

---

## Medium Voltage Circuit Breaker Switchgear Projects, ANSI vs. IEC. What's the Difference in Construction?

March 7, 2017

In today's marketplace it is becoming more and more common to see both ANSI/IEEE and IEC standards in specifications for a project. In the case of medium-voltage (MV) circuit breaker switchgear projects IEEE C37.20.2, *IEEE Standard for Metal-Clad Switchgear* and IEC 62271, *High-voltage switchgear and controlgear—Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*, are commonly cited in the same specification.

Until 2003 both ANSI/IEEE and the IEC standards contained a type of MV switchgear that was termed Metal-Clad (MC) Switchgear. The 2003 edition of IEC 62271-200, which superseded IEC 60298, discontinued use of the term Metal Clad and instead introduced a new classification of switchgear assemblies based upon Loss of Service Continuity (LSC) categories. There were numerous valid technical reasons for the IEC to discontinue the use of the term Metal Clad and Annex C of the 2003 edition of 62271-200 describes the reasons for the changes in some detail. The last sentence of Annex C.1 summarizes by stating "Differences between IEC and IEEE definitions made harmonization difficult."

This Tech Brief will focus only on the major differences in the construction requirements contained in the two standards. There are numerous other differences in Ratings, Tests, Internal Arc Classifications, etc. that will not be described in this Brief. Those differences will be the topics of future Tech Briefs.

Metal-Clad Switchgear as defined in ANSI/IEEE meets the requirements of IEC class LSC2B-PM metal-enclosed switchgear and controlgear. However, ANSI/IEEE also requires several additional features in order to be classified MC switchgear that are not required in class LSC2B-PM switchgear. These differences are summarized below.

- The main circuit switching and interrupting devices (i.e. circuit breakers) must be withdrawable, equipped with self-aligning and self-coupling primary disconnecting devices, and disconnectable control and auxiliary circuits. Manual secondary disconnecting devices must also be interlocked with the switching device such that the switching device control connections are always made and maintained when the circuit breaker is in the connected position. **Stationary, or non-withdrawable, switching devices are allowed in IEC providing the requirements of LSC2B-PM are still met.**
- Voltage transformers and control power transformers must be contained in separate metal enclosed compartments. The primary circuits of all voltage transformers must include current-limiting fuses for protecting transformers and shall be mounted in such a way that they must be disconnected from the high voltage circuit before access can be obtained. There must also be provisions for disconnecting or automatically grounding the low voltage circuit of voltage transformers when the high voltage circuit is disconnected. Additionally, a method for grounding the high voltage winding and/or fuses during the disconnecting operation to dissipate static charges shall be provided. **Fixed-mounted and unfused transformers are allowed in IEC providing the requirements of LSC2B-PM are still met.**
- All the live parts must be enclosed within grounded metal compartments. Metallic barriers between primary compartments must be a minimum of 11 gauge steel. Barriers not made of 11 gauge steel, such as aluminium, must be increased in thickness or reinforced to provide a strength equivalent to steel. **Although IEC LSC2B-PM requires metallic barriers, there is no thickness or strength requirement stated.**
- A metal barrier in front of, or a part of, the switching device to ensure that when the device is in the connected position no high-voltage parts are exposed by the opening of a door must be provided. **The IEC standard does not require this barrier, but rather addresses high-voltage part access by means of interlock controlled or procedure based compartment access requirements.**

---

## Medium Voltage Circuit Breaker Switchgear Projects, ANSI vs. IEC. What's the Difference in Construction?

- Main bus bar compartments must be divided between adjacent vertical sections of an installation. ***The IEC standard does not require this additional separation of the main bus compartment. The bus compartment may be one continuous compartment for the entire installation.***

The following are requirements for IEEE equipment for which there are no equivalent IEC requirements.

- Mechanical interlocks must be provided for protecting operators from the accidental discharge of stored energy from withdrawable switching devices by any of the following means:
  1. Interlocks in the compartment to prevent the complete withdrawal of the switching device from the compartment when the stored energy mechanism is charged.
  2. A suitable device provided to prevent the complete withdrawal of the switching device until the closing function is blocked.
  3. A mechanism provided to automatically discharge the stored energy before or during the process of withdrawing the switching device from the compartment. If the stored energy is discharged before the switching device is moved from the connected position, an adjunct electrical interlock is required to prevent stored energy recharge.
- A locking means must be provided to prevent moving the withdrawable switching device into the connected position.
- All primary conductors and connections must be covered with flame resistant insulating material throughout. ***Bare conductors are allowed in the IEC. Although this brief is limited to describing construction only, IEEE primary conductors and connections are required to operate at a temperature rise 10 degrees Centigrade cooler than IEC, which could result in larger conductor sizes for the same or similar continuous current ratings.***
- All insulating materials used for the support of primary conductors must be track resistant.
- Instruments, meters, relays, secondary control devices, and their wiring must be isolated by grounded metal barriers from all primary circuit elements, with the exception of short lengths of wire such as at instrument transformer terminals and secondary disconnecting devices.
- There are numerous requirements and restrictions in ANSI/IEEE for control and secondary circuit and device wiring such as wire size, flexibility, protection and support, wire type, wiring terminals, terminal blocks, the designation of auxiliary switches and contacts, device function numbers, voltage limits of instrument and control circuit and polarity of dc connections to device coils.
- There are stringent requirements for the corrosion protection of enclosures that utilize external ferrous parts for both organic and inorganic corrosion protection coatings alike.

So, what's the difference? As you can see above, there are many. This is not meant to presume that manufacturers of IEC MV switchgear can not or will not supply equipment that will meet the additional ANSI/IEEE requirements for the "same" switchgear. Rather, it is simply to point out that equipment that meets only the basic requirements of IEC 62271-200 is definitely not the same. It is definitely worth considering the above when both ANSI/IEEE C37.20.2 and IEC 62271-200 are requirements of the same RFQ or specification for MV circuit breaker switchgear projects.

**Ted A. Burse**

**Director, Research and Development**