



Product Family: Control Transformers

Number: AN-MISCH-008

Subject: Fuse sizing for primary and secondary windings

Date Issued: 2/26/04

Revision: Original

What are the options in North America?

North American standards, including UL 508, National Electric Code 450 and the Canadian Electrical Code Part I, require overcurrent protection on all control circuit transformers. There are two options for overcurrent protection:

Option 1

Provide an overcurrent device in the primary circuit rated to the current of the transformer. The overcurrent limits are as follows:

- Primary 9 amps or more; no more than 125% of rated current.
- Primary 2 to 9 amps; no more than 167% of rated current.
- Primary less than 2 amps; no more than 300% of rated current for power circuits.
no more than 500% of rated current for control circuits.

This method is considered less desirable as start-up inrush to the transformer can frequently surpass the current rating of the device and result in nuisance interruptions.

Option 2

The second option is to install overcurrent devices in both the primary and secondary circuits of the transformer. In this option, the secondary device must be rated no more than 125% of rated current of the transformer and the primary no more than 250%. NEC permits 300% overcurrent on the primary for this option).

In both options listed, it is recommended that **time delay** fuses be considered to avoid unnecessary interruptions.



References:

*UL 508, 32.7
UL 845, 11.16 and 11.17
NEC 430-72 (c) exception #2
NEC 450-3 (b) 1 and 2
CEC Part I, 26-256*



THIS INFORMATION PROVIDED BY AUTOMATIONDIRECT.COM TECHNICAL SUPPORT IS PROVIDED "AS IS" WITHOUT A GUARANTEE OF ANY KIND.

These documents are provided by our technical support department to assist others. We do not guarantee that the data is suitable for your particular application, nor do we assume any responsibility for them in your application.

UL AND CSA (NORTH AMERICAN) STANDARDS

Primary (UL and CSA)

To assist in the selection of fuses, the following chart recommends the maximum primary fuse rating, in amperes. The first number shown is the maximum overcurrent protection when the primary current is less than 2 amps and the overcurrent protection device is rated for 300%. The second number shown (in brackets) is recommended when the primary is less than 2 amps and the overcurrent device is to be rated at 500% of rated current. Where only one number is indicated, the primary is 2 amps or more and one rating of over current protection is shown as optimal. Choose the next higher fuse rating if these numbers do not correspond with standard fuse selections.

Prf. VcIt	VA RATING																
	25	50	75	100	150	200	250	300	350	500	750	1000	1500	2000	3000	5000	7500
115 (1)	6/10 (2)	1-1/4 (3-2/10)	1-5/10 (4)	2-1/2 (6-1/4)	3-1/2 (8)	5	4	5	5	5	10	15	20	25	-	-	-
120 (1)	6/10 (2)	1-1/4 (3)	1-5/10 (4)	2-1/4 (6-1/4)	3-1/2 (8)	5	4	5	5	5	10	15	15	20	-	-	-
200 (6/10)	3/10 (1-1/4)	3/4 (1-5/10)	1-1/8 (2-1/2)	1-1/2 (3-1/2)	2-1/4 (5)	3 (6-1/4)	3-1/2 (7-1/2)	4-1/2 (8)	5	4-1/2	7	9	15	15	20	-	-
208 (6/10)	3/10 (1-1/8)	6/10 (1-5/10)	1 (2-1/4)	1-4/10 (3-1/2)	2 (4-1/2)	2-5/10 (6)	3-1/2 (7)	4 (8)	5	4	6	8	12	15	20	30	-
220 (1/2)	3/10 (1-1/8)	6/10 (1-5/10)	1 (2-1/4)	1-1/4 (3-2/10)	2 (4-1/2)	2-1/2 (5-5/10)	3-2/10 (6-1/4)	4 (7-1/2)	4-1/2	4	6	8	12	15	20	30	-
230 (1/2)	3/10 (1)	6/10 (1-5/10)	5/10 (2)	1-1/4 (3-2/10)	1-5/10 (4)	2-1/2 (5)	3-2/10 (6-1/4)	3-1/2 (7-1/2)	4-1/2	4	6	8	10	15	20	30	-
240 (1/2)	3/10 (1)	6/10 (1-1/2)	5/10 (2)	1-1/4 (3)	1-5/10 (4)	2-1/4 (5)	3 (6-1/4)	3-1/2 (7)	4	3-1/2	5	7	10	15	15	30	-
277 (4/10)	1/4 (5/10)	1/2 (1-1/4)	5/10 (1-5/10)	1 (2-1/2)	1-5/10 (3-1/2)	2 (4-1/2)	2-1/2 (5)	3-2/10 (6-1/4)	3-1/2 (8)	5	5	6	9	12	15	25	-
347 (4/10)	1/4 (5/10)	1/2 (1-1/4)	5/10 (1-5/10)	1 (2-1/2)	1-5/10 (3-1/2)	2 (4-1/2)	2-1/2 (5)	3-2/10 (6-1/4)	3-1/2 (8)	5	6-1/4	5	7-1/2	10	15	20	30
380 (3/10)	3/16 (6/10)	3/10 (5/10)	1/2 (1-1/4)	3/4 (1-5/10)	1-1/8 (2-1/2)	1-1/2 (3-2/10)	1-5/10 (3-1/2)	2-1/4 (4-1/2)	2-1/2 (6-1/4)	3-1/2 (8)	5-5/10 (9)	4-1/2	6-1/4	9	15	20	25
400 (3/10)	3/16 (6/10)	3/10 (5/10)	1/2 (1-1/4)	3/4 (1-5/10)	1-1/8 (2-1/2)	1-1/2 (3)	1-5/10 (3-1/2)	2-1/4 (4)	2-1/2 (6-1/4)	3-1/2 (8)	5-5/10 (9)	4-1/2	6-1/4	9	12	15	20
416 (3/10)	15/100 (6/10)	3/10 (5/10)	1/2 (1-1/8)	5/10 (1-5/10)	1 (2-1/4)	1-4/10 (3)	1-5/10 (3-1/2)	2 (4)	2-1/2 (6)	3-1/2 (8)	5	4	6	8	12	15	20
440 (1/4)	15/100 (1/2)	3/10 (5/10)	1/2 (1-1/8)	5/10 (1-5/10)	1 (2-1/4)	1-1/4 (2-5/10)	1-5/10 (3-2/10)	2 (3-1/2)	2-1/4 (5-5/10)	3-2/10 (8)	5	4	6	8	12	15	20
460 (1/4)	15/100 (1/2)	3/10 (5/10)	4/10 (1)	5/10 (1-5/10)	5/10 (2)	1-1/4 (2-1/2)	1-5/10 (3-2/10)	1-5/10 (3-1/2)	2-1/4 (5)	3-2/10 (8)	4-1/2	3-1/2	6	8	12	15	20
480 (1/4)	15/100 (1/2)	3/10 (3/4)	4/10 (1)	5/10 (1-1/2)	5/10 (2)	1-1/4 (2-1/2)	1-1/2 (3)	1-5/10 (3-1/2)	2 (5)	3 (7-1/2)	4-1/2	3-1/2	5	7	10	15	20
550 (2/10)	1/8 (4/10)	1/4 (6/10)	4/10 (5/10)	1/2 (1-1/4)	5/10 (1-5/10)	1 (2-1/4)	1-1/4 (2-1/2)	1-5/10 (3)	1-5/10 (4-1/2)	2-1/2 (6-1/4)	4	5	4-1/2	6	9	15	15
575 (2/10)	1/8 (4/10)	1/4 (6/10)	3/10 (5/10)	1/2 (1-1/4)	3/4 (1-5/10)	1 (2)	1-1/4 (2-1/2)	1-1/2 (3)	1-5/10 (4)	2-1/2 (6-1/4)	3-1/2	5	4-1/2	6	9	15	15
600 (2/10)	1/8 (4/10)	2/10 (6/10)	3/10 (5/10)	1/2 (1-1/4)	3/4 (1-5/10)	5/10 (2)	1-1/4 (2-1/2)	1-1/2 (2-5/10)	1-5/10 (4)	2-1/4 (6-1/4)	3-1/2	5	4	6	9	15	15



THIS INFORMATION PROVIDED BY AUTOMATIONDIRECT.COM TECHNICAL SUPPORT IS PROVIDED "AS IS" WITHOUT A GUARANTEE OF ANY KIND.

These documents are provided by our technical support department to assist others. We do not guarantee that the data is suitable for your particular application, nor do we assume any responsibility for them in your application.

Secondary

The overcurrent protection listed below, in amperes, is 125% of the rated current of the transformer. Choose the next higher fuse rating if these numbers do not correspond with standard fuse selections.

Sec. Voltage	VA RATING															
	25	50	75	100	150	200	250	300	350	500	750	1000	1500	2000	3000	5000
12	3-1/2	7	10	15	20	30	-	-	-	-	-	-	-	-	-	-
24	1-6/10	3-2/10	5	6-1/4	10	12	15	20	20	30	-	-	-	-	-	-
90	4/10	8/10	1-1/4	1-8/10	2-1/2	3-1/2	4-1/2	5	6-1/4	9	12	15	30	30	-	-
95	4/10	8/10	1-1/4	1-6/10	2-1/2	3-1/2	4	5	6	8	12	15	20	30	-	-
100	4/10	8/10	1-1/4	1-6/10	2-1/2	3-2/10	4	5	5-6/10	8	12	15	20	30	-	-
110	3/10	3/4	1-1/8	1-1/2	2-1/4	3	3-1/2	4-1/2	5	7-1/2	10	15	20	30	-	-
115	3/10	6/10	1	1-4/10	2	2-8/10	3-1/2	4	5	7	10	15	20	30	-	-
120	3/10	6/10	1	1-1/4	2	2-1/2	3-2/10	4	4-1/2	6-1/4	10	15	20	20	-	-
220	15/100	3/10	1/2	3/4	1-1/8	1-1/2	1-8/10	2-1/4	2-1/2	3-1/2	5-6/10	7	9	15	20	30
230	15/100	3/10	1/2	6/10	1	1-4/10	1-8/10	2	2-1/2	3-1/2	5	7	8	15	20	30
240	15/100	3/10	1/2	6/10	1	1-1/4	1-6/10	2	2-1/4	3-2/10	5	7	8	12	20	30

IEC (EUROPEAN) STANDARDS

IEC (European) Standards are very different from UL (North American) standards including fuses and fuse selection guidelines. As the electrical characteristics of these fuses are different, UL and IEC rated fuses are **NOT interchangeable**. Of significance is the time current characteristics. Fuses built to North American standards **DO NOT MEET** European Standards.

Unlike North American standards whereby overcurrent protection is to be 125% of the rated current of the transformer (25% derated), **no derating** is required for IEC Fusing applications.

Primary (IEC)

Pri. Volt	MAXIMUM RECOMMENDED IEC FUSE RATING											
	25VA	50VA	75VA	100VA	150VA	200VA	250VA	300VA	350VA	500VA	750VA	1000VA
230V	0.11 A	0.22 A	0.33 A	0.43 A	0.03 A	0.87 A	1.09 A	1.30 A	1.52 A	2.17 A	3.26 A	4.35 A
240V	0.10 A	0.21 A	0.31 A	0.42 A	0.03 A	0.83 A	1.04 A	1.25 A	1.46 A	2.08 A	3.13 A	4.17 A
115V	0.31 A	0.57 A	0.78 A	1.10 A	1.57 A	1.98 A	2.50 A	2.92 A	3.44 A	5.01 A	7.25 A	9.44 A
120V	0.30 A	0.55 A	0.75 A	1.05 A	1.50 A	1.90 A	2.40 A	2.80 A	3.30 A	4.80 A	6.95 A	9.05 A
200V	0.18 A	0.33 A	0.45 A	0.63 A	0.90 A	1.14 A	1.44 A	1.68 A	1.98 A	2.88 A	4.17 A	5.43 A
208V	0.17 A	0.32 A	0.43 A	0.61 A	0.87 A	1.10 A	1.38 A	1.62 A	1.90 A	2.77 A	4.01 A	5.22 A
220V	0.16 A	0.30 A	0.41 A	0.57 A	0.82 A	1.04 A	1.31 A	1.53 A	1.80 A	2.62 A	3.79 A	4.94 A
230V	0.16 A	0.29 A	0.39 A	0.55 A	0.78 A	0.99 A	1.25 A	1.46 A	1.72 A	2.50 A	3.63 A	4.72 A
240V	0.15 A	0.28 A	0.38 A	0.53 A	0.75 A	0.95 A	1.20 A	1.40 A	1.65 A	2.40 A	3.47 A	4.53 A
277V	0.13 A	0.24 A	0.32 A	0.45 A	0.65 A	0.82 A	1.04 A	1.21 A	1.43 A	2.08 A	3.01 A	3.92 A
347V	0.10 A	0.19 A	0.26 A	0.36 A	0.52 A	0.66 A	0.83 A	0.97 A	1.14 A	1.66 A	2.40 A	3.13 A
380V	0.09 A	0.17 A	0.24 A	0.33 A	0.47 A	0.60 A	0.76 A	0.88 A	1.04 A	1.52 A	2.19 A	2.86 A
400V	0.09 A	0.17 A	0.23 A	0.32 A	0.45 A	0.57 A	0.72 A	0.84 A	0.99 A	1.44 A	2.08 A	2.71 A
416V	0.09 A	0.16 A	0.22 A	0.30 A	0.43 A	0.55 A	0.69 A	0.81 A	0.95 A	1.38 A	2.00 A	2.61 A
440V	0.08 A	0.15 A	0.20 A	0.29 A	0.41 A	0.52 A	0.65 A	0.76 A	0.90 A	1.31 A	1.90 A	2.47 A
460V	0.08 A	0.14 A	0.20 A	0.27 A	0.39 A	0.50 A	0.63 A	0.73 A	0.86 A	1.25 A	1.81 A	2.36 A
480V	0.07 A	0.14 A	0.19 A	0.26 A	0.38 A	0.47 A	0.60 A	0.70 A	0.82 A	1.20 A	1.74 A	2.26 A
550V	0.07 A	0.12 A	0.16 A	0.23 A	0.33 A	0.41 A	0.52 A	0.61 A	0.72 A	1.05 A	1.52 A	1.97 A
575V	0.06 A	0.11 A	0.16 A	0.22 A	0.31 A	0.40 A	0.50 A	0.58 A	0.69 A	1.00 A	1.45 A	1.89 A
600V	0.06 A	0.11 A	0.15 A	0.21 A	0.30 A	0.38 A	0.48 A	0.56 A	0.66 A	0.96 A	1.39 A	1.81 A

Note: IEC publication 127, Sheet I, Type T fuses are recommended.



THIS INFORMATION PROVIDED BY AUTOMATIONDIRECT.COM TECHNICAL SUPPORT IS PROVIDED "AS IS" WITHOUT A GUARANTEE OF ANY KIND.

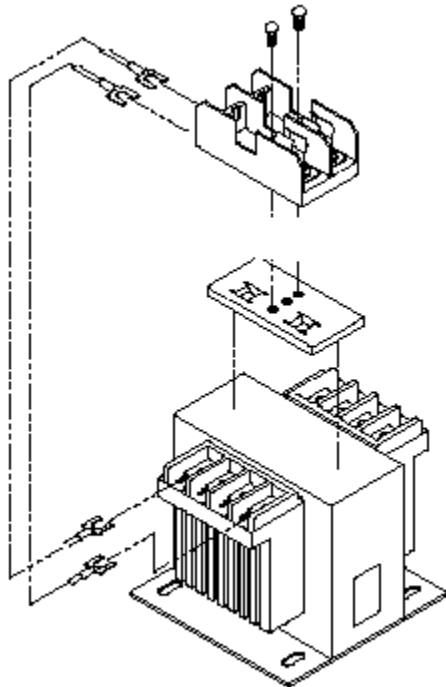
These documents are provided by our technical support department to assist others. We do not guarantee that the data is suitable for your particular application, nor do we assume any responsibility for them in your application.

Secondary (IEC)

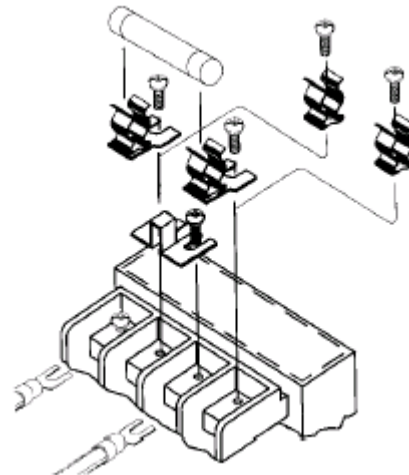
Sec. Volt	MAXIMUM RECOMMENDED IEC FUSE RATING											
	25VA	50VA	75VA	100VA	150VA	200VA	250VA	300VA	350VA	500VA	750VA	1000VA
12 V	2.08 A	4.17 A	6.25 A	8.33 A	9.00 A	16.67 A	20.83 A	25.00 A	29.17 A	41.67 A	62.50 A	83.33 A
24 V	1.04 A	2.08 A	3.13 A	4.17 A	1.08 A	8.33 A	10.42 A	12.50 A	14.58 A	20.83 A	31.25 A	41.67 A
90 V	0.28 A	0.56 A	0.83 A	1.11 A	0.49 A	2.22 A	2.78 A	3.33 A	3.89 A	5.56 A	8.33 A	11.11 A
95 V	0.26 A	0.53 A	0.79 A	1.05 A	0.23 A	2.11 A	2.63 A	3.16 A	3.68 A	5.26 A	7.89 A	10.53 A
100 V	0.25 A	0.50 A	0.75 A	1.00 A	0.12 A	2.00 A	2.50 A	3.00 A	3.50 A	5.00 A	7.50 A	10.00 A
110 V	0.23 A	0.45 A	0.68 A	0.91 A	0.06 A	1.82 A	2.27 A	2.73 A	3.18 A	4.55 A	6.82 A	9.09 A
115 V	0.22 A	0.43 A	0.65 A	0.87 A	0.04 A	1.74 A	2.17 A	2.61 A	3.04 A	4.35 A	6.52 A	8.70 A
120 V	0.21 A	0.42 A	0.63 A	0.83 A	0.02 A	1.67 A	2.08 A	2.50 A	2.92 A	4.17 A	6.25 A	8.33 A
220 V	0.11 A	0.23 A	0.34 A	0.45 A	0.02 A	0.91 A	1.14 A	1.36 A	1.59 A	2.27 A	3.41 A	4.55 A
230 V	0.11 A	0.22 A	0.33 A	0.43 A	0.03 A	0.87 A	1.09 A	1.30 A	1.52 A	2.17 A	3.26 A	4.35 A
240 V	0.10 A	0.21 A	0.31 A	0.42 A	0.03 A	0.83 A	1.04 A	1.25 A	1.46 A	2.08 A	3.13 A	4.17 A

Note: IEC publication 127, Sheet III, Type M fuses are recommended.

Primary Fuse Holder



Secondary Fuse Holder



Technical

Assistance: If you have questions regarding this Application Note, please contact us at 770-844-4200 for further assistance