# Primary Fuses; To Use or Not To Use...

## That is the question.

Secondary fuses for a control transformer in an enclosed control panel circuit have long been standard practice in the industry. However, our experience has shown that many of the Sprecher+Schuh customers do not request "optional" primary fuses when ordering panels.

And most panels without control transformers are ordered without any "optional" control circuit fuses, which can leave the control circuit wiring unprotected. Since the 2005 NEC added Article 409 "Industrial Control Panels" and required that panels must have a short-circuit current rating (SCCR) label, the need for fuses is now more important than ever. This paper discusses the following:

- Changes to the 2005 National Electric Code (NEC) and Article 409.
- The need for control circuit fuses in an enclosed Industrial Control Panel.
- How Sprecher+Schuh products can help customers conform to the NEC and UL508A standards.

## Meeting the Code

The 2005 NEC introduced Article 409 which covers "Industrial Control Panels intended for general use and operating at 600V or less".

The 2008 NEC Article 409.2 provides a definition for an Industrial Control Panel that is compatible with industry product standards such as UL 508A, Industrial Control Panels. In the 2008 Code, the definition of control circuit was added. The definition of Industrial Control Panel was also revised to include panels with two or more control components.


Article 409.2 defines control circuits and panels as follows:

**Control Circuit -** The circuit of a control apparatus or system that carries the electric signals directing the performance of the controller but does not carry the main power current.

**Industrial Control Panel -** An assembly of two or more components consisting of one of the following:

(1) Power circuit components only, such as motor controllers, overload relays, fused disconnect switches, and circuit breakers

(2) Control circuit components only, such as pushbuttons, pilot lights, selector switches, timers, switches, control relays

(3) A combination of power and control circuit components

These components, with associated wiring and terminals, are mounted on or contained within an enclosure or mounted on a subpanel. The industrial control panel does not include the controlled equipment.

Article 409.110 (3) of the 2008 Code states that an Industrial Control Panel shall be marked with the panel Short-Circuit Current Rating (SCCR) that is plainly visible after installation.

Article 409.110 (3) states:

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 (FPN: UL 508A, Supplement SB, is an example of an approved method.)

Exception to (3): Short-circuit current rating markings are not required for Industrial Control Panels containing only control circuit components.

Note; The reference to a Listed and Labeled panel refers to one that has been investigated and tested to determine the SCCR by an authority such as UL. The reference to an approved method to determine the SCCR, such as UL508A standard, is what most panel builders will utilize.

The UL508A standard allows 16 AWG control circuit wiring to be protected by a branch circuit protection device (BCPD) up to 40A when there are no remote control

devices and up to 10A when there are remote control devices. When the BCPD exceeds these values, control circuit fuses should be included in the panel. This applies to fused control circuits connected to the line source without a control transformer; otherwise, the SCCR will be defaulted to 5kA.

Standard selection of starters and motor circuit controllers in Sprecher + Schuh catalogs address various horsepower and amperage needs for common application specifications. Additionally, modification charts detail factory assembled changes that can be ordered to comply with certain requirements not met by an off the shelf product.

These modification pages are used by Sprecher + Schuh customers, field sales and internal quotation staff alike. The NEC label requirement has made it necessary to address the modification tables in order to include a primary fuse on some applications. The changes are easy to make and simply call for adding a fuse holder and Class CC fuses to the enclosure in addition to those mounted on the secondary of the transformer.

FH8 Class CC Fuse Holder (FH8-2PC30)

## Why the change?

Sprecher + Schuh standard control circuit wiring is 16 AWG. To prevent problems and safety issues, a control circuit should always be fused if the branch circuit is greater than 40A, and there is no remote control such as a pilot device with a Start-Stop function. If the circuit is controlled remotely and the wires are leaving the enclosure, circuits greater than 10A should be fused, such as a Hand-Off-Auto application. Designing and building these enclosures without fuses automatically rates the panel at the SCCR minimum of 5kA, which most of the time is far less than the equipment inside the box is capable of. If the control circuit is not fused and a wire loosens due to vibration or improper assembly, the panel could become "hot" and an electrical shock is possible.

Typical Type 7/9 enclosure with large flange for oil and gas industry leaves little extra room for additional components.

Type 7 & 9 starters in the explosion proof arena are especially in need of primary and secondary fuses. Fusing of the control circuit should be provided but is often foregone due to the size limitations of the enclosure. Explosion proof enclosures are inherently large and bulky and adding to their size is often prohibitive. The very nature of these enclosures makes them more likely to need the extra protection of a primary fuse to prevent the possibility of electrical shock from 480V or 240V common control circuits. In addition, these enclosures are often located in remote or inconvenient locations, making it difficult or impossible to retrofit them should an inspection require their modification with a control fuse device.

Some exceptions to these examples do exist, such as Kwikstarters and type A and B box enclosures. The Kwikstarter II product line is a compact starter system in a small enclosure. For most applications requiring an SCCR label, the Kwikstarter II would not apply because of its amp limitations, a maximum of 17A. The Type A enclosed starters could apply in some cases but can not be used because they are not large enough to add the extra fuses required. However, components in Type B enclosures are large enough in power output but the box is often still too small for a primary fuse transformer. Type B boxes should be considered carefully. A larger enclosure may need to be considered to accomplish a higher short-circuit current rating.

KWIKstarter II series of enclosed starters

## Sprecher + Schuh can help

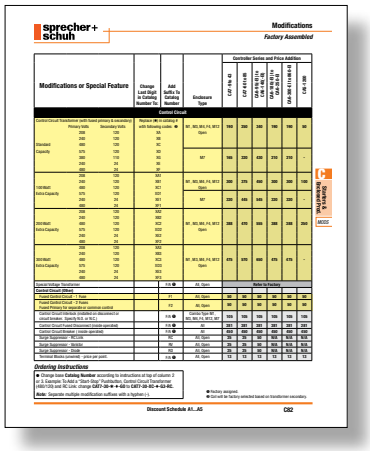
This is where Sprecher + Schuh factory modifications and the custom quotation department step in. Standard items may fit most applications, but the custom quote assures the equipment will meet the exact needs of the customer. The following procedure and catalog changes have been implemented to increase compliance with NEC Article 409 requirements:

- Primary and secondary fuses on all custom quotations, where applicable
- Updating the modifications chart in Section C to include primary fuses in the modification of catalog numbers
- And updating of individual selection pages in Section C, Section F and the Orange Express selection guide where these modifications are available.

The custom quotation department has always included both primary and secondary fuses when specified by the customer. Future quotations will include them automatically when applicable, resulting in a slight price increase to accommodate the additional components. Updates to the modification table on page C82 of the SSUSA8000 catalog include the following;

1. Removal of the FP suffix – the fused primary has been added to the Control Circuit Transformer suffix (XA through XF3). These modification prices have increased slightly as a result of this addition.

2. Other Control Circuit modification prices (F1 and F2) have been reduced. Suffix F2 in particular should be used for separate and common control applications. Remember, without fuses the default short-circuit current rating is 5kA.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Modifications
Factory Assembled

Modifications or Special Feature

Change Last Digit in Catalog Number To

Add Suffix To Catalog Number

Enclosure Type

Controller Series and Price Addition

Control Circuit

Ordering Instructions

Discount Schedule A1...A3

C82

While the quotation department will address these issues internally, distributors and field quotations should pay special attention. The changes to the modification table in Section C also affect pages in Section F and Orange Express. Catalog corrections to these pages should be referenced to ensure proper catalog number submission for enclosed starters and motor circuit controllers. Refer to the Sprecher + Schuh website for the most up to date catalog pages available at www.sprecherschuh.com and the Distributor Extranet at ftp://raftp.rockwellautomation.com.

## Summary

The need for primary fuses has increased due to approval requirements and general safety issues. By paying attention to where primary fuses are most needed, in enclosed applications over 40 Amps and explosion proof enclosures, compliance with National Electric Code and UL standards is possible because the Short-circuit Current Rating of the panel can be increased to an acceptable level. By automatically including primary and secondary fuses on custom quotations, and updating the factory modifications chart in our general catalog, Sprecher + Schuh is demonstrating our dedication and commitment to ensure our customer's equipment is of the highest quality possible. For more information or questions regarding these changes, please contact your local Sprecher + Schuh representative.

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| Modifications or Special Feature | Change Last Digit in Catalog Number To: | Add Suffix To Catalog Number | Enclosure Type | Controller Series and Price Addition | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | CA7-9 to 43 | CA7-60 to 85 | CA6-95(-EI) to CA6-140(-EI) | CA6-180(-EI) to CA6-250-EI | CA6-300-EI to 860-EI | CA5-1200 |
| **Control Circuit** | | | | | | | | | |
| Control Circuit Transformer (with fused primary & secondary) Primary Volts / Secondary Volts | Replace (✱) in catalog # wtih following codes: ❷ | | M1, M3, M4, F4, M12 Open | 190 | 250 | 340 | 190 | 190 | 50 |
| 208 / 120 | XA | | | | | | | | |
| 240 / 120 | XB | | | | | | | | |
| Standard 480 / 120 | XC | | | | | | | | |
| Capacity 575 / 120 | XD | | M7 | 210 | 320 | 430 | 210 | 210 | ~ |
| 380 / 110 | XG | | | | | | | | |
| 240 / 24 | XE | | | | | | | | |
| 480 / 24 | XF | | | | | | | | |
| 208 / 120 | XA1 | | | | | | | | |
| 240 / 120 | XB1 | | M1, M3, M4, F4, M12 Open | 300 | 375 | 450 | 300 | 300 | 100 |
| 100 Watt 480 / 120 | XC1 | | | | | | | | |
| Extra Capacity 575 / 120 | XD1 | | | | | | | | |
| 240 / 24 | XE1 | | M7 | 320 | 445 | 545 | 320 | 320 | ~ |
| 480 / 24 | XF1 | | | | | | | | |
| 208 / 120 | XA2 | | | | | | | | |
| 240 / 120 | XB2 | | | | | | | | |
| 200 Watt 480 / 120 | XC2 | | M1, M3, M4, F4, M12 Open | 388 | 470 | 555 | 388 | 388 | 250 |
| Extra Capacity 575 / 120 | XD2 | | | | | | | | |
| 240 / 24 | XE2 | | | | | | | | |
| 480 / 24 | XF2 | | | | | | | | |
| 208 / 120 | XA3 | | | | | | | | |
| 240 / 120 | XB3 | | | | | | | | |
| 300 Watt 480 / 120 | XC3 | | M1, M3, M4, F4, M12 Open | 475 | 570 | 650 | 475 | 475 | ~ |
| Extra Capacity 575 / 120 | XD3 | | | | | | | | |
| 240 / 24 | XE3 | | | | | | | | |
| 480 / 24 | XF3 | | | | | | | | |
| Special Voltage Transformer | | F/A ❶ | All, Open | Refer to Factory | | | | | |
| **Control Circuit (Other)** | | | | | | | | | |
| Fused Control Circuit - 1 Fuse | | F1 | All, Open | 50 | 50 | 50 | 50 | 50 | 50 |
| Fused Control Circuit - 2 Fuses Fused Primary for separate or common control | | F2 | All, Open | 50 | 50 | 50 | 50 | 50 | 50 |
| Control Circuit Interlock (installed on disconnect or circuit breaker. Specify N.O. or N.C.) | | F/A ❶ | Combo Type M1, M3, M4, F4, M12, M7 | 105 | 105 | 105 | 105 | 105 | 105 |
| Control Circuit Fused Disconnect (inside operated) | | F/A ❶ | All | 281 | 281 | 281 | 281 | 281 | 281 |
| Control Circuit Breaker ( inside operated) | | F/A ❶ | All | 450 | 450 | 450 | 450 | 450 | 450 |
| Surge Suppressor - RC Link | | RC | All, Open | 25 | 25 | 50 ❸ | ❸ | ❸ | ~ |
| Surge Suppressor - Varistor | | RV | All, Open | 25 | 25 | 50 ❸ | ❸ | ❸ | ~ |
| Surge Suppressor - Diode | | RD | All, Open | 25 | 25 | ~ | ~ | ~ | ~ |
| Terminal Blocks (unwired) - price per point. | | F/A ❶ | All, Open | 13 | 13 | 13 | 13 | 13 | 13 |

## *Ordering Instructions*

● Change base **Catalog Number** according to instructions at top of column 2 or 3. Example: To Add a "Start-Stop" Pushbutton, Control Circuit Transformer (480/120) and RC Link: change **CAT7-30-✱-♦-GO** to **CAT7-30-XC-♦-G3-RC.**

***Note:*** Separate multiple modification suffixes with a hyphen (-).

❶ Factory assigned.
❷ Coil will be factory selected based on transformer secondary.
❸ "EI" Coils include built-in surge suppression so adder does not apply. See page A82 for "EI" coil selection.