



Tapping Busbar Considerations

Many code authorities have encountered situations in which installers wish to tap busbars to accommodate the installation of fire pumps or to connect renewable energy sources such as photovoltaic systems.

This raises several questions, including the following:

- Does this field modification affect the UL Listing of the panelboard or deadfront switchboard?
- Are there any available guidelines for tapping the busbar?
- What are the concerns regarding this practice?

Panelboards and deadfront switchboards are not Listed to have their busbars tapped unless there are existing holes in the busbars marked with the word “Tap” adjacent to the holes. Other holes in the busbar that are not marked with the word “Tap” are intended for the connection of overcurrent devices, other device’s as identified by the product markings and in the installation instructions or other uses identified by the manufacturer.

When the electrical equipment Listing does not include product markings or instructions for tapping busbars, code authorities often ask what can be done to approve such modifications. This situation should be treated like any other field modification of Listed equipment.

Evaluating modifications of UL Listed equipment

When a UL Listed product is modified after it leaves the manufacturing facility, UL has no way to determine if it continues to comply with the applicable safety requirements

used initially for its certification without a separate assessment of the modified product. A Field Evaluation can assess general safety issues associated with the product modification such as proper selection of rated components, electrical spacings, mechanical securement, etc., and may address ampacity and short circuit rating concerns, depending on the type of construction and the rating. However, it’s important to understand that the extent of the field evaluation can be limited if destructive testing such as overloading or short circuit testing is necessary in order to determine compliance to specific requirements in the applicable standard.

It is the responsibility of the code authority to first determine whether a modification is acceptable or significant enough to require one of UL’s Field Engineering Services staff members to evaluate the modified product. In determining if a field evaluation should be conducted, the code official needs to consider the extent and nature of the modification, and make sure the field evaluation can effectively evaluate the impact the modification has on the product’s ability to comply with safety requirements.

The field evaluation is conducted to assist the code official in making the determination on approving the installation. The evaluation will only be conducted after UL consults with the code official to determine that UL’s investigation addresses all areas of concern while meeting all of a code official’s needs.

Concerns to be addressed

Some Listed power equipment may have installation instructions with specific directions on tapping the busbars. If this is the case, this equipment can be field modified, following those manufacturer’s instructions, in accordance with the National Electrical Code® (NEC) Section 110.3(B). The UL White Book identifies the required markings for field-installed equipment that have been evaluated by UL. For additional information, please see the guide information for panelboards (QEUY) and for dead-front switchboards (WEVZ). If not addressed





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in the installation instructions, any modifications must be evaluated by the Code Official according to NEC Section 110.3(A) or by having a UL Field Evaluation conducted.

A terminal or provision for a terminal in a panelboard or switchboard which has been evaluated for use as a tap, other than those to be used by the supply utility for voltage metering pick-up, are marked “Tap” in the factory.

Drilling or enlarging holes in busbars can increase the current density and reduce current carrying capacity. Some equipment is constructed with fully rated busbars, which have a typical current density of 1000 A per square inch of cross sectional area for copper and 750 A per square inch of cross sectional area for aluminum. However, some equipment uses busbars at a higher current density and have temperature testing conducted to determine compliance with UL’s requirements. Removing busbar material can result in higher operating temperatures, and additional holes can potentially weaken the busbar, which adversely affects the short circuit rating of the equipment required by NEC Section 110.10.

Both sufficient wiring space and wire bending space need to be provided for the conductors and the wire connector at the tap connection. In measuring the wiring space, code officials need to consider the possibility of the connectors rotating, which may

result in reduction of the spacing between uninsulated live parts of opposite polarity and uninsulated live parts and ground.

Wire connectors (lugs) need to be Listed for the purpose and have the proper ratings for specific application, and the mounting hardware for wire connectors needs to be properly selected and attached with the correct torque. The potential reduction of required spacings from the wire connectors or fasteners to the enclosure or other busbars also needs to be evaluated.

In completing the modification, all foreign material such as cutting oil, burrs and metal shavings needs to be removed from the equipment enclosure. Temporarily removed materials such as insulating barriers need to be returned to their original positions and secured.

The above are just a few of the concerns and items that must be inspected, checked and reviewed where such modifications are made to this type equipment.

Summary

There are many safety concerns to consider when busbars are tapped in the field. If the product is not Listed for field tapping, the code official must determine whether to approve the modified product or not. A UL field evaluation can provide assistance to the code official in particular cases, but not all.

