Global “Short-Circuit Current Ratings”
Global Products, Global Solutions

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Presentation Agenda

- SCCR Background
- NEC, UL 508A “SB” vs. IEC
- MCS Motor Starter Circuits
- SMC Soft-Starter Circuits
- PowerFlex Drive Circuits
- rockwellautomation.com Web Tool
- Global SCCR Summary
Global Short-Circuit Current Ratings

Global Products, Global Solutions!

Customer Solutions

- Competitiveness
- Common Design
- Coordinated Protection
- Complete Solutions

Manufacturer Name: ABC Company
Voltage: 600V
Phase: 3-Phase
Frequency: 60Hz
Full Load Current: 300A
Amperage
Short Circuit Current Rating*: 150,000A

Suitable for use in a small facility or a building with less than 500 square feet of area that is a small circuit.
Importance of Short-Circuit Current Ratings

**Short-Circuit:**
- An over-current fault that exceeds normal full load currents... 10x, 100x, 1,000x of FLC
- Catastrophic results if SC Faults are not cleared properly

**SC Faults are critical to:**
- Worker Safety
- Customer Applications (Critical Care, Continuous Process)
- Circuit Components, Assemblies & System Installations
- Productivity & Downtime ($100k’s per hour)

**We forget how much “power” we are really discussing:**
- “65kA @ 400V”
- “100kA @ 480V”
- “80kA @ 690V”
What is a Short-Circuit Current Rating?

- **Short-Circuit “Interrupting Rating” (Breaking Capacity):**
  - The maximum short circuit current at rated voltage that a over-current protective device can safely interrupt and clear (Fuses & Circuit Breakers)

- **Short-Circuit Current Rating – SCCR:**
  - The maximum available short-circuit current an electrical component can sustain without the occurrence of excessive damage *when protected with* an over-current protective device

“Motor Protection Circuit Breaker”
Protective Device
Icu/Ics = 65kA @ 400V

“Combination Motor Controllers”
Icu/Ics = 65kA @ 400V
IEC Type “2” Coordination
Building a Short-Circuit Current Rating

- **Protection Levels:**
  - Component
  - Combinations
  - Branch Circuit
  - Panel Assembly

- "Motor Protection Circuit Breaker"
  - $I_{cu}/I_{cs} = 65kA @ 400V$

- "Combination Motor Controllers"
  - $I_{cu}/I_{cs} = 65kA @ 400V$
  - IEC Type "Z" Coordination

- "Panel SCCR"
  - 65kA @ 400V

- "Branch Circuit SCCR"
  - 65kA @ 400V
Common Global SCCR Requirements

- Determine System Voltage & Frequency
- Determine Available Fault Currents (AFC)
- Ensure Control Panel SCCR covers the AFC
- Mark the Panels Accordingly

**SCCR “Evaluation Process” varies greatly**
Presentation Agenda

- SCCR Background
- NEC, UL 508A “SB” vs. IEC
- MCS Motor Starter Circuits
- SMC Soft-Starter Circuits
- PowerFlex Drive Circuits
- rockwellautomation.com Web Tool
- Global SCCR Summary
# NEC, UL 508A “SB” vs. IEC

## North American Markets

**Category**
- Products
  - UL 508 Part I – All Equipment
  - UL 508, 489, 1077 – Circuit Breakers
  - UL 98 – Disconnect Switches
  - UL 508 Part II – Mag Motor Controllers
  - UL 508 Part III – Man Motor Controllers
  - UL 508 Part IV – Comb Motor Controllers
  - UL 508 Part V – Reduced Voltage Starters
  - UL 508 Part IV – Solid-State AC Motor Control
  - UL 508 Part X – Auxiliary Devices
  - UL 1059 – Power & Terminal Blocks
  - UL 508C – Power Conversion Equipment
- Panels & Machinery
  - NFPA 79 – Electrical Standard for Industrial Machinery
  - UL 508A (SB) – Industrial Control Panels
  - UL 845 – Motor Control Centers
  - UL 1558 – LV Switchgear
- Electrical Installations
  - NEC (NFPA 70) – National Electrical Code
  - CEC – Canadian Electrical Code

## International Markets

**Category**
- Products
  - IEC 61947-1 – General
  - IEC 61947-2 – Circuit Breakers
  - IEC 61947-3 – Disconnect Switches
  - IEC 61947-4 – Contactors & Starters
  - IEC 61947-4-2 – Soft-Starters
  - IEC 61947-5 – Control Circuit Devices
  - IEC 61947-7 – Terminal Blocks
  - IEC 61800-3 – Variable Freq Drives
- Panels & Machinery
  - IEC 61204 – Electrical Equipment of Industrial Machines
  - IEC 61439 – LV Control-gear & Switchgear Assemblies
  - IEC 61912 – Application of SCCR (TR)
- Electrical Installations
  - IEC 60364 – Low-Voltage Electrical Installations for Buildings
SCCR on UL Industrial Control Panels

NEC & UL 508A

NEC Articles:
- 409 – Industrial Control Panels
  “General use, 600V or less”
- 440 – Air Conditioning & Refrigeration
- 610 – Cranes & Hoists
- 670 – Industrial Machinery

409.110 Marking:
(3) 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-2001, Supplement SB, is an example of an approved method

General Use Industrial Control Panels:
- Construction
- Panels
- Power Circuits
- Control Circuits
- Ratings
- Markings
- Specific Use IC Panels
- Supplement SB: “SCCR for IC Panels”
UL 508A Supplement SB

- UL 508A – Industrial Control Panels
  - “Panel Builders Standard”

- **Standardized** process to determining SCCR for panels
  - Limited traditional analysis methods
  - Evaluates Voltage Ratings (Y/D Systems)
  - Default to minimum assigned ratings
  - **Forces all power components to have**
    - “high fault” SCCR ratings
      - Umbrella Testing
      - **UL Witnessed – all High Fault Tests!**

**SUPPLEMENT SB - SHORT CIRCUIT CURRENT RATINGS FOR INDUSTRIAL CONTROL PANELS**

- SB1 Scope .......................................................... SB1
- SB2 Glossary ....................................................... SB1
- SB3 Construction .................................................. SB1
  - SB3.1 Internal wiring connections .......................... SB1
  - SB3.2 Overcurrent protection of control circuit .......... SB1
- SB4 Ratings ........................................................ SB2
  - SB4.1 Short circuit current rating ............................. SB2
  - SB4.2 Short circuit current ratings of individual power circuit components .......... SB2
  - SB4.3 Feeder components that limit the short circuit current available .......... SB5
  - SB4.4 Determination of the overall short circuit current rating of the panel .... SB8
- SB5 Markings ........................................................ SB9
  - SB5.1 General ...................................................... SB9
  - SB5.2 Cautionary markings ................................. SB9
UL 508A SB

Determining SCCR’s - 3 Basic Steps

- UL 508A Supplement SB
  - “Short-Circuit Current Ratings for Industrial Control Panels”
  - Shall be determined by the following evaluation procedure:

- SB4.1: Short-Circuit Current Rating (SCCR)
  a) First, establish the short circuit current ratings of individual power circuit components as specified in SB4.2
  b) Second, modify (limit) the available short-circuit current within a portion of a circuit in the panel due to the presence of current limiting components as specified in SB4.3
  c) Third, determine the overall panel short-circuit current rating as specified in SB4.4
SB4.2.1 All power circuit components, including disconnect switches, branch circuit protective devices, branch circuit fuse holders, load controllers, motor overload relays, terminal blocks, and bus bars, shall have a short-circuit current rating expressed in amperes or kilo-amperes and voltage.

- **Exception No. 1:** Power transformers, reactors, current transformers, dry-type capacitors, resistors, varistors, and voltmeters are not required to have a short circuit current rating.

- **Exception No. 2:** The “S” contactor of a wye-delta motor controller is not required to have a short-circuit current rating.
SB4.3 – Feeder components that limit the short-circuit current available:

- **SB4.3.1** – For branch circuits supplied by a *power transformer with an isolated secondary winding*, a power transformer with an isolated secondary...

- **SB4.3.2** – For branch circuits supplied by a *Listed circuit breaker marked “current limiting”* in the feeder circuit, the short circuit current rating...

- **SB4.3.3** – For branch circuits supplied by a *Class CC, G, J, L, RK1, RK5, or T fuse* in the feeder circuit, the short-circuit current rating...
**UL 508A SB4.3**

*Current-Limiting Components*

**SB4.3.2** For branch circuits supplied by a *Listed circuit breaker marked “current-limiting”* in the feeder circuit, the short-circuit current rating on the line side of the circuit breaker shall be one of the following:

- **a)** The short-circuit current rating of the *feeder circuit breaker* when all of the components in the branch circuit have a short-circuit current rating not less than the published peak let-through current of the circuit breaker, see Figure SB4.1, and the short-circuit current rating of all branch circuit protective devices on the load side are not less than the short-circuit current rating of the feeder circuit breaker.

- **b)** The smallest short-circuit current rating of any branch circuit protective device on the load side of the feeder circuit breaker, when the conditions of SB4.3.2(a) exist except the short-circuit current rating of the branch circuit protective devices on the load side are less than the short-circuit current rating of the feeder circuit breaker.
UL 508A SB4.4
Overall SCCR of the Panel

SB4.4.1 For each branch circuit provided with branch circuit protection within the industrial control panel, *the smallest short-circuit current rating of all power circuit components* on the load side of a branch circuit protective device and the control circuit over-current protection in SB3.2.1 shall be determined and compared with the short-circuit current rating of the branch circuit protective device. *The smaller of the two ratings shall be assigned to the line side of the branch circuit protective device.*

In other words, use the lowest rating of a component or branch protective device to determine branch rating.
UL 508A SB4.4
Panel SCCR – Validate Results

1. Panel SCCR will be determined by the **smallest SCCR** of any **feeder or branch over-current protective device or component**

2. Branch Circuit Protection Devices, **BCPDs must cover panel available fault level**

3. All components and controllers with SCCR’s based on **high-fault ratings must be used with the specified branch circuit protective device**

4. And finally, **the panel SCCR must cover the available fault current supplying the panel!**
UL 508A SB
Components Requiring “High Fault” SCCR

- High Fault Ratings with Circuit Breakers & Fuses
- Motor Controllers:
  - Motor Starters
  - Soft-starters
  - Drives
  - Servo Controllers
- Wiring & Connection Systems:
  - Busbar Mounting Systems
  - Adapter Modules
  - Commoning Links & Feeder Blocks
  - Power Distribution Blocks
  - Terminal Blocks
  - Fuse Holders
- Feeder Devices:
  - Disconnect Switches
  - Circuit Breakers
140U-D Branch Circuit Protection Device

- **140U-D MCCB**
  - UL 489 Molded Case Circuit Breaker
    - Current Limiting
  - Thermal/Magnetic Protection
  - 2 & 3 Pole
  - 0.5 .. 30A Ir Range
  - 480V, 65..100kA Interrupting Ratings
  - 45mm wide
  - Full Line Accessories:
    - Aux, Shunt, Under-voltage
    - Commoning Links & Feeder Block
    - Operating Handles
    - Connection Modules
MCC & IC Panel Applications – 140U-D

Vertical Bus
(65kA @ 480V)

ACB Main Incomer

Horizontal Bus
(65kA @ 480V)

“Fuseless & Mission Critical Circuits”

“Motor Branch Circuit Breaker”
140U-H..L MCCB
(Iq = 65kA @ 480V)

“Feeder Breaker”
140U-H..L MCCB
(Iq = 65kA @ 480V)

“Non Motor Loads”
- Lighting
- Heaters
- Metering
- Transformers
- Power Supplies
- Control Circuits
- PLC Control
(Iq = 65kA @ 480V)

“Branch”
140U-D MCCB
(Iq = 65..100kA @ 480V)

Eliminates requirement for “Series or Cascading Ratings”
IEC 61439 Part 1 - General Rules

- Covers all Switchgear & Control-gear variants in 61439 Series
- No longer includes TTA or PTTA designations, now satisfied thru verification rules

General requirements:

- Panel must have a SCCR rating that covers the available fault current
  - Same requirement as NEC & UL
- Panel SCCR is determined by equipment manufacturer per 61439-1
  - Same requirement as NEC & UL
  - Different process to determine ratings

5.1 General

The characteristics of the ASSEMBLY shall ensure compatibility with the ratings of the circuits to which it is connected and the installation conditions and shall be specified by the ASSEMBLY Manufacturer using the criteria identified in 5.2 to 5.5.
IEC 61439-1
Verification of Performance under Short-circuit Conditions

- Verification by the application of *Design Rules, Calculation or Test*.

- Verification based on the “Reference Design”
  - Original Manufacturer Design
  - Must be Tested

- Verification not required for the following:
  - Short-circuit Prospective Fault (I_{cp}) or Withstand (I_{cw}) is \leq 10kA
  - Conditional Short-circuit Current where the I_{pk} is \leq 17kA
  - Auxiliary Circuits are connected to transformers \leq 10kA

- All other circuits must be verified
IEC 61439-1
“Reference Design”

- “Reference Design” based on:
  - Original Manufacturer assembly
  - Focus on the bus structure & connection systems
- **Verification by test** for SC Current Withstand!

- Types of Ratings:
  - Short-time **Current Withstand**
    - \( I_{cw} = \text{Rated kA for 1..3 sec.} \)
    - \( I^2t \text{ & } I_{pk} \text{ (Thermal/Dynamic Stress)} \)
  - Conditional Short-circuit **Current**
    - \( I_{cc} = \text{Rated kA at rated voltage with specified SCPD (CB or Fuses)} \)
- Ratings can be used for **verification by calculation**:
  - Acceptability of assembly for installation
  - Evaluation of circuits within the assembly
  - Coordination of SCPD selection

**System**
- \( V = 400\text{V} \)
- \( f = 50\text{Hz} \)
- \( I_{cp} = 25\text{kA} \)

**Reference Design**
- \( U_e = 415\text{V} \)
- \( I_{cw} = 50\text{kA}, 1 \text{ sec} \)
- \( I_{pk} = 105\text{kA} \)

**Internal Circuits**
- Feeders & BCPD = CB
- \( I_{cc}/I_{cs} = 50\text{kA} \)
- \( V = 415\text{V} \)

**Branch Components**
- \( I_{cc} = 50\text{kA} \)
- \( V = 415\text{V} \)
IEC 61439-1
SC Verification Design Checklist

- **Verification by “Design”**
  - Compares original Reference Design to new variant assembly

- **Design Checklist reviews:**
  - \( I_{cw} \), conductor cross-section, spacings, materials, enclosure size & compartment design

- **If all questions answered “yes”, additional verification not required**

- **Additional evaluations:**
  - Series or Cascading Ratings
  - Circuit Impedances, Cable Lengths
  - Let-thru Characteristics (\( I^2t \) & \( I_{pk} \))
  - Withstand Characteristics (\( kA \) & \( t_{sec} \))
  - Devices evaluated (power blocks ?)

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**Table 13 – Short-circuit verification by design rules:**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Requirements to be considered</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Is the short-circuit withstand rating of each circuit of the ASSEMBLY to be assessed, less than or equal to, that of the reference design?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Is the cross sectional dimensions of the busbars and connections of each circuit of the ASSEMBLY to be assessed, greater than or equal to, those of the reference design?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Is the spacing of the busbars and connections of each circuit of the ASSEMBLY to be assessed, greater than or equal to, those of the reference design?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Are the busbar supports of each circuit of the ASSEMBLY to be assessed of the same type, shape and material and have, the same or smaller spacing, along the length of the busbar as the reference design?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Are the material and the material properties of the conductors of each circuit of the ASSEMBLY to be assessed the same as those of the reference design?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Are the short-circuit protective devices of each circuit of the ASSEMBLY to be assessed equivalent, that is of the same make and series ( a ) with the same or better limitation characteristics (( I^2t ), ( I_{pk} )) based on the device manufacturer’s data, and with the same arrangement as the reference design?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Is the length of unprotected live conductors, in accordance with 8.6.4, of each non-protected circuit of the ASSEMBLY to be assessed less than or equal to those of the reference design?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>If the ASSEMBLY to be assessed includes an enclosure, did the reference design include an enclosure when verified by test?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Is the enclosure of the ASSEMBLY to be assessed of the same design, type and have at least the same dimensions to that of the reference design?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Are the compartments of each circuit of the ASSEMBLY to be assessed of the same mechanical design and at least the same dimensions as those of the reference design?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*YES* to all requirements – no further verification required.

*NO* to any one requirement – further verification is required, see 10.11.4 and 10.11.5.

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\( a \) short-circuit protective devices of the same manufacture but of a different series may be considered equivalent where the device manufacturer declares the performance characteristics to be the same or better in all relevant respects to the series used for verification, e.g. breaking capacity and limitation characteristics (\( I^2t \), \( I_{pk} \)), and critical distances.
Presentation Agenda

SCCR Background

NEC, UL 508A “SB” and IEC

MCS Motor Starter Circuits

SMC Soft-Starter Circuits

PowerFlex Drive Circuits

rockwellautomation.com Web Tool

Executive Summary
Branch Circuit Solutions

- Branch circuit solutions can be complex:
  - Component selection can be difficult to determine coordinated “High Fault” SCCR

- RA Branch Circuit Solutions:
  - Tested at RA “Accredited” High Current Test Facilities
  - Test Programs approved & witnessed by UL
    - Third Party Certification
  - Ratings included in UL File Reports

- Ratings are typically attained with standard component sizing, limited oversizing required

- Provide web tool for “customer ease of selection”
  - Select product solution
  - Select application parameters
  - Output: SCCR Selection Table and “One Line BOM”
Global SCCR Applications

Wide variation of Voltage & kA requirements at 50/60Hz
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- Global SCCR Summary
SCCR for Motor Starter Combinations

- **Global Voltages:**
  - 380..400V, 415V, 440V, 525V, 690V **50Hz**
  - 460/480, 575/600V **60Hz**

- **Short Circuit Performance:**
  - 50, 65 & 100kA
  - Type 1, Type 2

- **Branch Protection Devices:**
  - Fuses, MCP, MCCB, MPCB

- **Motor Starters: (0.1..860A)**
  - 2C Starters (MPCB + Contactor)
  - 3C Starters (MCP + Contactor + OLR)
  - 3C Starters (Fuses + Contactor + OLR)
  - 2C Load Feeder (MCCB + Contactor)

- **Motor Overload Protection:**
  - Electronic
  - Bimetal
  - 825
Selection Tables & Test Summary Letters
3 Component Starters (MCP + Contactor + OLR)

- SCCR: 65kA @ 460V
- 3C Starters w/ UL MCP
- Type "2" Coordination

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**Short-circuit Coordination**

<table>
<thead>
<tr>
<th>Motor Circuit Breaker</th>
<th>Contactor</th>
<th>Overload Relay</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCCR: 65kA @ 460V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**TEST SUMMARY**

Type 1 & 2 SC Coordination – 460V (480V Line), 65kA
Type D Combination Motor Controller, 100-C/D Contactors and 193-E Electronic Overload Relays

- **Purpose of Tests:**
  Evaluate SC Performance of Allen-Bradley 140M Motor Circuit Protectors, 100-C/D Contactors and 193-E Electronic Overload Relays

- **Test Standard:**
  UL 508 Type D Combination Motor Controller
  IEC 60947-1: Edition 2.1 2002-12

- **Test Devices:**
  Motor Circuit Protectors, Contactors, Electronic OLR
  140M-HBP-D00, 100-C20, 193-EC, EE
  140M-HBP-D10, 100-C25, 193-EC, EE
  140M-HBP-D15, 100-C30, 193-EC, EE
  140M-JBP-D10, 100-D140, 193-EC, EE
  140M-JBP-D20, 100-D210, 193-EC, EE
  140M-JBP-D40, 100-D250, 193-EC, EE
  140M-jBP-D40, 100-D300, 193-EC, EE

- **Summary of Tests:**
  - Short-circuit "y" tests: 1 operation with all devices closed, 1 operation with contactor closing into fault
  - Dielectric tests at 1,200VAC
  - Short-circuit "Ig" tests: 1 operation with all devices closed, 1 operation with contactor closing into fault
  - Dielectric tests at 1,200VAC

- **Test Circuits:**
  - Open Circuit Voltage: 463V Volts, 3-Phase, 69Hz
  - Available Symmetrical Current: 3.18kA r.m.s.
  - Power Factor: 30.80%

- **Test Results:**
  The test device combinations listed above met IEC SC Coordination Type 1 & 2 criteria.

- **Test Report References:**
  EP-2460F
  E125316

Reviewed by:

Henry Czajkowski
Manager, Engineering Services
Rockwell Automation

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**Selection Tables & Test Summary Letters**

**2 Component Starters (MPCB + Contactor)**

- **SCCR: 65kA @ 400V**
- **2C Starters w/ MPCB**
- **Type “2” Coordination**

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### Short-circuit Coordination

**Type 2 5C Coordination**

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<th>Motor</th>
<th>Circuit Breaker</th>
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<th>S.C. Coordination</th>
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**Type “2” Coordination**

**TEST SUMMARY**

<table>
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<tr>
<th>Test Devices:</th>
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<tr>
<td>Motor Protection</td>
</tr>
<tr>
<td>Circuit Breaker</td>
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<tr>
<td>Contactor</td>
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<tr>
<td>140M-DBE-C10</td>
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<td>140M-DBE-C16</td>
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<td>140M-DBE-C45</td>
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<td>140M-DBE-C50</td>
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</table>

**Summary of Tests:**

- Short-circuit “Y” tests: 1 operation with all devices closed, 1 operation with contactor closing into fault
- Dielectric tests at 1000VAC
- Short-circuit “f” tests: 1 operation with all devices closed, 1 operation with contactor closing into fault
- Dielectric tests at 1000VAC

**Test Circuits:**

- Open Circuit Voltage: 436/440 Volts, 3-Phase, 50Hz
- Available Symmetrical Current: 1 and 3 kA r.m.s.
- Power Factor: 90 and 90%
- 20% Reviewed by:
  - Hans Weichert
  - Engineering Supervisor
  - High Current Laboratory, Aarau
Presentation Agenda

SCCR Background

NEC, UL 508A “SB” vs. IEC

MCS Motor Starter Circuits

SMC Soft- Starter Circuits

PowerFlex Drive Circuits

rockwellautomation.com Web Tool

Global SCCR Summary
SCCR Branch Circuit Solutions
SMC Soft-Starters

- **Global Voltages:**
  - 220V, 380..400V, 415V, 440V, 525V, 690V **50Hz**
  - 200-208V, 230V, 460V, 575V **60Hz**

- **Short Circuit Performance:**
  - Standard Fault, 65 & 100kA
  - Type 1, Type 2 Coordination

- **Branch Protection Devices:**
  - Fuses & Circuit Breakers

- **Soft-Starters: (1..800A)**
  - SMC-3
  - SMC-50
  - SMC Flex

- **Starting Modes:**
  - Line & Delta Connected Motors
  - Standard & Heavy Duty
**SCCR Selection Table**

**SMC-3 w/ Fuses**

### Short-circuit Coordination

**Starter Type:** Soft-starter - Line Connected Motors  
Normal Duty Rating - AC53b  
Fuses + Line Contactors + SMC-3  
UL/CSA Class J & L Fuses, Current Limiting

**Line Contactor:** 100-C, 100-D (100S-C, 100S-D)  
Rated Operation Voltage: 600V 60Hz  
Rated Conditional S.C. Current (Iq): 70kA (rms sym.)  
Level of S.C. Coordination: Type “1” or “2” per IEC 60947-4  
UL 508 High Fault SCCR

### Table of Values

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<th>Motor</th>
<th>[HP]</th>
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<th>IEC 60947-2</th>
<th>Branch Circuit Protection Device - Fuse</th>
<th>Line Contactor</th>
<th>SCR Fuse (Optional)</th>
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*Remark: Type 2*
Presentation Agenda

- SCCR Background
- NEC, UL 508A “SB” vs. IEC
- MCS Motor Starter Circuits
- SMC Soft-Starter Circuits
- PowerFlex Drive Circuits
- rockwellautomation.com Web Tool
- Executive Summary
Global Voltages:
- 220V, 380..400V, 415V, 440V, 525V, 690V 50Hz
- 230/240V, 460/480, 575/600V 60Hz

Short Circuit Performance:
- 65 & 100kA
- IEC Type 1 & 2 Coordination

Branch Protection Devices:
- Fuses & Circuit Breakers (MCCB, MPCB)

Motor Starters: (1..800A)
- PowerFlex 525
- PowerFlex 4/4M
- PowerFlex 750 Series

Circuit Variables:
- Circuit Protection Components
- Power/Line Conditioning Components
- Control Components
Drive Circuit Solutions

- **Core Drive Components:**
  - *Branch Circuit Protection*
  - *Drive*
  - *EMC Filter*
  - *Isolation Transformers*
  - *Line Reactors (Input/Output)*
  - *Terminators*
  - *Reflective Wave Devices*

- **Control Components:**
  - *Branch Circuit Protection*
  - *Isolation Contactors (Input/Output)*
  - *Bypass Starters*
  - *Multi-Motor Controllers (Output)*

*Note: Components require SCCR's per UL 508A SB*
# SCCR Selection Table

**PowerFlex 525 w/ Fuses**

## Short-circuit Coordination

<table>
<thead>
<tr>
<th>Motor Ratings</th>
<th>Drive Ratings - Normal Duty</th>
<th>SCCR Protection</th>
<th>Line Reactor</th>
<th>Contactor</th>
<th>Bypass Starter</th>
<th>IEC Coordination</th>
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<td>SCCR: 100kA @ 460V</td>
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<td>Type 2</td>
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<td></td>
<td>UL Fuse Protection</td>
<td>“Standard” Fuse Sizing (Max)</td>
<td>Normal &amp; Heavy Duty Starting</td>
<td>Type “2” Coordination</td>
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## Motor Ratings (3ph 1500rpm)

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<th>Max. Fuse Size</th>
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<th>Contactor</th>
<th>OLR</th>
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*Values in A (A) are approximate and subject to change.*

---

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### SCCR Selection Table

#### PowerFlex 525 w/ Fuses

**Short-circuit Coordination**

- **Motor Ratings**
- **Drive Ratings - Normal Duty**
- **SCPD - Fuse**
- **Line Reactor**
- **Contactor**
- **Bypass Starter**
- **IC Coordination**

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<tr>
<th>Motor Ratings</th>
<th>Drive Ratings - Normal Duty</th>
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**Coordinating Information**

- **SCCR**: 100kA @ 460V
- **UL Fuse Protection**
- **"Optimized" Fuse Sizing**
- **Normal & Heavy Duty Starting**
- **Type "2" Coordination**

---

**Remainder:**

*Type 2 Coordination*
### SCCR Selection Table

**PowerFlex 525 w/ Circuit Breakers**

**Short-circuit Coordination**

- **Motor Ratings**
- **Drive Ratings - Normal Duty**
- **BCPD - Circuit Breaker**
- **Line Reactor**
- **Contactor**
- **Bypass Starter**

### SCCR: 65kA @ 460V
- MCCB Circuit Breaker Protection
- Normal & Heavy Duty Starting
- Type "2" Coordination

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<thead>
<tr>
<th>Motor Ratings</th>
<th>Drive Ratings - Normal Duty</th>
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<th>Contactor</th>
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</table>
## SCCR Selection Table

### PowerFlex 525 w/ Circuit Breakers

**SCCR: 65kA @ 400V**

**- Circuit Breaker Protection**

**- Normal & Heavy Duty Starting**

**- Type "2" Coordination**

### Short-circuit Coordination

**Starter Type:**
AC Variable Frequency Drive

**Circuit Breakers**

**MCCB**

**By-pass Starters:**
140M MPCI and 100-C, 100S-C

**Rated Operational Voltage:**
480V, 50Hz

**Test Voltage:**
65kA (max sym)

**Rated Conditional SCCR Current (Iq):**
Type "1" or "2" per IEC 60947-4

### Motor Ratings

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<tr>
<th>HP</th>
<th>Input</th>
<th>Output</th>
<th>w/ EMC Filter</th>
<th>w/ EMC Filter</th>
<th>BCPD - Circuit Breaker</th>
<th>Line Reactor</th>
<th>Contactor</th>
<th>Bypass Starter</th>
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### Motor Ratings

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<th>HP</th>
<th>Input</th>
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<th>w/ EMC Filter</th>
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Web Selection Tool

- **Focus on Branch Circuit Solutions:**
  - Electromechanical Starters
  - Soft-Starters
  - Component Drives

- **Selection based on:**
  - Common Voltage & Frequency
  - Common SCCR
  - Common Level of Coordination

- **Data subject to change:**
  - New component introductions
  - Optimized combination ratings

"Always Use Current Posted Documentation"
# Product Category

*IEC Motor Control*

## Global Short Circuit Current Ratings

*Product Configuration Assistant*

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<thead>
<tr>
<th>Product Category</th>
<th>IEC Motor Control</th>
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<tbody>
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<td><strong>MCS motor starter combinations with fuse or circuit breaker protection, covering DOL, reversing and Start-Delta applications</strong></td>
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<tr>
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<th>System Voltage Data</th>
<th>Motor Voltage</th>
<th>Performance Specification</th>
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<td><strong>- NO SELECTION</strong></td>
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## MESSAGES

- **MESSAGES**
General Starter Data - Starter Type

2 Component Starters (MPCB + Contactor)
## System Voltage Data – Motor Voltage

460V, 60Hz

### Global Short Circuit Current Ratings

**Product Configuration Assistant**

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<th>Product Category</th>
<th>IEC Motor Control</th>
</tr>
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<tbody>
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<td></td>
<td>MCS motor starter combinations with fuse or circuit breaker protection, covering DOL, reversing and Start-Delta applications</td>
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### General Starter Data

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### System Voltage Data

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<tr>
<th>Data</th>
<th>460V 60Hz</th>
</tr>
</thead>
</table>

### Motor Voltage

- 380/400V 50Hz
- 415V 50Hz
- 440V 50Hz
- **460V 60Hz**
- 500V 50Hz
- 525V 50Hz
- 575V 60Hz
- 690V 50Hz

**Performance Specification**

- **NO SELECTION**
### Performance Specification

**140M + 100-C (Type E)**

![Image](image_url)

**Global Short Circuit Current Ratings**

**Product Configuration Assistant**

<table>
<thead>
<tr>
<th>Product Category</th>
<th>IEC Motor Control</th>
</tr>
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<tbody>
<tr>
<td><strong>MCS motor starter combinations with fuse or circuit breaker protection, covering DOL, reversing and Start-Delta applications</strong></td>
<td></td>
</tr>
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**General Starter Data**

- **Starter Type**: 2 Component Starters (MPCB + Contactor)
- **System Voltage Data**: 480V 60Hz
- **Motor Voltage**: 480V 60Hz
- **Performance Specification**
  - **Specification**: 140M + 100-C (Type E)
  - **UL 508 MPCB**
### Available Documents

**SCCR Selection Table & Test Summary Letter**

#### Global Short Circuit Current Ratings

<table>
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<tr>
<th>Available Documents</th>
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#### Selection Summary

- **Product Category**: IEC Motor Control
- **Starter Type**: 2 Component Starters (MPCB + Contactor)
- **System Voltage Data**: 460V 60Hz
- **Motor Voltage**: 460V 60Hz
- **Performance Specification**: 140M + 100-C (Type E)

[Modify] [Cancel]
UL 508A & NEC 409 Resources

Allen-Bradley Short Circuit Current Ratings (SCCR)
- Access the Short Circuit Current Rating for Allen-Bradley Products using ProposalWorks™ (Product Selection Toolbox) — This tool will allow you to obtain the SCCR by entering a catalog number or accessing our product directory to build one. For more information see the "SCCR Data" Tutorial.
- View a listing of Allen-Bradley Products with SCCR Data

IEC Motor Control Solutions - Global Short Circuit Current Ratings
- IEC motor control and protection devices have been tested and certified for High Fault Short Circuit Combination Ratings with fuses and molded case circuit breakers.

SCCR Selection Tables & Test Summary Letters
- Get the latest on changes in NEC article 409 and the revised UL508A standard. Whether you are a panel builder or an OEM, this information will be valuable for ensuring your products comply with the changes.
Global SCCR Summary

- High Fault SCCR requirements increasing globally
- UL 508A SB procedure can be applied to global applications
- RA customers require solutions for global voltages & faults levels
- Utilize www.rockwellautomation.com/...productcertifications/ul508a
  - Complete Branch Circuit Solutions:
    - MCS Starter Circuits
    - SMC Soft-starter Circuits
    - PowerFlex Drive Circuits
  - UL Witnessed & Listed Ratings
  - SCCR Selection Tables – “One Line BOM”
- Improving Customer Solutions!
Global “Short-Circuit Current Ratings”

Global Products, Global Solutions

Thank you for your time!!
Presentation Agenda

- SCCR Background
- NEC, UL 508A “SB” vs. IEC
- MCS Motor Starter Circuits
- SMC Soft-Starter Circuits
- PowerFlex Drive Circuits
- rockwellautomation.com Web Tool
- Global SCCR Summary