Product Group: CPT Series Transformers
Number: AN-CPT-002

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Title: CPT Transformer Selection Guide

Summary: This application note will show how to select a transformer to your application.

In this application note we will assume the application has a 240VAC source voltage, a 120VAC load voltage, and a total amperage draw of 1.5A.

We will take the following steps when selecting a transformer:

I. Determine Voltage Requirements and Group
II. Determine VA
III. Select a Transformer

I: Determine Voltage Requirements and Group

A. Determine Primary Voltage

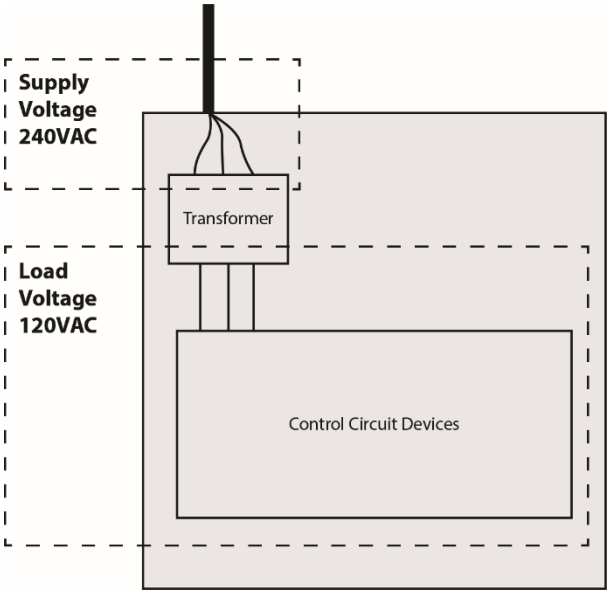
Primary Voltage is the voltage at the power source. Some transformers may have more than one available primary voltage.

In this example our source voltage is 240VAC.

B. Determine Secondary Voltage

Secondary Voltage is the voltage required by the load. Some transformers may have more than one available secondary voltage.

In this example our load voltage is 120VAC.



C. Select Transformer Group

Transformers are organized by groups. All transformers within the same group will have the same Primary and Secondary voltages.

Certain Primary voltages will produce specific Secondary voltages on the transformer. Use the table below to see Primary voltages and their corresponding Secondary voltages.

Given our voltage requirements we will select a Group J transformer because it offers a 240VAC primary and a 120VAC secondary.

Group	Primary	Secondary
Group A	220x440	110
	230x460	115
	240x480	120
Group B	240x480	24
Group C	120x240	24
Group E	550	110
	575	115
	600	120
Group F	208/277	120
Group G	208/230/460	115
Group I	380/400/415	110x220
Group J	200/220/440	23/110
	208/230/460	24/115
	240/480	25/120
Group K	240x480	120x240

In transformer voltage specifications, a "/" separates voltages that can be applied to or obtained from the same winding(s). A "x" separates voltages that can be applied to or obtained from coils connected in parallel or series and will feature terminal jumpers to select the voltage.

II: Determine VA

Transformers are sized by VA of the load. There are two types of VA, Sealed and Inrush. Per NEC codes, a transformer must be sized to accommodate both the total Inrush VA, which occurs when an inductive load is switched on, and the Sealed VA. This combination is called Application Inrush VA and can be calculated with the following formula:

$$\text{Application Inrush VA} = \sqrt{(\text{Total Inrush VA})^2 + (\text{Sealed VA})^2}$$

Sealed VA of the load can be calculated with the following formula:

$$\text{Volts} \times \text{Amps} = \text{Sealed VA}$$

For this example, our load consumes 1.5 amps and needs a voltage of 120VAC. Our Sealed VA is 180.

$$120 \times 1.5 = 180\text{VA}$$

Total inrush VA is the combined inrush VA of every component in the system if they were to be activated at the same time. Component inrush VA must be obtained from the component manufacturer. Resistive components such as incandescent lights or heating elements do not have inrush currents and only contribute to Sealed VA.

The coils in our load have an inrush of 70VA. There are 15 coils in this load.

We can now fill in our formula:

$$\sqrt{(70 \times 15)^2 + (180)^2} = 1065.3\text{VA}$$

Our Application Inrush VA is 1065.3VA.

III: Select a Transformer

Transformer inrush capabilities are defined in the following table. There are three columns with ratings dependent on the voltage at the primary.

NEMA Standard ICS 2-110 requires that a contactor successfully close at 85% of its coil rated voltage. However, this is an ideal specification and assumes the primary voltage source is always the nominal voltage (i.e. 0% variation from nominal). This does not consider the normal voltage variations in the power source or losses within the transformer windings.

If the primary voltage is stable and does not vary by more than 5% from nominal, use the 90% Secondary Voltage column.

If primary voltage varies between 5% and 10% from nominal, use the 95% Secondary Voltage column.

Transformer VA Rating	95% Secondary Voltage	90% Secondary Voltage	85% Secondary Voltage
25[1]	100	130	150
50[1]	170	200	240
75[1]	310	410	540
100[1]	370	540	730
150[2]	780	930	1150
200[2]	810	1150	1450
250[2]	1400	1900	2300
300[2]	1900	2700	3850
350[2]	3100	3650	4800
500[2]	4000	5300	7000
750[2]	8300	11000	14000
1000[2]	15000	21000	27000
1000[3]	9000	13000	18500
1500[3]	10500	15000	20500
2000[3]	17000	25500	34000
3000[3]	24000	36000	47500
5000[3]	55000	92500	115000

[1] 105°C Insulation [2] 130°C Insulation [3] 180°C Insulation

In our example, the primary input power is within 5% of nominal. In the 90% column find the first value that exceeds 1065.3VA. According to the chart, we should use a 200VA transformer because it has an inrush capability of 1150VA at 90% Secondary Voltage.

100[1]	370	540	730
~~150[2]~~	~~780~~	~~930~~	~~1150~~
200[2]	810	1150	1450
~~250[2]~~	~~1400~~	~~1900~~	~~2300~~

We will use FMX transformer CPT-0200J-1F because it is a Group J transformer that can supply 200VA.

Group J transformers also have a 25V secondary output which can be used at the same time as the 120V output. However, VA and inrush must be calculated in total for both the 120V and 25V output if they are to be used at the same time.