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How to Size and Select a Transformer

1. Go to “How to size a transformer” on page 1.3 to determine the proper KVA based on the required load voltage, line voltage and load current.

   For an example let’s use Load voltage = 480 volts, Load current, = 80 Amps and Line voltage = 208 volts. Using the calculation yields a 66 KVA transformer.

2. Go to “How to select a transformer” on page 1.6 and choose the appropriate style of transformer for the application from the listing.

   For example if you need a transformer for a three phase industrial application you can choose the Three Phase Ventilated style.

3. Go to the appropriate section in the catalog.

   For this example, section 5.

4. Go to the chapter and review the chapter table of contents and find the page for your voltage group.

   For 208 volt primary to 480 volt secondary, 150 degree temperature rise units are on page 5.4.

5. On the Selection chart find the voltage group heading, 208 V- 480Y/277 – Aluminum windings, and select a line with a KVA equal to or larger that the KVA you calculated for your application in the first column of the chart, 75 KVA. Directly to the right is the catalog number for the transformer, 423-7231-000. Check the rest of the information in the row for the dimensional information, shipping weight, 565 lbs, wiring diagram number, T208D, and options such as weather shield, 423-7008-075, and mounting brackets, 223-7008-075.

How to size a transformer

- **Transformer size is determined by the KVA of the load.**
- **Load voltage, or secondary voltage, is the voltage needed to operate the load.**
- **Line voltage, or primary voltage, is the voltage from the source.**
- **Single-Phase has two lines of AC power.**
- **Three-Phase has three lines of AC power, each line 120 degrees out of phase with the other two.**
- **KVA is kilovolt ampere or thousand volt amperes. This is how transformers are rated.**

NOTE: If motors are started more than once per hour, increase minimum transformer KVA by 20%.

To determine the size of the transformer you need, use this handy formula, or refer to the Technical Reference Section.

Determine the Load Voltage

Load Voltage = _____

Determine the Load Current (Amps)

Load Current/Amps = _____

Determine the Line Voltage

Line Voltage = _____

Determine if your application is single-phase or three-phase, and use the corresponding formula in the column at right.

The KVA of the transformer should be equal to or greater than the KVA of the load to handle present requirements and to account for future expansion.

Or, use our Product Specifier at **www.JeffersonElectric.com** for quick and easy transformer selection.

Transformer Selection Formulas

Single-Phase Transformers

$$\frac{\text{Volts x Amps}}{1000} = \_\_\_\_\_ \text{ KVA}$$

Plug your numbers into the formula:

$$\frac{\text{Volts} \quad \text{x Amps}}{1000} = \_\_\_\_\_ \text{ KVA}$$

Three-Phase Transformers

$$\frac{\text{Volts x Amps x 1.732}}{1000} = \_\_\_\_\_ \text{ KVA}$$

Plug your numbers into the formula:

$$\frac{\text{Volts} \quad \text{x Amps} \quad \text{x 1.732}}{1000} = \_\_\_\_ \text{ KVA}$$

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Full Load Currents (In Amperes) For Single-Phase Transformers
Voltage (Line-to-Line)

KVA Rating	120 V	208 V	240 V	277 V	480 V	600 V
.050	.42	.24	.21	.18	.10	.08
.075	.63	.36	.31	.27	.16	.13
.100	.83	.48	.42	.36	.21	.17
.150	1.25	.72	.63	.54	.31	.25
.250	2.08	1.20	1.04	.90	.52	.42
.500	4.16	2.40	2.08	1.8	1.04	.83
.750	6.25	3.60	3.13	2.7	1.56	1.25
1	8.3	4.8	4.2	3.6	2.1	1.7
1.5	12.5	7.2	6.2	5.4	3.1	2.5
2	16.7	9.6	8.3	7.2	4.2	3.3
3	25	14.4	12.5	10.8	6.2	5.0
5	41.7	24	20.8	18.0	10.4	8.3
7.5	62.5	36.1	31.2	27	15.6	12.5
10	83.4	48	41.6	36	20.8	16.7
15	125	72	62.5	54	31.2	25
25	208	120	104	90	52	41.7
37.5	312	180	156	135	78	62.5
50	417	240	208	180	104	83.5
75	625	361	312	270	156	125
100	834	480	416	361	208	167
167	1396	805	698	602	349	279

Full Load Currents (In Amperes) For Three-Phase Transformers
Voltage (Line-to-Line)

KVA Rating	208 V	240 V	480 V	600 V
3	8.3	7.2	3.6	2.9
6	16.6	14.4	7.2	5.8
9	25	21.6	10.8	8.7
15	41.6	36.0	18.0	14.4
30	83	72	36	29
45	125	108	54	43
75	208	180	90	72
112.5	312	270	135	108
150	416	360	180	144
225	625	542	271	217
300	830	720	360	290
500	1390	1200	600	480
750	2080	1800	900	720

For Other Single-Phase KVA Ratings or Voltages

$$\text{Amperes} = \frac{\text{KVA x 1000}}{\text{Volts}}$$

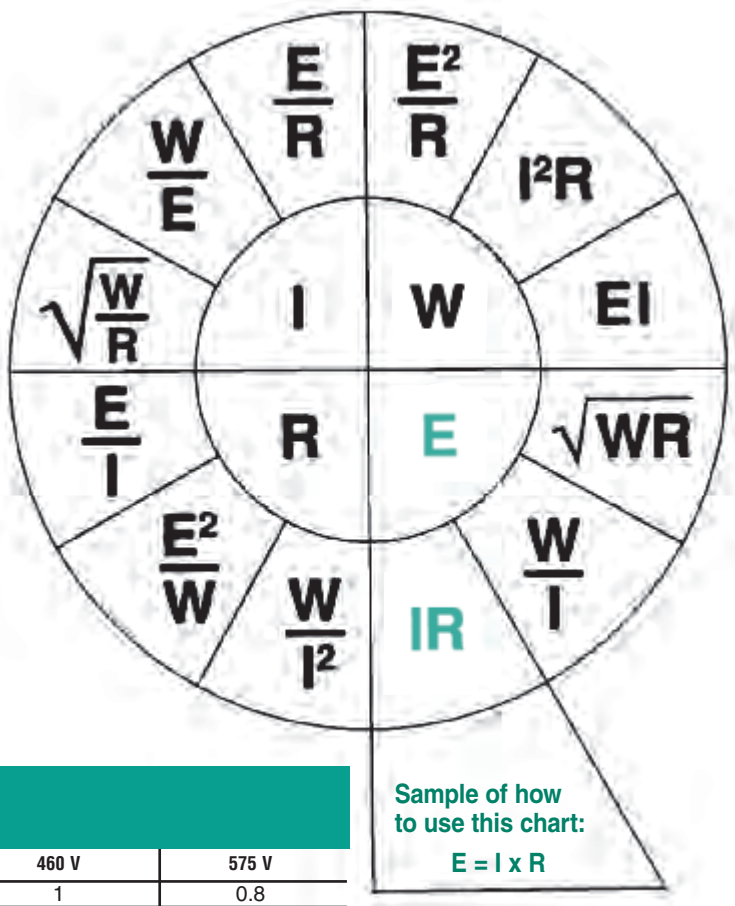
For Other Three-Phase KVA Ratings or Voltages

$$\text{Amperes} = \frac{\text{KVA x 1000}}{\text{Volts x 1.732}}$$

Source: EASA Handbook

Single-Phase AC Motors
Full Load Currents (Amperes)

HP	115 V	230 V
1/6	4.4	2.2
1/4	5.8	2.9
1/3	7.2	3.6
1/2	9.8	4.9
3/4	13.8	6.9
1	16	8
1 1/2	20	10
2	24	12
3	34	17
5	56	29
7 1/2	80	40
10	100	50



Sample of how to use this chart:

E = I x R

Electrical Relationships

Three-Phase AC Motors
Full Load Currents (Amperes)

Rating	115 V	230 V	460 V	575 V
1/2	4	2	1	0.8
3/4	5.6	2.8	1.4	1.1
1	7.2	3.6	1.8	1.4
1 1/2	10.4	5.2	2.6	2.1
2	13.6	6.8	3.4	2.7
3		9.6	4.8	3.9
5		15.2	7.6	6.1
7 1/2		22	11	9
10		28	14	11
15		42	21	17
20		54	27	22
25		68	34	27
30		80	40	32
40		104	52	41
50		130	65	52
60		154	77	62
75		192	96	77
100		248	124	99
125		312	156	125
150		360	180	144
200		480	240	192

NOTE: If motors are started more than once per hour, increase minimum transformer KVA by 20%.

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How to Select a Transformer

Single Phase Encapsulated - 50 VA to 25 KVA - Section 2
For all general loads, indoors or out, including lighting, industrial and commercial applications. Units may be banked for three phase operation

Single Phase Ventilated – 15 to 100 KVA – Section 3
For all general single phase loads, indoors or out, including lighting, industrial and commercial applications

Three Phase Encapsulated – 3 to 75 KVA – Section 4
For all general three phase loads, indoors or out, including lighting, industrial and commercial applications

Three Phase Ventilated – 15 to 1000 KVA – Section 5
For all general three phase loads, indoors or out, including lighting, industrial and commercial applications.

Totally Enclosed Non Ventilated – 15 to 500 KVA – Section 6
Single and three phase designed for use in dirty environments.

Drive Isolation – 3 to 990 KVA – Section 7
For industrial and commercial applications with SCR-controlled adjustable speed motor drives, and AC adjustable frequency or DC drives

Non-Linear Three Phase – 15 to 500 KVA – Section 8
For electronic loads to meet non-linear load demands caused by modern office equipment
For indoor and outdoor applications

Buck-Boost – 50 VA to 10 KVA – Section 9
For correcting voltage line drops, landscape lighting, low voltage lighting, international voltage adaptation and motor applications. Buck-boost transformers do not compensate for fluctuating line voltages.

Industrial Control – 50 to 5000 VA – Section 10
For control panels, conveyor systems, machine tooling equipment, commercial sewing machines, pumping system panels, and commercial air conditioning applications.

Lighting – 100 to 1000 watts – Section 11
For use with submersible fixtures including swimming pools, water fountains, low voltage circuits near water or other shock hazards. These transformers are not submersible.

Custom Designs

Jefferson Electric's engineering team is available to work with you to produce the most efficient and cost effective solution for your specific transformer requirements. Depending on your needs, we offer both modified standards and unique designs.

Modified Standard Transformers

We can take our standard transformer designs and modify them to meet your needs including:

- modified enclosures (shape, dimensions and color)
- input voltages and frequencies (600V and below)
- output voltages (adding more than one, 600V and below)

To request a quote on a modified standard, simply select the model that most closely matches your requirements, copy that page and fax it to us (800-942-5169), along with your desired modifications and estimated order volume. Visit our website for an on-line quote form.

Unique Designs

There are applications where a completely new transformer design is the only viable solution. Our experienced staff will design and produce the transformer that precisely matches your exact specifications, regulatory requirements and internal cost reduction goals.

If you have a dry type transformer requirement that requires a special design, please contact us (phone 800-892-3755 or fax 800-942-5169) to discuss your needs or fill out the "Get A Quote" section on our website www.jeffersonelectric.com.

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Certification and safety requirement marks found on Jefferson products include:

Underwriters Laboratories Listing Mark

Samples of the product have met UL's safety requirements primarily based on UL's own published Standards of Safety.

UL Recognized Component Mark

This mark means that the *component alone* meets the requirements for a limited, specified use.

C-UL Listing Mark

Products with this type of mark have been evaluated to Canadian safety requirements by UL, which may be somewhat different than U.S. safety requirements.

CSA International Mark
(formerly Canadian Standards Association)

This mark may appear alone, or with other qualifiers. If it appears alone, it means that the product is certified for the Canadian market, to the applicable Canadian standards.

Conformité Européene

To market electrical products within the European Union (EU), product conformity and the proper use of the CE mark on machines and control equipment is critical. As a major supplier to global companies serving customers in the EU, Jefferson Electric pays special attention to meeting the EU specification and certification requirements. These global companies need the guarantee of free trade of goods, elimination of trade restrictions and harmonization of technical regulations to sell their products to EU member countries. All Jefferson Electric products that meet or exceed the requirements of these directives are designated by the CE mark.

To request CE certified equivalents for products not already certified, please contact our Technical Support department at 800-892-3755.

ETL Intertek Verified

United States and Canada require general purpose transformers to meet specific energy efficiency standards. Jefferson Electric has contracted with Intertek ETL SEMKO an independant organization to test and certify our products. The ETL logo on our products indicates that the transformer meets the energy efficiency standards as defined by the NEMA TP-1 standard.

Seismic

In order to meet seismic qualifications, products must go through rigorous testing to meet the International Building Code (2006/2009 IBC) and the California Building Code (2007/2010 CBC) requirements. Each test must also be met in accordance with ICC-ES AC156 seismic qualifications.

ABS Qualified

ABS (American Bureau of Shipping) approved for use on marine vessels including off-shore oil rigs.

CSL-3

CSL-3 transformers operate more efficiently than NEMA (TP-1) transformers. Each CSL-3 transformer is designed to have 30% less loss than a TP-1 transformer.