

UNDERWRITERS LABORATORIES INC. CERTIFICATION REQUIREMENT DECISION

This Certification Requirement Decision is prepared by UL LLC. It is normative for the applicable UL Product Certification Program(s); however, it is currently not part of the UL Standard(s) referenced below.

Product Category (CCN): CYJV, CYJV2

Standard Number: UL 2238

Standard Title: Standard for Cable Assemblies and Fittings for Industrial Control and Signal Distribution

Edition Date: May 14, 2011

Edition Number: 2

Section / Paragraph Reference: New Supplement SA

Subject: Optional Short Circuit Rated Cable Assemblies and Fittings for Industrial Control and Signal Distribution

DECISION:

1. Scope

1.1 These requirements cover devices intended for inter-connection of equipment, sensors, and actuators in remote-control, signaling, and power-limited circuits. Included are cable assemblies and fittings, feeder-tap cable systems, feed-through connectors, multi-outlet fittings, panel-mount fittings, and splitters. These devices are not intended for disconnect means. These devices are rated not more than 60 A and not more than 600 V.

1.1.1 This Standard also contains Supplement SA – Short Circuit Current Rated(SCCR) Cable Assemblies and Fittings for Industrial Control and Signal Distribution

SUPPLEMENT SA - Short Circuit Current Rated (SCCR) Cable Assemblies and Fittings for Industrial Control and Signal Distribution

INTRODUCTION

SA1 Scope

SA1.1 The requirements of this Supplement cover Cable Assemblies and Fittings for Industrial Control and Signal Distribution provided with an identified Short-Circuit Current Rating (SCCR). These requirements are optional and supplement the requirements contained elsewhere in this standard.

SA2 Glossary

SA2.1 For the purposes of this Supplement, the following definitions apply.

SA2.2 **SHORT CIRCUIT CURRENT RATING** – Rating on cable assemblies and fittings representing the maximum level of short-circuit current that a component or assembly can withstand.

SA3 General

SA3.1 Cable Assemblies and Fittings for Industrial Control and Signal Distribution shall comply with all requirements in the Standard for Cable Assemblies and Fittings for Industrial Control and Signal Distribution, UL 2238.

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CONSTRUCTION

SA4 General

SA4.1 All terminals of Cable Assemblies and Fitting for Industrial Control and Signal Distribution shall be assembled or provided as a complete assembly as intended, according to the manufacturer's instructions.

SA4.2 Short circuit current ratings

SA4.2.1 All Cable Assemblies and Fitting for Industrial Control and Signal Distribution shall have a short circuit current rating expressed in amperes or kilo- amperes and voltage.

PERFORMANCE

SA5 Short-Circuit Withstand Test

SA5.1 General

SA5.1.1 A device shall be subjected to the tests in accordance with SA5.2.1- SA5.2.2 when protected by a fuse or circuit breaker as specified in SA5.2.1 and SA5.2.2. The overcurrent protective device used shall have an interrupting rating at least equal to the test current. See Section SA6.

SA5.1.2 If such equipment is marked to limit protection to fuses only, it shall not be considered as intended for use in a circuit protected by an inverse-time circuit breaker.

SA5.1.3 Testing with inverse-time circuit breakers shall not be required if it is shown that the clearing time of the inverse-time circuit breakers will be less than that of the fuse with which the product has been tested. Testing with inverse-time circuit breakers is not required when it is shown that the let-through energy (I^2t) and peak let-through current (I_p) of the inverse-time circuit breakers is less than that of the fuse with which the product has been tested.

SA5.2 Protective devices

SA5.2.1 The fuses used for the tests shall be specified as follows:

- a) For a device intended for use on general purpose branch circuits, the rating of the fuse used shall be the ampere rating of the device.
- b) For a device intended for use on motor branch circuits, the fuses used for the tests shall be specified by the manufacturer in accordance with Table SA5.1.

Table SA5.1
Ratings of fuses used for test

Type of fuse ^a	Maximum percent of device rated current ^b	Fuse Current (Amp) marking required ^h	Fuse Type (Class) marking required ⁱ
Nontime delay	400 ^{c,d}	No	Yes
Nontime delay	< 400 but ≥300 ^e	Yes	Yes
Nontime delay	<300 but >225 ^f	Yes	Yes
Time delay	≤225g	Yes	Yes
^a Tests with 225% full load ampere time delay fuses are not representative of tests with 400% full load ampere non-time delay fuses.			
^b These values are to be used when the manufacturer does not specify fuse sizes and refers to a maximum percent level, such as "Fuse not to exceed 300% of motor full load amps."			
^c For non-time delay fuses, if the calculated value of the fuse is between two standard ratings as specified in SA5.2.3, a fuse of the nearest standard rating but not more than four times the full-load motor-current rating is to be used.			
^d Tests with 400% non-time delay fuses cover use with 225% time delay fuses.			
^e Tests with non-time delay fuses rated less than 400%, and equal to or greater than 300 percent cover use with 175% time delay fuses.			
^f Tests with less than 300% non-time delay fuses requires additional testing with 225% (or as marked) time delay fuses.			
^g The product is marked to indicate the level of protection and that the branch-circuit protective device is able to be of the time-delay type.			
^h When the fuse size employed for the short circuit test requires a marking, the device shall be marked as specified in Section SA6.			
ⁱ For Fuse Type (Class) see Section SA6, Markings.			

SA5.2 .2 Standard ampere ratings for fuses are 1, 3, 6, 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 110, 125, 150, 175, 200, 225, 250, 300, 350, 400, 450, 500, 600, 601, 700, 800, 1000, 1200, 1600, 2000, 2500, 3000, and 4000.

SA5.2 .3 Testing shall be conducted with Class RK5 fuses.

Exception: Other class of fuses may be used, if the device is marked to indicate the Class Type of fuse. See marking in SA6.4.

SA5.2 .4 For a device intended to be used with fuses and short circuit rating greater than 5,000 A, the protective devices used for the test are to be sized in accordance with SA5.2.1 and are to be selected as follows:

a) Fuses specified for branch-circuit protection devices rated greater than 5,000 A shall be limited to high-interrupting capacity, current-limiting types - for example, Class CC, G, J, L, R, and T.

b) A device that is required to be used with RK1 or RK5 fuses is to be tested with fuses having I_{2t} and I_p characteristics for Class RK5 fuses. All references to Class R fuses are intended to mean fuses with energy let-through (I²t), characteristics of Class RK5 fuses.

Exception: A device that is marked to restrict its use to RK1 fuses is able to be tested with fuses having energy let-through characteristics of a Class RK1 fuse.

c) A Class CC, G, J, L, R, or T fuse, or motor short-circuit protector is to be selected such that, when tested on a single-phase circuit, the peak let-through current and clearing I_{2t} are not less than the maximum value established for the fuse - see the UL 248 series of standards - or motor short-circuit protector rating that is intended to be used with the controller being tested.

For a fuse with I_p and I^2t limits established for several different short-circuit current levels, the test fuse is to be selected to have at least the maximum values of the current corresponding to the marked short-circuit current rating of the motor control device.

Exception: A test limiter is able to be used in place of the fuses.

SA5.2.5 An inverse-time circuit breaker used for the test described in SA5.2.8 – SA5.2.19 and Table SA5.2 shall be specified by the manufacturer in accordance with (a), (b), or (c):

- a) For a device intended for use on general purpose branch circuits, the rating of the inverse time circuit breaker shall be the ampere rating of the device.
- b) For a device intended for use on motor branch circuits, the inverse-time circuit breaker may be rated four times the device rating for currents of 100 A or less or three times the device rating for full-load currents greater than 100 A. If the calculated value of the circuit breaker is between two standard ratings as specified in SA5.2.6, a circuit breaker of the nearest standard rating less than the calculated value shall be used. If the calculated value of the circuit breaker is less than 15 A, a circuit breaker rated 15 A shall be used. No marking of the circuit breaker rating is required on the product.
- c) The inverse-time circuit breaker mentioned above may have a rating less than that specified in (b) if the product is marked to indicate the limit of protection.

Table SA5.2
Standard short circuit test values

Device amperage rating	Test current	Power factor ^c
A	A ^a	
0 - 50	5,000 ^b	0.70 - 0.80
51 - 200	10,000	0.70 - 0.80
201 - 400	18,000	0.25 - 0.30
^a Symmetrical rms amperes.		
^b 10,000 A at manufacturer's option.		
^c Lower power factors may be used.		

SA5.2.6 Standard ampere ratings for inverse-time circuit breakers are 1, 3, 6, 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 110, 125, 150, 175, 200, 225, 250, 300, 350, 400, 450, 500, 600, 700, 800, 1000, 1200, 1600, 2000, 2500, 3000, and 4000.

SA5.2.7 The marking referred to in SA5.1.1, SA5.2.5, and Table SA5.1 may alternatively be located in the installation instructions.

SA5.2.8 A device shall be tested in an enclosure representative of that likely to be encountered in service.

SA5.2.9 A device shall be wired to each of the testing terminals by no more than 4 ft (1.2 m) of wire per pole. The wire shall be as specified by the manufacturer.

SA5.2.10 The grounding (bonding) conductor shall be installed as intended. For this test:

- a) A male device shall be assembled to a 2-ft (0.6-m) length of flexible cord or cable. The male device was inserted into the mating female device. The load conductors shall be shorted together.

b) A female device shall be assembled to a length of flexible cord or cable wired at one end to the testing terminals. The total conductor length between supply terminals and fitting shall not exceed 4 ft (1.2 m).

SA5.2.11 The test conductors including flexible cord or cable may exceed the specified length if they are in the test circuit during calibration.

SA5.2.12 The grounding (bonding) conductor and the metal enclosure shall be connected through a non-time-delay, 30-A cartridge fuse to the electrical supply live pole judged least likely to arc to ground. The fuse referred to in SA5.1.1 shall be connected in series with the pole judged most likely to strike ground. The connection shall be made to the load side of the limiting impedance by a 10 AWG (5.3 mm²) copper wire that is 4 to 6-ft (1.2 to 1.8-m) long.

SA5.2.13 The connection may be made with 12 or 14 AWG (3.3 or 2.1 mm²) copper wire if the branch-circuit conductors the equipment is intended to be connected to are 12 or 14 AWG (3.3 or 2.1 mm²).

SA5.2.14 During the test, surgical cotton shall be placed at all openings, covers, flanges, joints, and the like, on the outside of the enclosure.

SA5.2.15 Equipment rated for direct current shall be tested using a direct current electrical source; alternating-current equipment shall be tested on a 60 Hz essentially sinusoidal current electrical source. The open-circuit voltage of the test circuit shall be 100 - 105% of the voltage rating of the device, except that the voltage may exceed 105% of the rated voltage with the concurrence of those concerned. The test circuit shall be capable of delivering the current specified in Table SA5.2 for a given motor rating when the system is short-circuited at the testing terminals to which the device under test is connected, and this shall be verified by means of an oscillograph.

SA5.2.16 For devices requiring a higher fault current rating, see the Standard for Industrial Control Equipment, UL 508 for short circuit test values.

SA5.2.17 Fuses specified for branch-circuit protection for a motor control device rated over 10,000 A shall be limited to high-interrupting capacity, current-limiting types - for example, Class CC, G, J, L, R, and T.

SA5.2.18 For all test operations, the test circuit shall be closed on the mated devices. Two devices shall be tested.

Exception: One device may be tested twice when agreeable to those concerned.

SA5.2.19 If a group of devices having different ratings are of the same construction and material and are intended for use with one size of fuse, tests on the highest ratings may be considered to be representative of that group.

SA5.2.20 After the protective device has cleared the fault, the device shall comply with the following:

- a) There shall not be any discharge of parts. The contacts shall not disintegrate, evaporate, or weld. There shall not be any damage to the device, the wiring terminals or other parts that would impair the function of the device.
- b) There shall not be any breakage of insulating bases or supports to the extent that the integrity of the mounting or insulation of live parts is impaired.

- c) There shall not be any ignition of the cotton or cord insulation, or any other risk of a fire, and the circuit breaker or the fuse in the test circuit shall operate when the test circuit is closed.
- d) The fuse connected between the live pole and the grounding (bonding) conductor or the enclosure shall not open.

SA5.3 Calibration of test circuits

SA5.3.1 Circuit characteristics

SA5.3.1.1 Equipment rated for direct current is to be tested using a direct current electrical source; alternating-current equipment is to be tested on a 60-Hz essentially sinusoidal current electrical source. The open-circuit voltage of the test circuit is to be 100 - 105% of the voltage rating of the overload relay, except that the voltage may exceed 105% of the rated voltage with the concurrence of those concerned. The test circuit is to be capable of delivering the specified current when the system is short-circuited at the testing terminals to which the device under test is to be connected, and this is to be verified by means of an oscillograph.

SA5.3.1.2 For available fault current circuits, air core type reactors are to be employed in the line to obtain the power factor in accordance with Table SA5.1. The reactors may be connected in parallel, but no reactor is to be connected in parallel with a resistor; except that a reactor in any phase may be shunted by a resistor if the power consumed by the resistor is in the range between 0.55 - 0.65% of the reactive volt-amperes in the reactor in that phase. The minimum value of the shunting resistance used with a reactor having negligible resistance is to be calculated from the equation:

$$R = 167 \frac{E}{I}$$

in which:

E is the voltage across the reactor with current I flowing as determined by oscillographic measurement during the short circuit calibration or by proportion from meter measurements at some lower current.

SA5.4 Alternating-current circuits

SA5.4.1 General

SA5.4.1.1 The available current capacity of the circuit is to be at least the value required for the short-circuit-current rating of the motor control device. The frequency of the test circuit is to be 60 ±12 Hz for an alternating-current circuit.

SA5.4.1.2 The available rms symmetrical current is to be determined at the device terminals. If the available current is determined at the test-station terminal and the physical arrangement in the test station requires leads longer than 8 ft (2.4 m) per terminal, the additional length of leads is to be included in the circuit calibration.

Exception No. 1: For a circuit rated 25,000 A or less, the available current may be determined at the test-station terminals.