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TechTopics No. 107

Dummy circuit breaker applications

On occasion, users specify metal-clad switchgear having one or more “dummy” circuit breakers. This term has not been defined in the IEEE Standards previously, but a definition is being incorporated in the next revision of IEEE Std C37.20.2 presently under development. Somewhat paraphrased, C37.20.2 describes a dummy circuit breaker as a device similar to a drawout circuit breaker, intended for insertion into a compartment designed for a drawout circuit breaker. The dummy circuit breaker has jumpers between the line- and load-side primary disconnects, and when installed in a circuit breaker compartment, connects the line side of the circuit breaker compartment to the load side of the circuit breaker compartment. A dummy circuit breaker has no operating mechanism, and is not capable of switching current or voltage. In brief, a dummy circuit breaker is a set of drawout jumpers.

The dummy circuit breaker must be able to withstand the same dielectric voltages and short-circuit currents as the switchgear in which it is to be used. This means that the lightning-impulse withstand voltage (BIL) and power-frequency withstand voltage capabilities of the dummy circuit breaker must match those of the circuit breaker that it replaces. Similarly, the dummy circuit breaker must have the same continuous current-carrying capability, as well as the same short-time withstand current and peak-withstand current capabilities as those of the circuit breaker it replaces.

A dummy circuit breaker has no switching capability, and therefore must not be inserted into or withdrawn from a switchgear compartment in which either set of primary disconnect stabs of the compartment are energized. This is a basic safety issue that is often overlooked by users, and is the reason for creation of this issue of TechTopics.

There are a number of applications in which a dummy circuit breaker may be specified. As a general statement, the dummy circuit breaker is considered to be a less costly alternative to a circuit breaker, particularly when current transformers, protective relaying, and other components are avoided. So, users specify a dummy circuit breaker as a means to reduce the first cost of an installation. Here are several examples of applications in which a dummy circuit breaker might be specified:

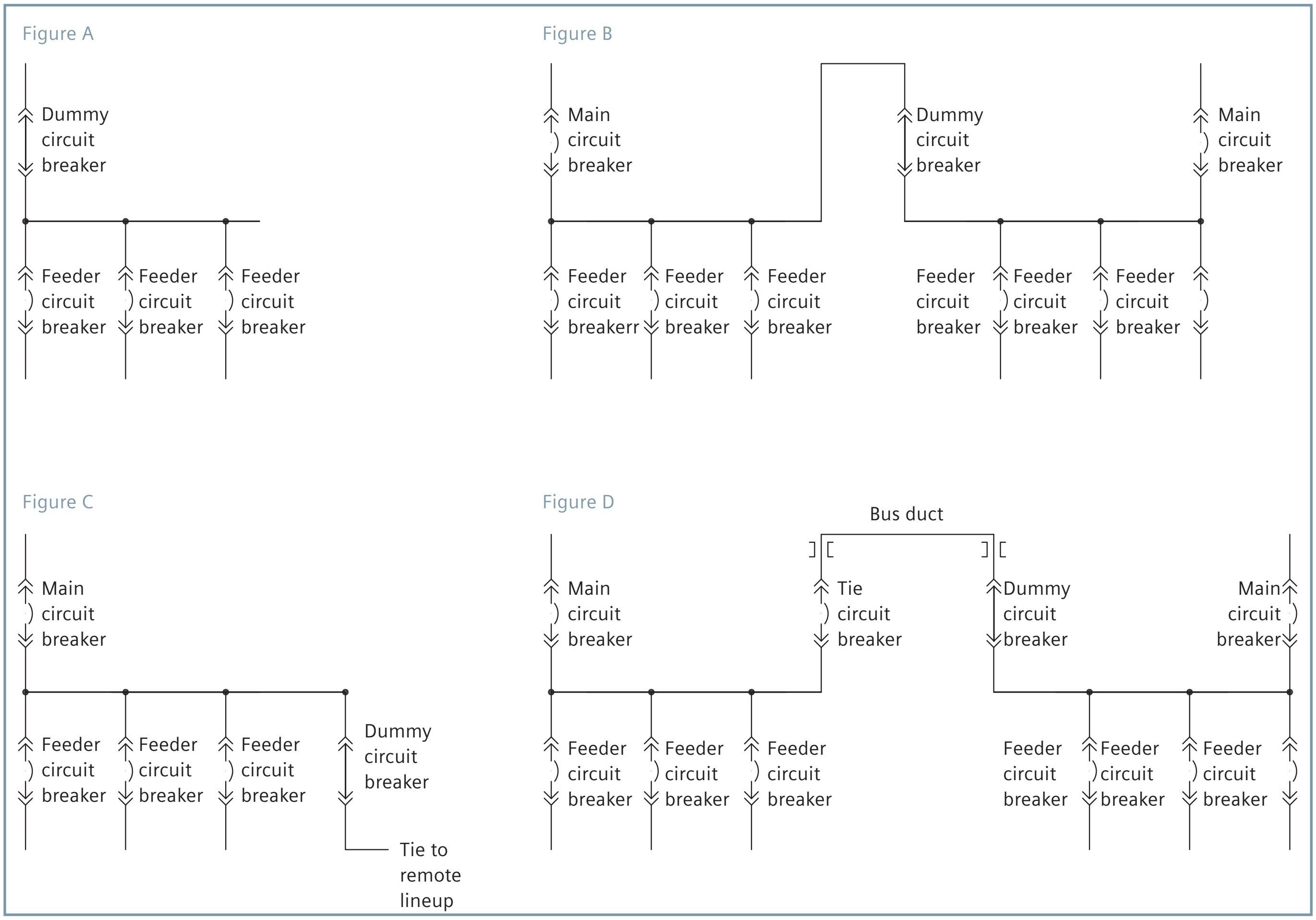
A. As a substitute for a drawout main circuit breaker in a radial substation (usually with only a small number of feeders). See Figure A.

B. As a substitute for a drawout tie circuit breaker in a double-ended substation. See Figure B.

C. As a means of disconnecting a tie circuit that connects to a remote switchgear lineup. This is quite similar to Figure B but with the double-ended source in some remote location. See Figure C.

D. As a substitute for a second drawout tie circuit breaker in a double-ended substation, where the substation is arranged with two separate lineups connected together with a tie bus duct. The use of a circuit breaker at one end of the tie bus, together with a dummy circuit breaker at the other end, allows for de-energizing of the tie bus duct for maintenance. It also allows complete de-energization of each side of the substation for maintenance. See Figure D.

Figure 1: One-line diagram



For any application involving a dummy circuit breaker, key-type interlocking is required to all possible sources of power that could energize either side of the compartment in which the dummy circuit breaker is to be installed. The compartment for the dummy circuit breaker must have key type interlocking that will prevent racking the dummy circuit breaker into or out of the compartment unless all possible power sources have been removed. The implications for this, considering the examples in the figures, are:

A. Key-type interlocks are required for all three feeder circuit breakers, and for the upstream source (such as a remote circuit breaker or a transformer primary air switch or circuit breaker) on the line side of the dummy circuit breaker.

B. Key-type interlocks are required for both main circuit breakers and for all six feeder circuit breakers.

C. Key-type interlocks are required for the local main circuit breaker, the three local feeder circuit breakers, and for the feeder circuit breaker at the remote lineup that is connected to the dummy tie circuit breaker.

D. Key-type interlocks are required for the local tie circuit breaker, the three feeder circuit breakers on the side of the equipment that has the dummy tie circuit breaker and for the main circuit breaker on the same side of the equipment.

These recommendations consider that any connection to the switchgear can be energized, even a feeder circuit breaker. If there is complete certainty that feeder circuit breakers can never be energized from the downstream side, then the key interlocks on the feeder circuit breakers may not be necessary.

The key interlocking is accomplished with a single key-interlock cylinder installed in each relevant item that must be interlocked, including any remote items. All of the keys from these circuits must be installed in a key-interlock transfer block in order to rotate the keys and release a single key that is installed in the dummy circuit breaker compartment. When the key is available to install in the dummy circuit breaker compartment, the dummy circuit breaker can be racked into or out of the compartment. When the racking operation is completed, the dummy circuit breaker key can be returned to the transfer block (thus locking the dummy circuit breaker so it cannot be racked), releasing all the other keys so that the source devices can be closed.

A final word of caution on the use of dummy circuit breakers. The National Electrical Code® (NEC®) requires that overcurrent protection be provided for the conductors connected to the dummy compartment. Since the dummy circuit breaker does not have any interrupting capacity, this means that the protection has to be provided by the other switching devices in the system. In Figure A, this protection would have to be provided by the upstream protective device. In Figure B, protection would have to be provided by the two main circuit breakers. In Figure C, the protection would also be by the main circuit breaker and by the remote source to the dummy circuit breaker. Finally, in Figure D, the protection for the bus duct would be by the main circuit breaker on the same side of the equipment as the dummy tie circuit breaker, and by the tie circuit breaker at the other end of the bus duct. A corollary to the NEC requirement is that the dummy circuit breaker and the connected conductors must be equal in capacity to the circuit-switching device (e.g., the main circuit breaker in Figure A) that provides the overcurrent protection required by the NEC.

An alternative when the dummy circuit breaker must be of lower current-carrying capacity would be to provide current transformers and protective relays on the dummy tie circuit breaker compartment, arranged to trip the sources of power in the event of a current in excess of the current capability of the dummy circuit breaker or its connected circuit. This is possible, but quite rare, as it reduces the cost savings that the use of a dummy circuit breaker is intended to make possible.

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