



Inspecting Tandem Circuit Breakers

By REUBEN SALTZMAN, ACI

It seems as if confusion abounds over the use of tandem circuit breakers in panelboards, even among electricians. **My goal is to set the record straight as to when tandem circuit breakers can be used.**

A TANDEM CIRCUIT BREAKER is a double circuit breaker that takes up the space of a single circuit breaker on a panelboard. You'll also hear them called duplex, slimline, twin, half-height, half-inch, double and wafer breakers, depending on local customs. While a two-pole circuit breaker gets connected to two different poles at a panelboard and has a common trip or a handle tie for simultaneous disconnecting of two poles, a tandem breaker does not.

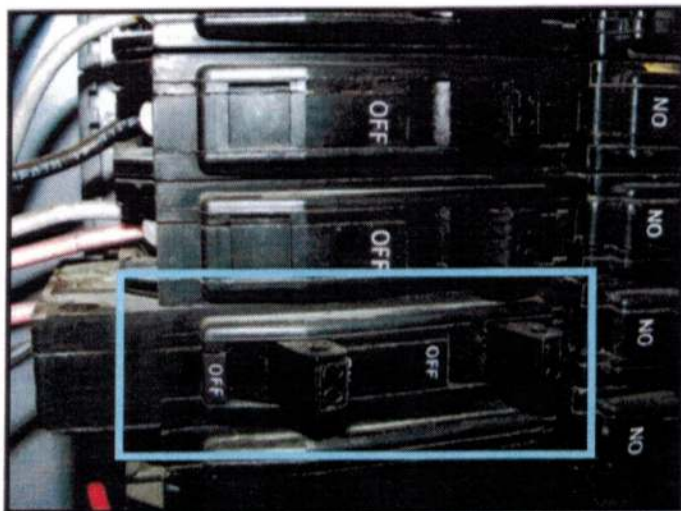
Because tandem circuit breakers allow for two circuits to be installed on a panelboard in a one circuit breaker space, they're typically used after a panelboard has been filled to capacity with standard circuit breakers. Because of this, they're often referred to as "cheaters."

Is this really 'cheating'? No, it's not. The use of tandem circuit breakers is a perfectly acceptable practice, as long as the panelboard is designed for tandem circuit breakers and they're installed in locations within the panelboard where they're allowed.

But how does a home inspector determine whether tandem circuit breakers are allowed on the panelboard they're inspecting? There are a number of ways to do so.

Class CTL Panelboards

Panelboards must follow UL Standard 67, which requires all lighting and appliance panelboards to be Class CTL (Circuit Total Limiting). Here's a formula for determining how many circuits are allowed in the Class CTL panelboard being inspected. Take the amperage of the panelboard, multiply by the number of poles, and divide by 10.



This older style tandem breaker can be found in Square D panelboards.

It sounds complicated, but it's not — let's use a 100-amp panelboard as an example:

$$100 \text{ Amp} \times 2 \text{ Poles} = 200$$

$$200 / 10 = 20$$

Based on this formula, the maximum number of circuits allowed in a 100-amp 120/240-volt panelboard is 20. For panelboards not manufactured as "lighting & appliance" panelboards, there is no limit to the number of circuit breakers allowed.

The 2008 National Electrical Code (NEC) makes it a little confusing. Previous editions of the NEC limited the maximum number of circuits in a lighting and appliance panelboard to 42. The 2008 version of the NEC removed the "lighting & appliance" panelboard designation; however, NEC 408.54 says, "A panelboard shall be provided with physical means to prevent the installation of more overcurrent devices than that number for which the panelboard was designed, rated, and listed."

Manufacturers still list the maximum number of circuit breakers allowed, and must provide a rejection feature to help prevent the use of tandem circuit breakers where not allowed. To date, no manufacturer has made a panel that allows more than the number of breakers allowed by the formula above.

Class CTL panelboards have different methods for preventing class CTL tandem circuit breakers from being used in locations where they're not allowed. ▶▶



This photo shows the difference between two-pole tandem and single circuit breakers. The tandem circuit breakers are highlighted. From top to bottom, there is a 60-amp two-pole circuit breaker; a 15-amp tandem circuit breaker (*highlighted*); a 20-amp tandem circuit breaker (*highlighted*); and a 20-amp single-pole circuit breaker.

Key Concepts

- ✓ A tandem circuit breaker is a double circuit breaker that takes up the space of a single circuit breaker on a panelboard.
- ✓ UL Standard 67 governs panelboards, which requires all lighting and appliance panelboards to be Class CTL (Circuit Total Limiting).
- ✓ Tandem circuit breakers are manufactured in a way to prevent people from using them improperly.
- ✓ There are a number of ways for a home inspector to determine whether or not tandem circuit breakers are allowed on a panelboard. It's important to do so because using them where not allowed can create a fire hazard.

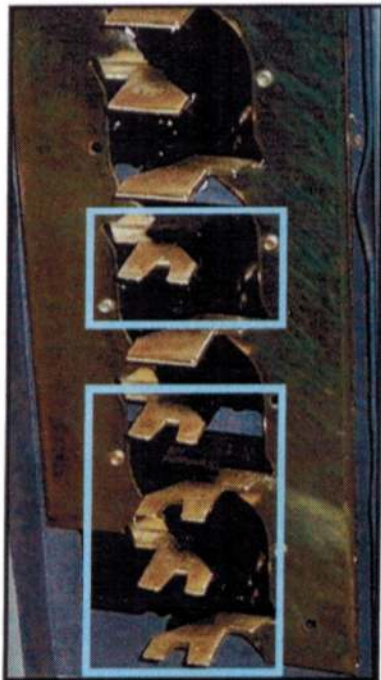
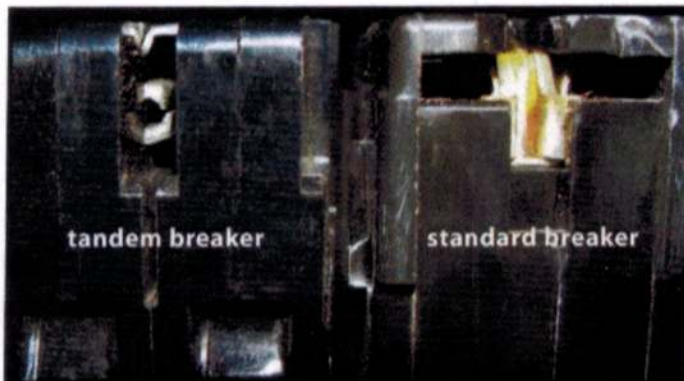
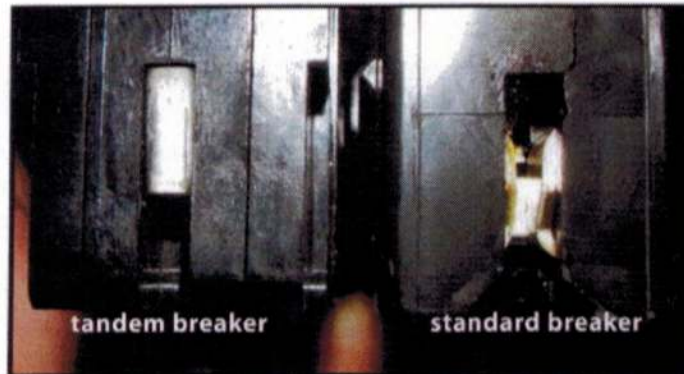


PHOTO © DOUGLAS HANSEN

The highlighted bus stabs are notched to allow the use of tandem circuit breakers; the bus stabs that don't have this notch won't allow tandem breakers.



Tandem circuit breakers are shaped differently from standard single-pole circuit breakers in an effort to prevent people from using them in an improper manner, but this doesn't stop everyone.

PHOTOS © REUBEN SALTZMAN

This is referred to as a "rejection feature." Sometimes, bus stabs on panelboards are notched to allow the use of tandem circuit breakers (see photo above left). In these cases, bus stabs without notches won't allow tandem breakers. Class CTL tandem circuit breakers are shaped differently from standard single-pole breakers to help prevent them from being installed where they don't belong (see photos above right). Tandem circuit breakers are manufactured this way in an effort to prevent people from using them in an improper manner, but this doesn't stop everyone. The rejection features on tandem circuit breakers sometimes are altered in the field, defeating this safety feature. This is probably where the term "cheater" comes from (see photos next page).

For panelboards manufactured before adoption of the Class CTL standard, non-Class CTL tandem circuit breakers are allowed to be installed as replacement circuit breakers only. Non-Class CTL tandem circuit breakers do not have the 'rejection' feature that Class CTL breakers have. Labels on the side of these circuit breakers clearly state they are not allowed in Class CTL panelboards. The difficulty for home inspectors is that the marking usually is not visible after installation.

In addition to the diagram, look for a label stating the maximum number of circuits allowed. If the number of full-size spaces equals the maximum number of circuits, no tandem circuit breakers are allowed. For example, if the panelboard allows 20 circuits and it has 20 full-size spaces, tandem circuit breakers aren't allowed.

The model of the panelboard

The model or part number of the electric panelboard usually will indicate whether or not the electric panelboard is designed to accept tandem

breakers and how many can be used. Here are a few examples:

- G3040BL1200 = 30 spaces, 40 total circuits allowed. Up to 10 tandem circuit breakers can be used.
- G3030BL1150 = 30 spaces, 30 total circuits allowed. Tandem circuit breakers are not allowed.
- BR1220B100 = 12 spaces, 20 total circuits allowed. Up to 8 tandem circuit breakers can be used.
- BR1212B100 = 12 spaces, 12 total circuits allowed. Tandem circuit breakers are not allowed.
- HOMC20U100C = 20 spaces, 20 total circuits allowed. Tandem circuit breakers are not allowed.

I think it's easy enough to see the pattern.

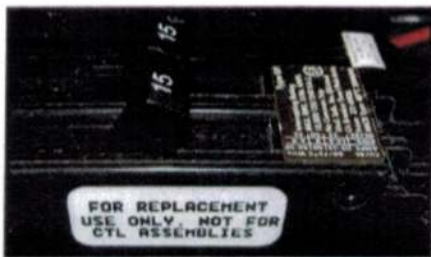
A diagram inside the panelboard

The wiring diagram inside the panelboard is a great way to determine if tandem breakers are allowed and, if so, exactly *where* they're allowed.

In addition to the diagram, look for a label stating the maximum number of circuits allowed. If the full-size circuits equal the maximum number, no tandem circuits are allowed. For example, if the panelboard allows 20 circuits and it has 20 full-size spaces, tandem circuit breakers aren't allowed.



The bottoms of these class CTL tandem circuit breakers have been broken off to make them fit where they didn't belong. This is probably where the term 'cheater' comes from.



As clearly indicated by the label on the side of this circuit breaker, it is not allowed in Class CTL panelboards. The difficulty for home inspectors is that the marking is usually not visible after installation.

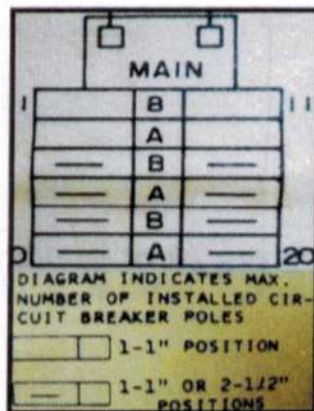
What's the concern with tandem circuit breakers?

When tandem circuit breakers are used in locations where they're not allowed, they could make an improper physical connection to the bus bar in the panelboard, which can create a fire hazard. Tandem circuit breakers also increase the total load on the bus bars in a panelboard; this is where home inspectors need to use common sense.

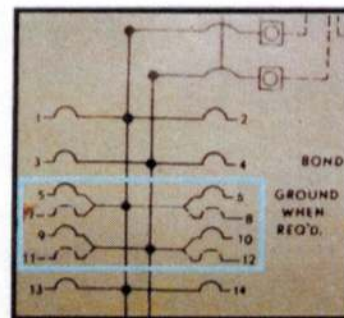
When a home inspector finds tandem circuit breakers used in improper locations, it's best to recommend repair by an electrician. If the bus bars of the panelboard have been damaged or altered to allow for the installation of tandem circuit breakers, the proper repair is to have the panelboard replaced. There is no way to determine if the bus bars have been damaged without actually removing the circuit breakers — and I don't recommend removing circuit breakers during the course of a home inspection. ■

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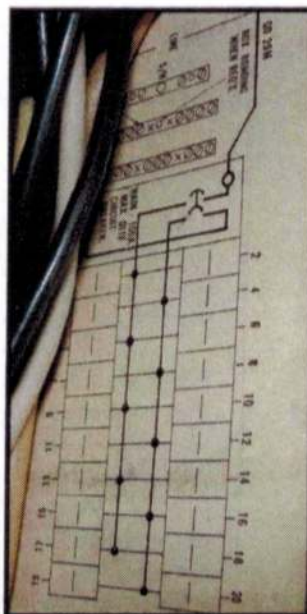
Reuben Saltzman, Structure Tech Home Inspections, Minneapolis, Minn., is a second-generation ASHI Certified Inspector whose experience with home remodeling and construction began at age four when he helped his father steam wallpaper and it has continued from there. He has worked for Structure Tech since 1997 and joined ASHI in 2004. Visit his blog at www.structuretech1.com/blog/.



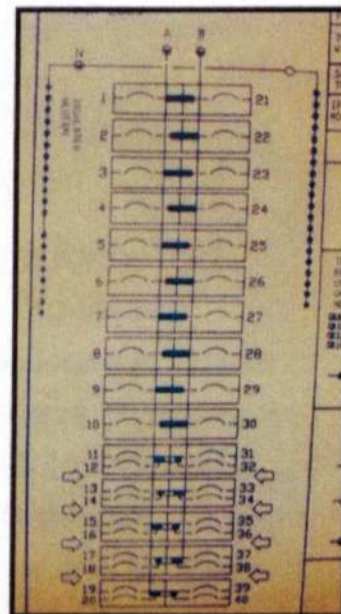
According to this diagram, the top four spaces of the panelboard allow only full size breakers, while the bottom eight slots allow tandem breakers.



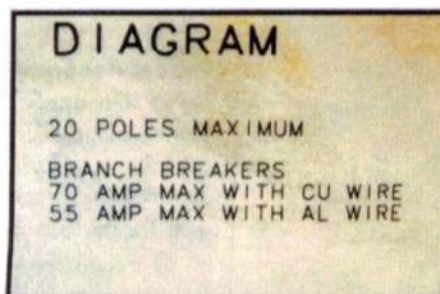
This panelboard diagram indicates tandem breakers can be used in four locations.



No tandem breakers are allowed in this panel board.



This panelboard allows tandem breakers in the bottom ten spaces only (11-20 and 31-40).



Only 20 circuits are allowed at the panelboard. It has 20 full-size spaces, so tandem circuit breakers aren't allowed.