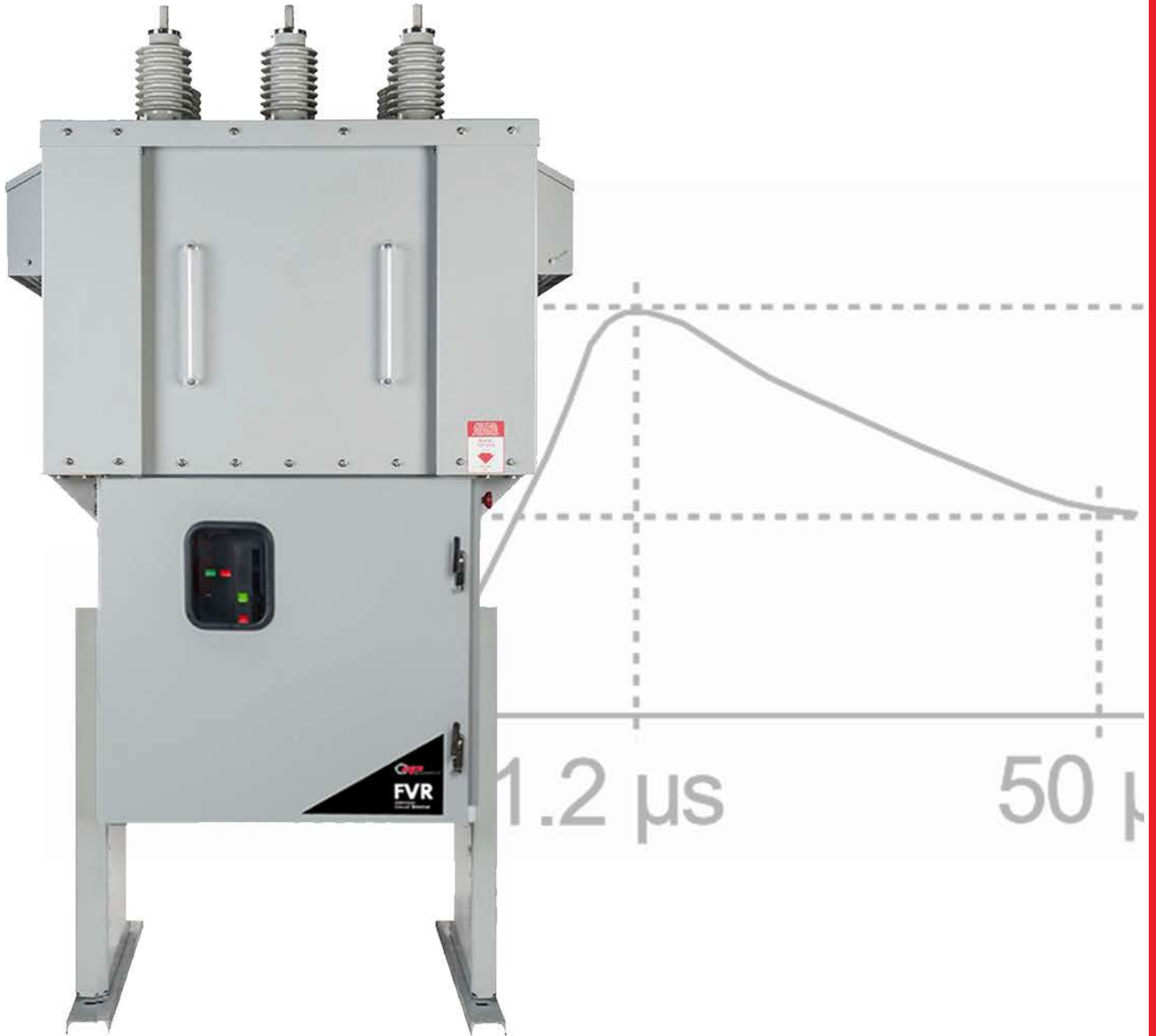


# BIL Ratings for Medium Voltage Circuit Breakers



by Keith Miller, PE, Engineering Manager

# BIL Ratings for Medium Voltage Circuit Breakers

The required lightning impulse withstand (BIL) ratings for medium voltage circuit breakers in the IEEE standards are often confused. This confusion stems from the terms “indoor” and “outdoor” which were previously applied to circuit breakers in the standards, which then determined what rating would apply. While the standards no longer use these terms, the confusion lives on.

Historically, the term “outdoor” was reserved for equipment designed for use in open-air substations. This type of breaker is commonly known as a station breaker. In contrast, breakers used in metalclad switchgear were always considered “indoor”, whether installed in a building or skinned in a weatherproof shell and referred to as outdoor non-walk-in construction. With the introduction of C37.06-2009, the terms indoor and outdoor were replaced with Class S1 and Class S2, respectively. These new terms bring much more clarity to the classifications. Per the introduction of that standard, “The term Class S1 circuit breakers is for cable systems (historical predominant use was for indoor circuit breakers) and the term Class S2 circuit breakers is for overhead line systems (historical predominant use was for outdoor circuit breakers)”.



***The term Class S1 circuit breakers is for cable systems (historical predominant use was for indoor circuit breakers) and the term Class S2 circuit breakers is for overhead line systems (historical predominant use was for outdoor circuit breakers)***

**IEEE C37.06-2009**

Per column 5 of table 15 of C37.06-2009, the required BIL for Class S1 (cable connected) 15kV circuit breakers is 95kV, while the BIL for Class S2 (overhead line connected) is 110kV. For 38kV circuit breakers, the required ratings are 150kV BIL for Class S1 (cable connected), and either 150kV or 200kV BIL for Class S2 (overhead line connected). For 5kV service, there is no rating for Class S2 (overhead line connected), only Class S1 (cable connected) which requires a 60kV BIL rating.

In addition, the IEEE standard for metalclad switchgear (C37.20.2-2015) is in full agreement with the Class S1 (cable connected) ratings from C37.06-2009. From table 1 of C37.20.2-2015, the required BIL is 60kV for 5kV equipment, 95kV for 15kV equipment, and 150kV for 38kV equipment. There is no mention of indoor or outdoor (or Class S1 / S2) in this standard with respect to any alternate ratings. As stated above, the term “outdoor” was really referring to station breakers - metalclad switchgear was and still is designed for cable connected systems only (“indoor” using the older terminology).

## REQUIRED BIL RATINGS FOR CLASS S1 AND S2 SWITCHGEAR

Class S1: Cable Connected		Class S2: Overhead Line Connected	
Voltage	BIL Rating	Voltage	BIL Rating
5kV	60kV	5kV	none
15kV	95kV	15kV	110kV
38kV	150kV	38kV	150kV/200kV

Source: IEEE C37.06-2009 Table 15, Column 5

## About the Author

Keith Miller, PE, is the Engineering Manager for Myers Controlled Power, LLC. A graduate of Ohio Northern University, Keith has nearly 30 years of experience in the design of power distribution equipment. He joined Myers Controlled Power in 1993 as an Electrical Designer and has advanced through the company to the position of Engineering Manager, which he has held since 2016. Keith is a registered Professional Engineer in the State of Ohio.