

ELECTRICAL DISTRIBUTION

Transformers

General Purpose Transformer Selection Guide

Follow these general guidelines when selecting a transformer.

- The National Electrical Code (NEC) Sec. 450-3 addresses the primary and secondary windings of transformers (600 volts or less). Primary fusing should not exceed 250% of full load amps; secondary fusing should not exceed 125% of full load amps
- To achieve maximum transformer efficiency, maintain average transformer loading between 60% and 80%
- Temperature Rise represents the number of degrees Celsius at which a transformer is designed to operate above 40°C ambient temp.
- The 3 phases (legs) of a delta transformer should be kept balanced within 5% of each other for maximum efficiency. Unbalanced loads can severely de-rate or even overload a transformer

1-Phase Transformer Selection

How to Select a 1-Phase Transformer For Resistive Loads	Example	Formula	Result
1. Determine the secondary voltage: 120 or 240.	240V	—	—
2. Determine the running amperage of your load.	10A	—	—
3a. Multiply voltage x amperage to determine VA.	—	240 x 10	2400
3b. Divide result of "3a" by 1000 to determine = kVA (kilo volt amp).	—	2400 / 1000	2.4 KVA
3c. Divide result of "3b" by transformer kVA to determine load percentage.	3 kVA	2.4 / 3	0.8 or 80%
How to Select a 1-Phase Transformer For Motor Loads	Example	Formula	Result
1. Determine the secondary voltage: 120 or 240.	240V	—	—
2. Determine the running amperage of your load.	10A	—	—
3a. Multiply voltage x amperage to determine VA.	—	240 x 10	2400
3b. Divide the result of "3a" by the PF (power factor) of motor.	0.85 PF	2400 / 0.85	2824
3c. Take the result of "3b" and multiply by the motor SF (service factor).	1.25 SF	2824 x 1.25	3530
3d. Divide result of "3c" by 1000 to determine kVA (kilo volt amp).	—	3530 / 1000	3.53 kVA
3e. Divide result of "3d" by transformer kVA to determine load percentage.	5 kVA	3.53 / 5	0.7 or 70%

3-Phase Transformer Selection

How to Select a 3-Phase Transformer For Resistive Loads	Example	Formula	Result
1. Determine the secondary voltage: 208 or 240.	240V	—	—
2. Determine the running amperage of your load.	80A	—	—
3a. Multiply voltage x amperage x 1.73 (square root of 3) to determine VA.	—	240 x 80 x 1.73	33,216
3b. Divide result of "A" by 1000 this = kVA (kilo volt amp).	—	33,216 / 1000	33.2 kVA
3c. Divide result of "B" by transformer kVA to determine load percentage.	45 kVA	33.2 / 45	0.73 or 73%
How to Select a 3-Phase Transformer For Motor Loads	Example	Formula	Result
1. Determine the Secondary voltage: 208 or 240.	240V	—	—
2. Determine the running amperage of your load .	80A	—	—
3a. Multiply voltage x amperage x 1.73 (square root of 3) to determine VA.	—	240 x 80 x 1.73	33,216
3b. Divide the result of "3a" by the PF (power factor) of motor.	0.85 PF	33,216 / 0.85	39,078
3c. Take the result of "3b" and multiply by the motor SF (service factor).	1.25 SF	39,078 x 1.25	48,847
3d. Divide result of "3a" by 1000 to determine kVA (kilo volt amp).	—	48,847 / 1000	48.8 kVA
3e. Divide result of "3b" by transformer kVA to determine load percentage.	75 kVA	48.8 / 75	0.65 or 65%

Control Power Transformer Selection Guide

- NEC Sec. 450-3 addresses primary and secondary control circuit protection. For motor control (MCCs) applications with primary current rated 2 amps or less, NEC Sec. 430-72(b) allows primary fuses to be sized at or less than 500% of rated primary current.

VA	95% Secondary Voltage	90% Secondary Voltage	85% Secondary Voltage
Inrush VA at 30% Power Factor			
25	—	—	—
50	170	238	308
75	236	353	471
100	298	447	599
150	590	805	1023
200	1065	1538	2163
250	1290	1949	2680
300	1237	1775	2299
350	1480	2104	2712
500	1836	2651	3441
750	3482	5042	6564
1000	4244	6345	8388
1500	10,023	14,735	19,304
2000	12,744	19,202	25,450
3000	18,176	28,096	37,797

- 1 Determine inrush and sealed VA of each coil in the control circuit.
- 2 Total the sealed VA of all coils.
- 3 Total the inrush VA of all coils at 100% secondary voltage. Add this value to the total sealed VA present (if any) when inrush occurs.
- 4 Determine secondary voltage.
 - a. If the supply voltage is stable and varies no more than ±5%, refer to the 90% Secondary Voltage column.
 - b. If voltage varies as much as ±10%, use the 95% Secondary Voltage column.
- 5 Using the regulation chart, select a transformer with both:
 - a. A continuous VA rating equal to or greater than the value obtained in Step 2.
 - b. A maximum inrush VA equal to or greater than the value obtained in Step 3.

Buck-Boost Transformer Selection

For 1-phase and open-delta 3-phase circuits (3 hot wires with no neutral, used in motor applications requiring 2 transformers).

- 1 Determine difference in voltage required (pick 1: 12, 16, 24 or 32).
 - 2 Multiply by circuit amperage = subtotal.
 - 3 Multiply subtotal by a safety factor of 1.2 = total VA.
- Example: 24V x 20A x 1.2 = 576VA
 Recommended transformer 750VA or 0.75kVA (No. 1H279).