The Transformer Authority

PIONEER TRANSFORMERS: Why us?

Scale

We produce over 100,000 transformers every year. With this high level of production comes buying power, a broad knowledge base and rapid work flow to meet our customers' magnetic needs.

- Purchasing power for economic solutions
- Large engineering staff for quick design turnaround and delivery
- Best delivery of custom options to meet customer deadlines

Pioneer Transformers has a large, constantly expanding product offering, growing with our customers' changing demands.

Highest Standards

Our products are backed by a strict ISO-based quality assurance system. Each unit is thoroughly tested before leaving the plant to ensure proper operation. All products are designed to conform to the appropriate NEMA, ANSI, UL, and CSA standards.

Certifications

Seismic, ABS, UL, CSA, CE, C802

Support

Our application engineers are available toll-free to help customers select the best transformer to meet their needs and assist in answering installation questions.

Customer service representatives are available to assist in placing and tracking orders, expediting shipments and answering order processing questions.

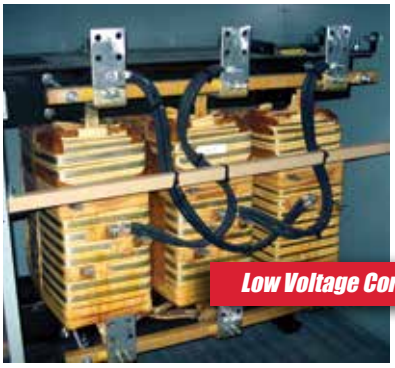
Contact Us

We're ready to help fulfill your transformer needs

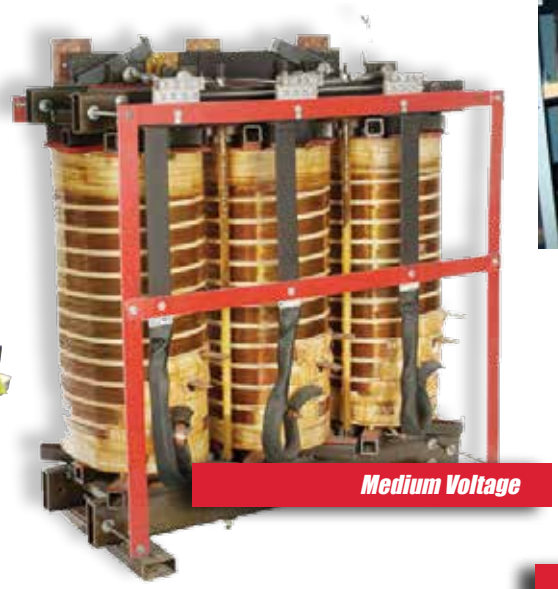
Phone: 800-892-3755

Email: info@jeffersonelectric.com

Website: jeffersonelectric.com



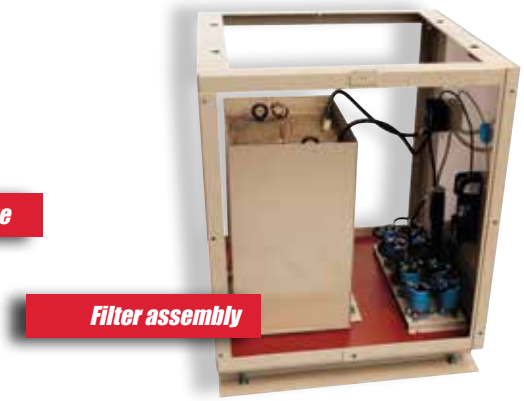
Low Voltage Core & Coil



Medium Voltage



18-Pulse



Filter assembly

3 to 75 kVA



Applications

- For general loads, indoors or out, including lighting, industrial and commercial applications

Specifications

- NEMA3R-rated enclosures
- 60 Hz operation
- Aluminum windings
- 135ºC temperature rise for 3 to 75 kVA
- Encapsulated with electrical grade resin
- Heat-cured ASA-61 gray powder coat finish
- Cores of high quality electrical steel
- Primary taps

Features, Functions, Benefits

- Large connection compartment with knockouts for ease of wiring and installation
- Slotted mounting holes for quick and easy mounting
- Convenient wall mount design with lifting hooks up to 15 kVA
- Many sizes in stock and available for immediate shipment
- Quiet operation for installation flexibility
- Seismic qualification certification for all units

Standards

- Built in accordance with NEMA, ANSI, UL and CSA standards

Options and Accessories

- 50/60 Hz optional
- Other sizes, voltages and temperature rises available
- Copper windings
- CE Marked units available as custom
- Class I Div 2 units available

Approvals

Enclosure Figures

Figure 4

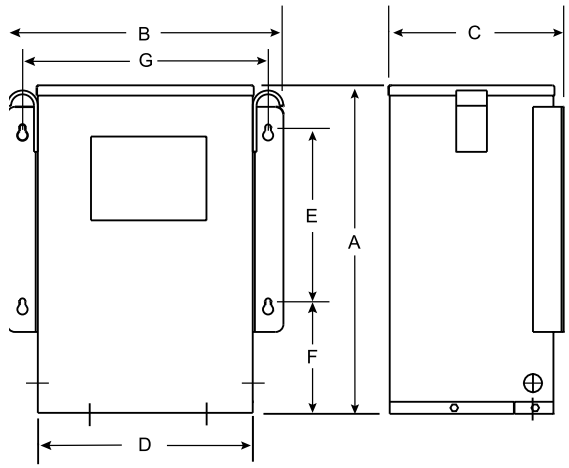
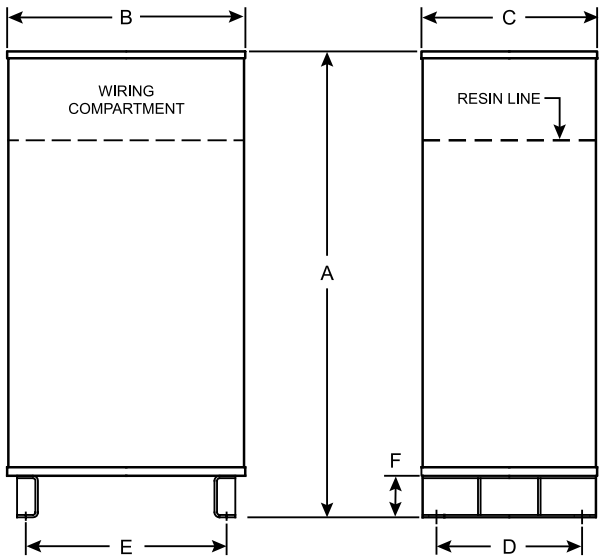


Figure 21



Model Numbers Defined

413-TXXY-ABC

Three-Phase, Encapsulated	
Standard	413
50/60 Hz	513
Type	
Old style	0
Standard	1
Updated style	3
Class I, Div 2	2

kVA Rating / XX		**kVA Rating / XX**	
3.0	10	20	17
5.0	11	25	18
6.0	12	30	19
7.5	13	37.5	20
9.0	14	45	21
10.0	15	50	22
15.0	16	75	23

Primary	**Secondary**	
208	480Y/277	1
240	208Y/120	2
240	480Y/277	3
480	208Y/120	4
480	480Y/277	5
120 Min 600 Max	120 Min 600 Max	6
480	240 Delta	7
480	240 Delta	8
600	Variable	9
Reserved for special items		0

Wiring	
Default	0
Copper	8
Temperature Rise	
135°C Rise	0
115°C Rise	1
70°C Rise	7
80°C Rise	8
95°C Rise	9
Shields	
No shield	0
Shield	5

Three-Phase Encapsulated General Purpose Transformers

135°C Temperature Rise with 25° Ambient • NEMA3R Enclosures • Taps: 2 @ 5% FCBN

kVA	Catalog Number	Enclosure Figure	Height (A) inches	Width (B) inches	Depth (C) inches	(D) inches	(E) inches	(F) inches	(G) inches	Est Ship Wgt	Wiring Diagram
480V — 208Y/120V											
3	413-1104-000	4	13.1	15.1	8.1	12.3	5.3	5.5	13.6	82	T480A
6	413-1124-000	4	13.1	15.1	8.1	12.3	5.3	5.5	13.6	119	T480A
9	413-1144-000	4	15.1	19	9.1	16.1	8.3	5.1	17.5	157	T480A
15	413-1164-000	4	15.1	19	9.1	16.1	8.3	5.1	17.5	228	T480A
30	413-3194-000	21	33	23	9.5	7	20.5	3		875	T480A
45	413-3214-000	21	36	25	11	8.5	21.75	3		980	T480A
75	413-3234-000	21	37	25	12.5	10.5	22.5	3		1100	T480A
480V — 240V											
3	413-1107-000	4	13.1	15.1	8.1	12.3	5.3	5.5	13.6	82	T480B
6	413-1127-000	4	13.1	15.1	8.1	12.3	5.3	5.5	13.6	119	T480B
9	413-1147-000	4	15.1	19	9.1	16.1	8.3	5.1	17.5	157	T480B
15	413-1167-000	4	15.1	19	9.1	16.1	8.3	5.1	17.5	228	T480B
30	413-1197-000	21	33	23	9.5	7	20.5	3		875	T480B
45	413-1217-000	21	36	25	11	8.5	21.75	3		980	T480B
75	413-1237-000	21	37	25	12.5	10.5	22.5	3		1100	T480B
600V — 208Y/120V											
3	413-1109-000	4	13.1	15.1	8.1	12.3	5.3	5.5	13.6	82	T600A
6	413-1129-000	4	13.1	15.1	8.1	12.3	5.3	5.5	13.6	119	T600A
9	413-1149-000	4	15.1	19	9.1	16.1	8.3	5.1	17.5	157	T600A
15	413-1169-000	4	15.1	19	9.1	16.1	8.3	5.1	17.5	228	T600A
30	413-1199-000	21	33	23	9.5	7	20.5	3		875	T600A
45	413-1219-000	21	36	25	11	8.5	21.75	3		980	T600A
75	413-1239-000	21	37	25	12.5	10.5	22.5	3		1100	T600A
600V — 480Y/277V											
3	413-110B-000	4	13.1	15.1	8.1	12.3	5.3	5.5	13.6	82	T600H
6	413-112B-000	4	13.1	15.1	8.1	12.3	5.3	5.5	13.6	119	T600H
9	413-114B-000	4	15.1	19	9.1	16.1	8.3	5.1	17.5	157	T600H
15	413-116B-000	4	15.1	19	9.1	16.1	8.3	5.1	17.5	228	T600H
30	413-119B-000	21	33	23	9.5	7	20.5	3		875	T600H
45	413-121B-000	21	36	25	11	8.5	21.75	3		980	T600H
75	413-123B-000	21	37	25	12.5	10.5	22.5	3		1100	T600H

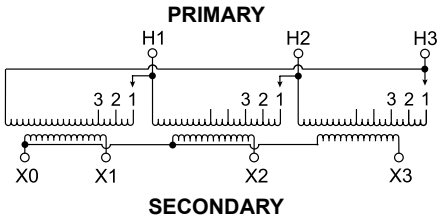
See website for additional kVA, copper windings and temperature options.
Housing dimensions subject to change without notice. Consult website or factory where dimensions are critical.
Use the “Find a Product” tool for detailed specification sheets.
For further information, contact an Application Engineer at 800-892-3755, technical_services@jeffersonelectric.com

Enclosure Figures

T480A Wiring Diagram & Connections

Wiring Diagram

Primary: 480 Volts Delta
Secondary: 208Y/120 Volts



Connections

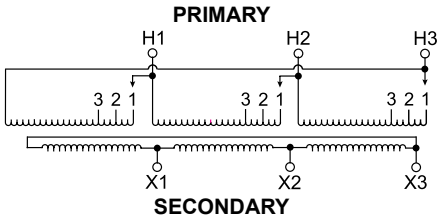
Primary Volts	On Each Coil Jumper Taps To	Primary Lines Connect To
480	1	H1, H2, H3
456	2	H1, H2, H3
432	3	H1, H2, H3

Secondary Volts	Secondary Lines Connect To
208	X1, X2, X3
120 1 Phase	Between X0 and X1 or X2 or X3

T480B Wiring Diagram & Connections

Wiring Diagram

Primary: 480 Volts Delta
Secondary: 240 Volts Delta



Connections

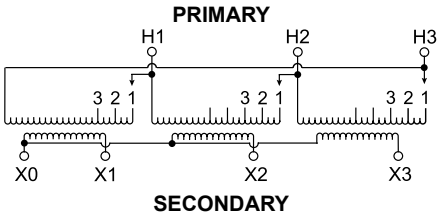
Primary Volts	On Each Coil Jumper Taps To	Primary Lines Connect To
480	1	H1, H2, H3
456	2	H1, H2, H3
432	3	H1, H2, H3

Secondary Volts	Secondary Lines Connect To
240	X1, X2, X3

T600A Wiring Diagram & Connections

Wiring Diagram

Primary: 600 Volts Delta
Secondary: 208Y/120 Volts



Connections

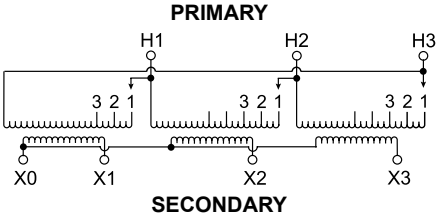
Primary Volts	On Each Coil Jumper Taps To	Primary Lines Connect To
600	1	H1, H2, H3
570	2	H1, H2, H3
540	3	H1, H2, H3

Secondary Volts	Secondary Lines Connect To
208	X1, X2, X3
120 1 phase	BetweenX0 and X1 or X2 or X3

T600H Wiring Diagram & Connections

Wiring Diagram

Primary: 600 Volts Delta
Secondary: 480Y/277 Volts



Connections

Primary Volts	On Each Coil Jumper Taps To	Primary Lines Connect To
600	1	H1, H2, H3
570	2	H1, H2, H3
540	3	H1, H2, H3

Secondary Volts	Secondary Lines Connect To
480	X1, X2, X3
277 1 phase	Between X0 and X1 or X2 or X3

More wiring diagrams can be found in catalog's appendix, section 15.
Use the "Find a Product" tool on our website for detailed specification sheets.
For further information, contact an Application Engineer at 800-892-3755, technical_services@jeffersonelectric.com

Guide to this section

This information is provided to ensure you select the unit that best suits your needs and to show you how to maintain it for a long life.

14-2 Jefferson Electric's Transformers
Our full list of transformer types

14-3 Specifying the Correct Transformer
Information on how to correctly specify the unit for your application

14-4 Technical Information
Technical information on which to base your decision

14-9 Safety and Installation
Information regarding safe operation and hassle-free installation of your transformer

14-9 Care and Maintenance
Tips and suggestions to keep your equipment running safely and smoothly

14-10 Troubleshooting Guide
The first place to check if your transformer is not running correctly

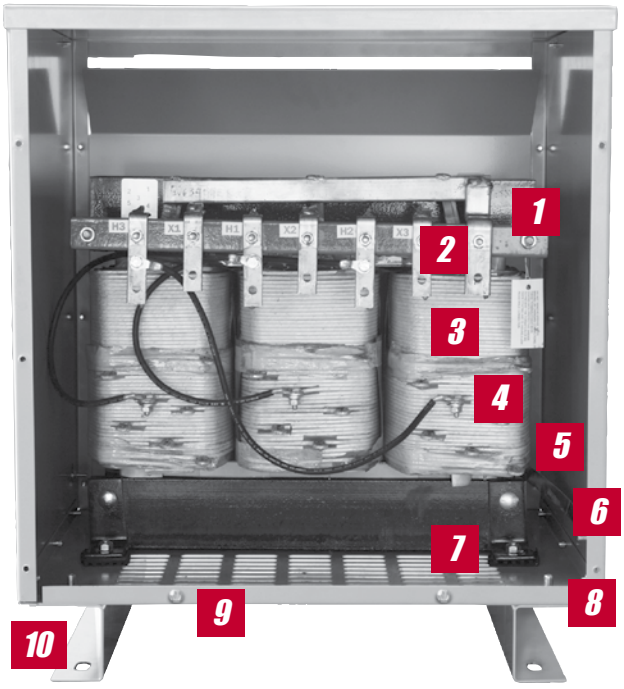
14-12 Certifications

14-13 Glossary

14-20 Warranty

Transformer Construction

Jefferson Electric transformers are built to the highest industry standards. Each unit is fully tested before it is shipped. We stand behind each unit we sell with a strong customer service department and Application Engineers knowledgeable in the use of transformers.



1. Fiberglass terminal board
2. Tightly stacked electrical steel core provides lower losses and low noise
3. Standard aluminum coils
4. Front loop taps are staggered for easy connection
5. Flexible core ground strap
6. Ground stud bolt
7. Vibration isolation pads provide quiet operation
8. Side or bottom conduit access for convenient mounting options
9. Bolt locations to hold front cover during installation loosen, don't remove
10. Easy access mounting holes

General Dry Type Transformers

Following is a list of our product line. For more information see the catalog section noted.

1 Single-Phase Ventilated
15 to 667 kVA
For all general loads, indoors or out, including lighting, industrial and commercial applications. Units may be banked for three phase operation.

2 Three-Phase Ventilated
15 to 2,500 kVA
For all general three phase loads, indoors or out, including lighting, industrial and commercial applications.

3 Non-Linear Three-Phase
15 to 1,000 kVA
Built to handle electronic loads to meet non-linear demands caused by modern office equipment. For indoor and outdoor applications.

4 Drive Isolation
3 to 990 kVA
For industrial and commercial applications with SCR-controlled adjustable speed motor drives, and AC adjustable frequency or DC drives.

5 Totally Enclosed Non-Ventilated
15 to 500 kVA
Single- and three-phase designed for use in challenging manufacturing environments.

6 Industrial Control
50 to 5,000 VA
For control panels, conveyor systems, machine tooling equipment, commercial sewing machines, pumping system panels, and commercial air conditioning applications.

7 Single-Phase Encapsulated
50 VA to 25 kVA
For all general loads, indoors or out, including lighting, industrial and commercial applications. Units may be banked for three phase operation.
Pool & Spa Lighting
Lamp Watts 100 through 1,000
For low voltage circuits near water or other shock hazards.

8 Three-Phase Encapsulated
3 to 75 kVA
For all general three phase loads, indoors or out, including lighting, industrial and commercial applications.

9 Buck-Boost
50 VA to 10 kVA
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.

10 Class I Division 2 Encapsulated transformers
1 to 25 kVA, Single Phase
3 to 75 kVA, Three Phase
Class I Division 2 units are key in hazardous locations in maintaining a safe environment.

11 18-Pulse
15 to 500 HP
Multi-pulse units are key in designing systems to mitigate the harmonic distortion generated by variable frequency drives and other digital equipment.

12 Medium Voltage
5 kV to 25 kV Class
Designs for industrial facilities and process lines, drilling and mining installations and commercial power applications. Each unit customized to your specifications.

13 Power Quality

13a HMT / Zig-Zag 15 to 1,500 VA
These transformers cancel 3rd harmonic currents in the secondary winding eliminating them from the primary winding.

13b Harmonic Suppression System (HSS)
This system eliminates, not accommodates, the 3rd harmonic current, removing it from the distribution system.

■ **Medium Voltage Industrial Control**
.5 to 5 kVA
See website for more information
For the demands of industrial control applications, even rugged conditions.

Specifying the Correct Transformer

Contact an Application Engineer at 800-892-3755 if you have questions regarding performance, design or installation. You can email them at technical_services@jeffersonelectric.com

- **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 the chart at the right.

Determine the Load Voltage

Load Voltage =

Determine the Load Current (Amps)

Load Current/Amps =

Determine the Line Voltage

Line Voltage =

Size and Select a Transformer

1. Determine the proper kVA based on the required load voltage, line voltage and load current.

   For an example: Load voltage = 480 volts, Load current = 80 Amps and Line voltage = 208 volts. Using the calculation yields a 66 kVA transformer.

Transformer Selection Formulas

Single-Phase Transformers

$$\frac{\text{Volts} \times \text{Amps}}{1000} = \text{kVA}$$

Plug your numbers into the formula:

$$\frac{\text{Volts} ____ \times \text{Amps} ____}{1000} = ____ \text{kVA}$$

Three-Phase Transformers

$$\frac{\text{Volts} \times \text{Amps} \times 1.732}{1000} = \text{kVA}$$

Plug your numbers into the formula:

$$\frac{\text{Volts} ____ \times \text{Amps} ____ \times 1.732}{1000} = ____ \text{kVA}$$

2. Choose the appropriate style of transformer for the application. See page 14-2. 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.
4. Select the options such as mounting brackets to assist your installation.

Full Load Currents (in Amperes), Voltage (line to line)

Single-Phase Transformers

kVA	120V	208V	240V	277V	480V	600V
.50	.42	.24	.21	.18	.10	.08
.75	.63	.36	.31	.27	.16	.13
.10	.83	.48	.42	.36	.21	.17
.15	1.25	.72	.63	.54	.31	.25
.25	2.08	1.20	1.04	.90	.52	.42
.50	4.16	2.40	2.08	1.8	1.04	.83
.75	6.25	3.60	3.13	2.7	1.56	1.25
1.0	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
2.0	16.7	9.6	8.3	7.2	4.2	3.3
3.0	25	14.4	12.5	10.8	6.2	5.0
5.0	41.7	24	20.8	18.0	10.4	8.3
7.5	62.5	36.1	31.2	27	15.6	12.5
10.0	83.4	48	41.6	36	20.8	16.7
15.0	125	72	62.5	54	31.2	25
25.0	208	120	104	90	52	41.7
37.5	312	180	156	135	78	62.5
50.0	417	240	208	180	104	83.5
75.0	625	361	312	270	156	125
100.0	834	480	416	361	208	167
167.0	1,396	805	698	602	349	279

Three-Phase Transformers

kVA	208V	240V	480V	600V
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	1,390	1,200	600	480
750	2,080	1,800	900	720

For other single-phase kVA ratings or voltages:

$$\text{Amperes} = \frac{\text{kVA} \times 1000}{\text{Volts}}$$

For other three-phase kVA ratings or voltages:

$$\text{Amperes} = \frac{\text{kVA} \times 1000}{\text{Volts} \times 1.732}$$

Source: EASA Handbook

Recommended Copper Wire and Transformer Size

HP	Transformer kVA	Distance — Motor to Transformer in Feet				
		100	150	200	300	500
Single-Phase Motors, 230V						
1½	3	10	8	8	6	4
2	3	10	8	8	6	4
3	5	8	8	6	4	2
5	7-1/2	6	4	4	2	0
7½	10	6	4	3	1	0

HP	Volts	Transformer kVA	Distance — Motor to Transformer in Feet				
			150	150	200	300	500
Three-Phase Motors, 230 & 460V							
1½	230	3	12	12	12	12	10
1½	460	3	12	12	12	12	12
2	230	3	12	12	12	10	8
2	460	3	12	12	12	12	12
3	230	5	12	10	10	8	6
3	460	5	12	12	12	12	10
5	230	7½	10	8	8	6	4
5	460	7½	12	12	12	10	8
7½	230	10	8	6	6	4	2
7½	460	10	12	12	12	10	8
10	230	15	6	4	4	4	1
10	460	15	12	12	12	10	8
15	230	20	4	4	4	2	0
15	460	20	12	10	10	8	6
20	230	Consult Local Power Company	4	2	2	1	000
20	460		10	8	8	6	4
25	230		2	2	2	0	000
25	460		8	8	6	6	4
30	230		2	1	1	00	0000
30	460		8	6	6	4	2
40	230		1	0	00	0000	300
40	460		6	6	4	2	0
50	230		1	0	00	0000	300
50	460		4	4	2	2	0
60	230		1	00	000	250	500
60	460		4	2	2	0	00
75	230		0	000	0000	300	500
75	460		4	2	0	00	000

Enclosures

Our standard enclosure is rated NEMA3R. Other enclosures are available. Let us help you specify the one to meet your exact needs.

NEMA Transformer Enclosure Definitions

Standard	*Description*
Type 1	General purpose – indoor.
Type 2	Drip-proof – indoor.
Type 3	Wind blown dust and water – indoor/outdoor.
Type 3R	Rainproof and sleet/ice resistant – outdoor.
Type 3S	Dust-tight, rain-tight, and sleet/ice proof – outdoor.
Type 4	Water-tight and dust-tight – indoor/outdoor.
Type 4X	Water-tight, dust-tight and corrosion resistant – outdoor.
Type 5	Dust-tight – indoor.
Type 6	Submersible, water-tight, dust-tight and sleet/ice resistant – indoor/outdoor.
Type 7	Class I, Group (S) A,B,C and/or D – indoor hazardous locations, air-break equipment
Type 8	Class I, Group (S) A,B,C and/or D – indoor hazardous locations
Type 9	Class II, Group (S) E,F and/or D – indoor hazardous locations - air-break equipment
Type 10	Bureau of Mines
Type 11	Drip-proof and corrosion resistant
Type 12	Industrial use dust-tight and drip-tight – indoor.
Type 13	Oil-tight and dust-tight – indoor.

Source: NEMA Pub. No. ST20

Transformer NEMA Maximum * Single- and Three-Phase db Ratings

kVA Rating	*600V*
0 - 9	40
10 - 50	45
51 - 150	50
151 - 300	55
301 - 500	60
501 - 700	62
701 - 1000	64

* K-Factor, low temp and special transformer sound rating = kVA of equivalent design at 150°C rise and K-1

Protective Equipment

The importance of protecting your power delivery system cannot be overstated. The system must be protected against short circuits, surges caused by lightning, switching and overheating. Equipment is available to provide this protection, but it must also be adequately sized and properly installed. Failure to do so could damage the transformer and invalidate its warranty.

Protective equipment includes circuit breakers and fuses.

The selection and placement of protective equipment within the system is the responsibility of the end user.

Circuit Breakers

When any component of a circuit fails, there is nothing to limit current flow except the resistance of the circuit conductors and the resistance of the fault itself. The currents in these situations can be extremely large and destructive, making it imperative to interrupt the circuit as quickly as possible.

Circuit breakers are designed to react to a fault by making a physical separation in the current carrying or conducting element by inserting an insulating medium. Breakers come in different types, depending on the insulating medium used. While the most common insulation is oil, air is used in some 600 Volt class circuits. For higher voltages and larger capacities, the insulating medium might be a vacuum or and inert gas such as sulphur hexafluoride.

Specifications for a circuit breaker will depend on the operating voltage of the circuit, the normal operating or maximum load current, and the maximum abnormal or fault current to be interrupted.

Circuit breakers are rated in kVA or mVA and express the ability of the breaker to withstand short circuit forces.

Circuit breakers must withstand large inrush currents that result when voltage is initially switched on. These currents can be 20 to 30 times the rated transformer current even with no-load. Therefore, breakers must have built-in time delay for the first 5 to 10 cycles to avoid tripping under “turn-on” currents.

Fuses

The most common protective device in use, the fuse is basically a circuit breaker that works only once and then must be replaced. When current exceeds the predetermined current value, a fusible link melts, opening the circuit.

When voltage is initially switched on, a large inrush current results, being greatest in the first half-cycle of operation, or approximately .01 second. This current becomes less severe over the next few cycles, or approximately .1 second until the transformer is operating normally. Because of inrush current, fuses are often selected to withstand as much as 25 times primary rated current for .01 second, and 12 times primary rated current for .1 second.

Storage should be avoided, but if this is not possible, the transformer must be protected against moisture and contaminants.

Condensation and moisture can be reduced with heaters. If the transformer has been subjected to moisture, it should be baked out before energizing. This is especially important in transformers of 5 kV or higher.

Fuse Selection

The tables provide guidance for selecting fuses when the maximum voltage in the circuit is 600 Volts or less. These tables are included in Article 450-3 of the National Electrical Code covering over-current protection of transformers.

If primary protection only is required, use Table 1. If both primary and secondary protection are required, refer to Table 2.

IMPORTANT: *These tables are to be used as a guide only. The final determination of application is the responsibility of the end user.*

Table 1—Primary Fuse Only

Transformer Primary Amperes	Maximum Primary Fuse % Rating
9 or more	125*
2 or 9	167
Less than 2	300

If 125% does not correspond to a standard ampere rating, the next higher standard rating described in NEC Article 240-6 shall be permitted.

Table 2—Primary and Secondary Fuses

Transformer Secondary Amperes	Maximum % Rating	
	Primary Fuse	Secondary Fuse
9 or more	250	125*
Less than 9	250	167

Primary Fuse Selection

Primary fuse selection is made according to rated primary current (Ipri). To determine Ipri, the transformer rating (VA or kVA) and primary voltage (Vpri) must be known as well as whether the transformer is single- or three-phase. With this information, use the appropriate formula to determine Ipri.

Once Ipri is known, select fuses according to or 2 above.

Secondary Fuse Selection

Secondary fuse selection is made according to rated secondary current (Isec). To determine Isec, the transformer rating (VA or kVA) and secondary voltage (Vsec) must be known as well as whether the transformer is single- or three-phase. With this information, use the appropriate formula to determine Isec.

Once Isec is known, select fuses according to Table 2 above.

Primary Fuse Formulas

Single-Phase Transformers

$$I_{pri} = \frac{\text{Transformer VA}}{V_{pri}}$$

OR

$$I_{pri} = \frac{\text{Transformer VA}}{V_{pri}} \times 1000$$

Three-Phase Transformers

$$I_{pri} = \frac{\text{Transformer VA}}{1.73 \times V_{pri}} \times 1000$$

Secondary Fuse Formulas

Single-Phase Transformers

$$I_{sec} = \frac{\text{Transformer VA}}{V_{sec}}$$

OR

$$I_{sec} = \frac{\text{Transformer VA}}{V_{sec}} \times 1000$$

Three-Phase Transformers

$$I_{sec} = \frac{\text{Transformer VA}}{1.73 \times V_{sec}} \times 1000$$

Temperature Considerations

Insulation and Temperature

All transformers are designed and manufactured with the best quality insulation available. There are classes of insulation systems for different temperatures as defined by NEMA and ANSI. Insulation classes are rated in °C rise above a specific ambient of 40°C maximum. A transformer having a specific class of insulation, for example Class 220, can have an average winding temperature rise of 150°C with a maximum hot spot temperature rise of 180°C. If the room ambient temperature is 40°C, then the total temperature of the hottest spot would be 220°C.

Our transformers are designed to operate at rated load and voltage in maximum room ambient temperatures of 40°C, average room ambient temperature not to exceed 30°C, and at altitudes not to exceed 3300 feet in accordance with NEMA standards.

Insulating Classifications

The designations for insulation systems are numerical classifications based on temperature ratings. Transformer ratings are based on temperature rise. The accompanying table shows the designations.

Transformer and Insulation System Ratings

Insulation Class	Temperature Rise	Ambient Temperature	Hot Spot Allowance
Ventilated			
105	55°C	40°C	10°C
150	80°C	40°C	30°C
180	110°C	40°C	30°C
220	150°C	40°C	30°C
Encapsulated			
105	70°C	25°C	10°C
130	95°C	25°C	10°C
180	135°C	25°C	20°C
Control Transformers			
105	55°C	40°C	10°C
130	80°C	40°C	10°C
135	100°C	40°C	15°C
180	120°C	40°C	20°C

Overloads

Overloads exceeding the maximum allowable insulation temperature can be tolerated, provided the overload is of short duration and is preceded and followed by a period of operation at less than rated kVA (refer to ANSI C57.96-1989, Tables 5,6,7). Overloading should be avoided unless approval is obtained from the Jefferson Electric engineering department.

High Ambient Temperatures

Ambient temperatures above 30°C average over a 24-hour period and 40°C maximum require either a larger kVA rating or a special low temperature rise transformer. A 150°C rise air cooled transformer can also be derated using the formula of .4% kVA reduction for each degree centigrade above 30°C ambient temperature.

Altitude Correction

For transformers above 3300 feet, reduce the kVA rating .3% for each 330 feet above 3300 feet.

Taps

If the transformer comes supplied with taps, they will generally have a full capacity rating. A common tap arrangement is two 2.5% taps above FCAN and four 2.5% taps below FCBN nominal voltage. Transformers are shipped with the taps connected for nominal voltage, that is, 480 volts for a 480 volt transformer. The installing electrician must change the taps if the supply voltage differs from the nominal voltage rating.

Certifications

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 Européenne
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 independent 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-3R standard.

Seismic
In order to meet seismic qualifications, products must go through rigorous testing to meet the International Building Code and the California Building Code 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.