transmission systems are as follows:

Nominal System Voltage (kV)	Maximum Operating Voltage (kV)
69	72.5
115	121
138	145
230	242
345	362

PJM circuit switchers are intended to operate on the transmission system shall be designed to operate at the above applicable voltages.

High voltage air disconnect switches associated with circuit switchers shall meet the requirements of IEEE C37.016 “IEEE Standard for High Voltage Circuit Switchers rated 15.5 kV through 245 kV”, which does not cover 345 kV circuit switcher yet.

2.0 Specifications

2.1 All circuit switchers shall meet or exceed the latest applicable ANSI, IEEE, NEMA, ASME, ASTM, NESC, and OSHA Standards and Loading Guides. In case of conflict, consult with the affected Transmission Owner(s); contact PJM for assistance with coordination.

2.2 Circuit switchers shall be designed with adequate electrical and mechanical characteristics for the specific electrical system on which it is installed and for the application for which it is intended. These include but shall not be limited to: continuous current rating, short-circuit capability, interrupting capabilities, operating voltage, BIL, transient recovery voltage, and environmental conditions.

Special consideration shall be given to all switching applications, specifically cable, capacitor, and reactor switching. Careful analysis of intended switching application is requisite to proper circuit switch application.

2.3 Circuit switchers shall be designed for an in service operating life, considering normal routine maintenance, comparable to other electrical apparatus in the system to which it is applied.

2.4 The following ratings apply to circuit switchers installed on the various transmission systems:

Nominal System Voltage (kV)	Maximum Operating Voltage (kV)	Minimum BIL (kV)
69	72.5	350
115	121	550
138	145	650
230	242	900
345	362	1300

- Comments: The driver of difference of Min. BIL of Breaker/Circuit Switcher and Transformer at each voltage level would need to be explored, if applicable.

  Circuit switcher BIL shall be carefully selected based on system studies, insulation coordination, and surge protection provided. Consideration shall be given to insulation capabilities to ground and insulation capability across an open circuit switcher. BIL must be carefully selected to avoid open circuit switcher flashover.

3.0 Application and Special Considerations

3.1 Local environmental conditions should be considered when selecting creep requirements for circuit switchers.

3.2 Circuit switchers at a minimum, shall be designed to operate at ANSI required ambient temperatures of -22° F to +105° F (-30° C to +40° C). All circuit switchers shall be designed to operate satisfactorily in the ambient temperatures dictated at their installed location. Some locations in PJM have required -40° C capability; refer PJM TSS document II, "Design Criteria for Electrical Facilities Connected to the PJM Transmission System," latest version.

3.3 Circuit switchers shall successfully open and close with 3/4 in of radial ice (per IEEE C37.016).

4.0 Emergency Ratings

Emergency ratings of electrical system apparatus, including circuit switcher, are critical to the reliable operation of the PJM system. Ratings of circuit switchers applied to the PJM system should be determined using manufacturers' guidelines.

5.0 Maintenance

5.1 See section V.L.2.E for maintenance requirements.