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# Switchboard Or Switchgear: Selection Criteria

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Low voltage electrical service (1,000 volts or less) delivered to a building or facility is first fed into a switchboard or switchgear which in turn distributes power to successively smaller equipment until finally being connected to lights, receptacles, and other utilization equipment through individual circuits.

Whether a switchboard or switchgear is used depends on several factors including the type and size of the facility.

The term “switchgear” is often used incorrectly by architects, contractors, and engineers when generically referring to all low-voltage distribution equipment, including switchboards. However, switchboards and switchgear are designed and tested to different sets of standards. They have significant differences in capabilities, overcurrent protective devices, space requirements, and cost. The purpose of this article is to explain these differences.

**Standards and Testing**

Switchboards are designed and tested to *NEMA PB 2 – Deadfront Distribution Switchboards* and *UL 891 – Switchboards*.

Switchgear are designed and tested to *IEEE C37.20.1 – Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear* and *UL 1558 – Switchgear*.

The key difference in these standards is that UL 1558 switchgear requires additional testing to establish a short-time 30-cycle (0.5 second) withstand rating. The standard short circuit current rating test for UL 891 switchboards is only for 3 cycles (0.05 seconds).

The 30-cycle withstand rating for switchgear permits the use of circuit breakers without an instantaneous function, or with the ability to turn it off. This allows the circuit breaker to “wait” longer for downstream breakers closer to a fault to trip first, minimizing the extent of power outages. This design approach, referred to as “selective coordination”, is mandated by the NEC for emergency systems, legally required standby systems, and Critical Operation Power Systems, and can be desirable for facilities where power reliability is critical.

**Overcurrent Protective Devices**

Switchboards may utilize fusible switches, fused power-circuit devices (bolted-pressure contact switches or high-pressure butt contact switches), molded case circuit breakers (MCCBs), or insulated case circuit breakers (ICCBs).

Switchgear utilizes only low-voltage power circuit breakers (LVPCBs), which offer several advantages over MCCBs (and to a lesser extent ICCBs) utilized in switchboards:

- Components of LVPCBs are accessible for inspection and maintenance, while MCCBs are sealed units with no component access (ICCBs may provide limited component access).
- LVPCBs are drawout mount as standard, while MCCBs are generally fixed (ICCBs are available as fixed or drawout mount). Drawout construction permits the breaker to be removed for service while the switchgear is energized, minimizing down time.
- LVPCBs are 100 percent rated as standard, while MCCBs and ICCBs are 80 percent rated as standard (100 percent rated breakers are available).
- LVPCBs may be electrically operated for remote control schemes (ICCBs may also be electrically operated).
- LVPCBs are designed to be more robust and endure more repetitive operations.

**Space Requirements**

Switchgear is larger and requires both front and rear access. Additional clearance must also be included to accommodate drawout circuit breaker racking. Rear-connected switchboards also require both front and rear access and may contain drawout circuit breakers. However, the space requirements for a traditional front-connected switchboard with fixed mount devices that can be mounted against a wall can be considerably less when compared to switchgear.

**Arc Flash Considerations**

The switchgear 30-cycle withstand rating mentioned earlier provides additional flexibility in regards to selective coordination. Unfortunately that flexibility means increased arc flash energy which is a safety concern for those working on the switchgear. Manufacturers continue to develop arc flash mitigation techniques for switchgear. Arc resistant switchgear, previously available only for medium-voltage applications, is becoming widely available for low-voltage applications. The arc resistant features are designed to redirect and channel arc flash energy up and away for increased worker safety.

**Cost**

Switchgear can be considerably more expensive than a traditional front-connected switchboard (up to three times as much). Rear-connected switchboards, though significantly more expensive than front-connected switchboards, are still less expensive than switchgear.

**So Do You Use a Switchboard or a Switchgear?**

The choice between switchboard and switchgear depends upon the application and, as always, cost weighs heavily in the decision. Switchgear is generally reserved for projects where the need for improved capabilities, reliability, and serviceability justify the additional cost (e.g. large scale manufacturing facilities, data centers, airports, convention centers, etc.).

Whichever one your project requires, BSD's new Section 26 2300 – Low-Voltage Switchgear, together with BSD's Section 26 2413 – Switchboards, which has recently been completely revised and updated, are sure to meet your specification needs.

**One Last Comment; Arc Energy Reduction**

The 2014 edition of the NEC (240.87) now requires arc energy reduction for all circuit breakers rated 1200 amps or higher, which are common in both switchboards and switchgear. The most cost effective solution for meeting this new requirement is an arc flash energy-reducing maintenance switch. This switch permits selection of a circuit breaker "maintenance mode" with alternate settings for reduced fault clearing time. Both BSD's switchboard and low-voltage switchgear master guide specifications both contain this option.

**About the Author:**
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