

Safety Switch Fine Strand Wire Guidelines

To ensure that Eaton Corporation's safety switches are applied correctly and safely, many factors need to be addressed. One important factor to consider is that the wire that is being used is suitable for use with the lug, or wire connector. In addition to ensuring that the lug is rated for the wire material (copper or aluminum), size, and insulation temperature rating the customer wants to use; also, it is likewise important that the lug is rated for the number of strands that make up that wire.

This instruction leaflet is presented to guide the installer when utilizing Eaton switches with fine stranded wire. This instruction leaflet should eliminate the possibility of product failure due to inappropriate lug/wire combinations.

There are eight major classifications for the stranding of wires. The classifications include B, C, D, G, H, I, K, & M which go in order from fewer strands to more strands. Thus, class B has the least amount of stranding, classes C, D, G, and H have intermediate amounts of stranding, and classes I, K, and M have the most finely stranded cables. Class B is the most common type of stranded cable and is the common stranding of building wire. The majority of lugs are designed to accommodate Class B stranding. (More information can be found in **Table 1** on determining strand classifications and **Table 2** can be used in conjunction with **Table 1** to determine the common types of building wire that fall into each class.)

Fine stranded wire usually falls within classes C or D; however, it is becoming more common to see wire falling between classes G to M. Fine stranded wire is commonly known as "welding cable" and

is very flexible and easy to install. Because of these characteristics, fine stranded wires are becoming more popular in control equipment to provide a durable, flexible routing solution against vibrations and infrequent motion. However, all lugs are not rated to be used with these higher classes of stranded wire.

With no marking or factory instructions to the contrary, most lugs may only be used with up to Class B stranded conductors. Many of the lugs that Eaton uses in the manufacture of Safety Switches are not currently listed by the lug manufacturer as suitable for use with fine stranded wire. However, Eaton has done independent testing of many of these lugs in conjunction with the safety switch and has achieved approval for fine strand wire compatibility.

The lugs that were approved, qualified under UL 486A-486B standards and passed the static heating testing. To pass the static heating test, the combinations of lug, fine strand wire, and ferrules must follow these specified criterion: the temperature rise must not exceed 50°C, the joint between the connector and conductor must remain intact, there must not be any breakage of the conductor or any strand of a stranded conductor, there must not be any stripping of threads, shearing of parts, or any other damage to the connector.

Table 3 illustrates the lug, fine strand wire, and ferrule combinations that are approved for use within the applicable safety switches. Currently, these are the only known compatible combinations that can be used and other combinations could result in failure. It is the installers' responsibility to make sure that the lug within the safety switch being ordered is approved for the type of cable intended for the installation of the product.



Powering Business Worldwide

Table 1. Strand Classification

Flex Cable Gauge	Flex Cable Strand Count							
	Concentric Strand			Rope Lay Concentric Strand		Rope Lay Bunch Strand		
	Class B	Class C	Class D	Class G	Class H	Class I 24 AWG ^①	Class K 30 AWG ^①	Class M 34 AWG ^①
20 AWG	7	19					10	26
18 AWG	7	19					16	41
16 AWG	7	19					26	65
14 AWG	7	19	37	49			41	104
12 AWG	7	19	37	49			65	168
10 AWG	7	19	37	49		26	104	259
9 AWG	7	19	37	49	133	33	133	336
8 AWG	7	19	37	49	133	41	168	420
6 AWG	7	19	37	49	133	63	266	665
4 AWG	7	19	37	49	133	105	420	1064
3 AWG	7	19	37	49	133	133	532	1323
2 AWG	7	19	37	49	133	161	665	1666
1 AWG	19	37	61	133	259	210	836	2107
1/0 AWG	19	37	61	133	259	266	1064	2646
2/0 AWG	19	37	61	133	259	342	1323	3325
3/0 AWG	19	37	61	133	259	418	1666	4256
4/0 AWG	19	37	61	133	259	532	2107	5320
250 kcmil	37	61	91	259	427	637	2499	6384
300 kcmil	37	61	91	259	427	735	2989	7581
350 kcmil	37	61	91	259	427	882	3458	8806
400 kcmil	37	61	91	259	427	980	3990	10101
500 kcmil	37	61	91	259	427	1225	5054	12691

① Wire gauge of each, individual strand

Table 2. Common Wire & Cable Classes

Class	Common Wire & Cable
B	PV / RHH / RHW / THW / TW / XHHW / USE-2 / CP / THHN / THWN
C	MTW / THHN / THWN
D	Topweld / Topflex / Flexitel / Powerflex / Xtrem
G	GPTM / SGT
H	SIS / TEW / HYP / GPT / TGGT / MGT
I	DLO / DLIH / SBC
K	Copper Grounding Cable / Welding Cable / SOW / SJOW / STOW / TFF / TFN / TFFN / XLPVC
M	Welding Cable / SO

Table 3. Lug and Fine Strand Wire Capabilities used at 75°C

Switch Application	Lug Type	Flex Cable Gauge	Flex Cable Strand Count	Flex Cable Strand Gauge	Flex Cable AWM Style	Qualified with Miromar Ferrule PN N950034	Tested with Stranding Class	
100 A	DH, DT Fusible & Non-Fusible	Line, Load	2	336	.016" = 26 AWG	3340, 3374	No	I, K
200A	DG, DH, DT Fusible & Non-Fusible	Ground, Line, Load	1/0	259	.020" = 24 AWG	3340, 3374	No	H, I
			3/0	259	.0255" = 22 AWG	3340, 3374	No	H
			3/0 & Cu Foil	1672	.05" = 30 AWG	1232, 1284, 1338, 10269	Yes	K
			Two 1/0	259	.020" = 24 AWG	3340, 3374	No	I
400A	DG, DH, DT Fusible & Non-Fusible	Line, Load	Two 3/0	259	.0255" = 22 AWG	3340, 3374	Yes	H
			Two 1/0	259	.020" = 24 AWG	3340, 3374	No	H
Elevator Connector	ES5, PS4 Fusible	Line, Load	Two 1/0	259	.020" = 24 AWG	3340, 3374	No	H
			Two 3/0	259	.0255" = 22 AWG	3340, 3374	Yes	H

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 Printed in USA
 Publication No. IL008004EN / TBG001056
 February 2013



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