



ELECTRICAL CONNECTIONS

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Understanding Industrial Control Panels

Understanding how an industrial control panel has been investigated and what the markings on the product mean will help to ensure that the proper industrial control panel has been selected for the intended function and installed in accordance with the UL Listing as well as Article 409 and section 110.3(B) of the National Electrical Code, ANSI/NFPA 70, (NEC).

Industrial control panels are defined by the NEC section 409.2 as an assembly of two or more power circuit components, control circuit components, or any combination of power and control circuit components. Industrial control panels covered by UL product category NITW (Industrial Control Panels) are factory-wired assemblies of industrial control equipment, such as motor controllers, switches, relays and auxiliary devices. The panels may include disconnect means and motor

branch-circuit protective devices. Please be aware that the UL Listed industrial control panel does not include coverage of any externally connected loads.

Industrial control panels covered by UL product category NITW are intended for general-use industrial applications for the control of heaters, lighting, motors or pump loads or a combination of these loads, and are intended for installation in ordinary locations in accordance with the NEC.

Industrial control panels may also be designated for the control of specific equipment — such as industrial machinery, cranes, refrigeration equipment and fountains — which may not be suitable for use with other equipment as well as industrial control panels that have been investigated for special applications covered by other UL product categories. Please see the sidebar for a partial list of these special products and applicable UL categories.

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Understanding Industrial Control Panels (continued)

Within UL product category NITW, there are three main product identities associated with industrial control panels, “Enclosed Industrial Control Panel,” “Open Industrial Control Panel” or “Industrial Control Panel Enclosure.” These specific product identities need to be considered by the Authority Having Jurisdiction (AHJ) when inspecting an installation, as each one has its own distinct installation application.

Enclosed industrial control panels



An enclosed industrial control panel is comprised of the enclosure, all components located within the enclosure, and all components mounted to the walls or cover of the enclosure. The construction of the entire unit has been investigated, including its ability to safely function within the specified marked voltage, current and short circuit current ratings. With that said, it should be noted that industrial control panels are only investigated for electrical fire and shock hazards and not for their ability to control equipment.

One can also refer to section 90.7 of the NEC, which in part states that except to detect for alterations or damage, the factory-installed internal wiring or the construction of equipment need not be inspected by the AHJ at the time of installation, provided the equipment has been listed by a qualified electrical testing laboratory, such as UL. So when inspecting a UL Listed enclosed industrial control panel, the AHJ is only required to verify that the equipment has not been damaged, its marked ratings are sufficient for the load and intended application, the field connections are properly terminated, and there has not been any field modifications to the wiring schematic.

Open industrial control panels



An open industrial control panel includes internal wiring, field wiring terminals and components mounted on a subpanel without a complete enclosure. The enclosure is intended to be supplied as a part of the installation. Unlike an enclosed industrial control panel, additional factors need to be considered when approving the installation of an open industrial control panel, some of which include:

- Review and follow the manufacturer’s installation instructions, which may describe a specific application requirement
- Verify suitability for installation and use in conformity with the provisions of the NEC
- Verify the mechanical strength and durability of the required enclosure necessary to protect the open industrial control panel
- Ensure the enclosure does not encroach in the required wire-bending and conductor termination space necessary for a safe installation
- Any other factors that contribute to the practical safeguarding of persons using or likely to come in contact with the open industrial control panel, such as exposure to live parts, proper grounding or bonding and arc flash hazards, just to name a few.

Industrial control panel enclosures



Industrial control panel enclosures have only been investigated to verify that the

Industrial Control Panels Categories

Partial list of UL product categories for industrial control panels investigated for special applications:

Access control systems (ALVY)

Flammable-liquid Dispensing devices (EQXX)

Factory Automation Equipment (GPNY)

Commercial/Industrial Gas Burners (KXWT)

Gas-Oil Burners (KYKR)

Oil Burners (KYZX)

Heating and Cooling Equipment (LZFE)

Motor Control Centers (NJAV)

Industrial Control Panels Relating to Hazardous Locations (NRBX)

Packaged Pumping Systems (QCZJ)

Specialty Refrigeration Equipment (SROT)

Control Panels (TWRF)

Miscellaneous Semiconductor Manufacturing Equipment (TWTZ)

Semiconductor Manufacturing Equipment, Limited Production (TWWU)

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Understanding Industrial Control Panels (continued)

enclosure complies with the construction requirements contained within UL 508A, the UL Standard for Safety for Industrial Control Panels. Since they have not been investigated with electrical components, the suitability of any field installed electrical components will need to be determined by the AHJ in the field.

In many cases AHJ's will be confronted with a UL Listed industrial control panel enclosure containing a variety of components, such as contactors, relays, terminal bars, pushbuttons and pilot lights. Since the overall assembly has not been investigated and certified by UL, the AHJ should treat the assembly as unlisted equipment and apply all applicable NEC requirements to that installation. If an AHJ is unsure if the installation complies with all the applicable NEC requirements — such as NEC sections 110.3(A), 312.6, 312.11 and Article 409 — they can always require a third party field evaluation of the unlisted equipment to UL 508A.

Markings

UL 508A includes all of the marking requirements referenced in NEC section 409.110 as well as many more. The majority

of UL 508A required markings are to be located so that they are visible after installation of the field wiring. However some markings are permitted to be on the field wiring diagram or installation instructions that are referenced on the industrial control panel nameplate. The field wiring diagram or installation instructions are required to be shipped with the industrial control panel.

In addition to the required markings, UL 508A also requires that an industrial control panel is to be provided with a complete electrical schematic wiring diagram including all components provided by the manufacturer.

For compliance with the NEC, an AHJ should review section 409.110, which requires that industrial control panels are to be marked with the following information:

- (1) Manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified
- (2) Supply voltage, number of phases, frequency, and full-load current for each incoming supply circuit
- (3) Industrial control panels supplied by more than one power source such that more than one disconnecting means is required to disconnect all power within the control panel shall be marked to indicate that more than one disconnecting means is required to de-energize the equipment
- (4) Short-circuit current rating of the industrial control panel based on one of the following:
 - a. Short-circuit current rating of a listed and labeled assembly
 - b. Short-circuit current rating established utilizing an approved method.
- (5) If the industrial control panel is intended as service equipment, it shall be marked to identify it as being suitable for use as service equipment
- (6) Electrical wiring diagram or the identification number of a separate electrical wiring diagram or a designation referenced in a separate wiring diagram
- (7) An enclosure type number shall be marked on the industrial control panel enclosure.

Summary

Understanding the applications and limitations of various industrial control panel Listings and their corresponding markings are necessary to ensure that the appropriate industrial control panel is used for its intended purpose so that a safe installation may be achieved. It should be understood that a UL Listed industrial control panel certification

mark only covers the industrial control panel. The certification does not include any of the equipment controlled by the industrial control panel or the equipment to which the industrial control panel has been mounted on. Also remember that industrial control panels have not been investigated for any externally connected loads.

For additional information on Industrial Control Panels, please use the **UL Online Certification Directory** or contact Jeff Fecteau at Jeffrey.Fecteau@ul.com or at +1.952.838.5452.