

Looking for low voltage transformer solutions?



Select the best from
the industry leader.



Square D® Low Voltage
Dry Type Transformers



by **Schneider** Electric

Make the most of
your energySM

Schneider
Electric

Special Transformers

This application guide is designed to provide a handy pocket reference for those who need to select and apply dry-type transformers in the course of their vocation. The information is also of use in all electrical work. Because it is a pocket guide, the information is brief and abbreviated.

Schneider Electric will build most special dry type transformers your application requires. Your Square D® field sales representatives, or transformer headquarters, will be happy to assist you in selecting the proper transformer. Data required to help you is: kVA or load amperage, primary voltage, secondary or load voltage, phase, frequency, taps, insulation class and temperature rise, type of enclosure, sound level, physical limitations—accessories required.

Transformers available from your distributor's stock

■ Single Phase Loads

Voltage: 240 x 480-120/240

Ratings: .050-167kVA

Voltage: 480-120/240

Ratings: 3-25kVA

Voltage: 600-120/240

Ratings: .050-37.5kVA

■ Three Phase Loads

Voltage: 480△-280Y/120

Ratings: 3-750kVA

Voltage: 480△-240△ with 120V center trap

Ratings: 15-500kVA

Voltage: 600△-280Y/120

Ratings: 6-75kVA

■ Buck and Boost (Single Phase)

Voltage: 120 x 240-12/24 or 16/32; 240 x 480-24/48

Ratings: .050-3kVA

Full Load Current in Amperes

Single Phase Low Voltage Dry Type Transformers

kVA	Rated Line-to-Line Voltage									
	120	208	220	240	277	380	400	416	480	600
0.25	2.08	1.20	1.14	1.04	0.90	0.66	0.63	0.60	0.52	0.42
0.5	4.17	2.40	2.27	2.08	1.81	1.32	1.25	1.20	1.04	0.83
0.75	6.25	3.60	3.41	3.13	2.71	1.97	1.88	1.80	1.56	1.25
1	8.33	4.80	4.55	4.17	3.61	2.63	2.50	2.40	2.08	1.67
1.5	12.5	7.21	6.82	6.25	5.42	3.95	3.75	3.61	3.13	2.5
2	16.7	9.61	9.09	8.33	7.22	5.26	5	4.81	4.17	3.33
3	25	14.4	13.6	12.5	10.8	7.9	7.5	7.21	6.25	5
5	41.7	24	22.7	20.8	18.1	13.2	12.5	12	10.4	8.33
7.5	62.5	36	34.1	31.3	27.1	19.7	18.8	18	15.6	12.5
10	83.3	48	45.5	41.7	36.1	26.3	25	24	20.8	16.7
15	125	72.1	68.2	62.5	54.2	39.5	37.5	36.1	31.3	25
25	208	120	114	104	90.3	65.8	62.5	60	52.1	41.7
37.5	313	180	171	156	135	98.7	93.8	90.1	78.1	62.5
50	417	240	227	208	181	132	125	120	104	83.3
75	625	360	341	313	271	197	188	180	156	125
100	833	480	455	417	361	263	250	240	208	167
167	1392	802	759	696	603	440	418	401	348	278
250	2083	1201	1136	1042	903	658	625	600	521	417
333	2775	1601	1514	1388	1202	876	833	801	694	555

Formula: Single Phase kVA – Volts x Load Amperes/1000

Three Phase Low Voltage Dry Type Transformers

kVA	Rated Line-to-Line Voltage							
	208	220	240	380	400	416	480	600
3	8.33	7.87	7.22	4.56	4.33	4.16	3.61	2.89
6	16.7	15.7	14.4	9.12	8.66	8.33	7.22	5.78
9	25	23.6	21.7	13.7	13	12.5	10.8	8.66
15	41.6	39.4	36.1	22.8	21.7	20.8	18	14.4
30	83.3	78.7	72.2	45.6	43.3	41.6	36.1	28.9
45	125	118	108	68.3	65	62.5	54.1	43.3
75	208	197	180	114	108	104	90.2	72.2
112.5	312	295	271	171	162	156	135	108
150	416	394	361	228	217	208	180	144
225	625	590	541	342	325	312	271	217
300	833	787	722	455	433	416	361	289
500	1388	1312	1203	760	722	694	601	481
750	2082	1968	1804	1140	1083	1041	902	722
1000	2776	2624	2406	1519	1443	1388	1203	962

Formula: Three Phase kVA – Volts x Load Amperes x 1.73/1000

The following tables have been reproduced through the courtesy of the National Fire Protection Association from the National Electric Code 2008 Edition.

Table 310.16 Allowable Ampacities of Insulated Conductors Rated 0 Through 2000 Volts, 60°C Through 90°C (140°F Through 194°F), Not More Than Three Current-Carrying Conductors in Raceway, Cable, or Earth (Directly Buried), Based on Ambient Temperature of 30°C (86°F)

Size AWG or kcmil	Temperature Rating of Conductor (See Table 310.13(A))						Size AWG or kcmil
	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)	
	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	
	Copper			Aluminum or Copper-Clad Aluminum			
18	—	—	14	—	—	—	—
16	—	—	18	—	—	—	—
14*	20	20	25	—	—	—	—
12*	25	25	30	20	20	25	12*
10*	30	30	40	25	30	35	10*
8	40	40	55	30	40	45	8
6	55	65	75	40	50	60	6
4	70	85	95	55	65	75	4
3	85	100	110	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	150	85	100	115	1
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0
250	215	255	290	170	205	230	250
300	240	285	320	190	230	255	300
350	260	310	350	210	250	280	350
400	280	335	380	225	270	305	400
500	320	380	430	260	310	350	500
600	355	420	475	285	340	385	600
700	385	460	520	310	375	420	700
750	400	475	535	320	385	435	750
800	410	490	555	330	395	450	800
900	435	520	585	355	425	480	900
1000	455	545	615	375	445	500	1000
1250	495	590	665	405	485	545	1250
1500	520	625	705	435	520	585	1500
1750	545	650	735	455	545	615	1750
2000	560	665	750	470	560	630	2000

Correction Factors

Ambient Temp. (°C)	For ambient temperatures other than 30°C (86°F), multiply the allowable ampacities shown above by the appropriate factor shown below						Ambient Temp. (°F)
21–25	1.08	1.05	1.04	1.08	1.05	1.04	70–77
26–30	1.00	1.00	1.00	1.00	1.00	1.00	78–86
31–35	0.91	0.94	0.96	0.91	0.94	0.96	87–95
36–40	0.82	0.88	0.91	0.82	0.88	0.91	96–104
41–45	0.71	0.82	0.87	0.71	0.82	0.87	105–113
46–50	0.58	0.75	0.82	0.58	0.75	0.82	114–122
51–55	0.41	0.67	0.76	0.41	0.67	0.76	123–131
56–60	—	0.58	0.71	—	0.58	0.71	132–140
61–70	—	0.33	0.58	—	0.33	0.58	141–158
71–80	—	—	0.41	—	—	0.41	159–176

* See 240.4(D) 2008 NEC.

Table 450.3(B) Maximum Rating or Setting of Overcurrent Protection for Transformers 600 Volts and Less (as a Percentage of Transformer-Rated Current)

Protection Method	Primary Protection			Secondary Protection (See Note 2.)	
	Currents of 9 Amperes or More	Currents Less Than 9 Amperes	Currents Less Than 2 Amperes	Currents of 9 Amperes or More	Currents Less Than 9 Amperes
Primary only protection	125% (See Note 1.)	167%	300%	Not required	Not required
Primary and secondary protection	250% (See Note 3.)	250% (See Note 3.)	250% (See Note 3.)	125% (See Note 1.)	167%

NOTES:

- Where 125 percent of this current does not correspond to a standard rating of a fuse or nonadjustable circuit breaker, a higher rating that does not exceed the next higher standard rating shall be permitted.
- Where secondary overcurrent protection is required, the secondary overcurrent device shall be permitted to consist of not more than six circuit breakers or six sets of fuses grouped in one location. Where multiple overcurrent devices are utilized, the total of all the device ratings shall not exceed the allowed value of a single overcurrent device. If both breakers and fuses are utilized as the overcurrent device, the total of the device ratings shall not exceed that allowed for fuses.
- A transformer equipped with coordinated thermal overload protection by the manufacturer and arranged to interrupt the primary current shall be permitted to have primary overcurrent protection rated or set at a current value that is not more than six times the rated current of the transformer for transformers having not more than 6 percent impedance and not more than four times the rated current of the transformer for transformers having more than 6 percent but not more than 10 percent impedance.

NEMA TP 1-2002 NEMA Class I Efficiency Levels for Dry Type Distribution Transformers

Low Voltage Reference Condition: 75°C and 35% Load			
Single Phase		Three Phase	
kVA	% Efficiency	kVA	% Efficiency
15	97.7	15	97
25	98	30	97.5
37.5	98.2	45	97.7
50	98.3	75	98
75	98.5	112.5	98.2
100	98.6	150	98.3
167	98.7	225	98.5
250	98.8	300	98.6
333	98.9	500	98.7
		750	98.8
		1000	98.9

Sound Levels

Square D® Dry Type Transformers are the quietest available, whether standard or special sound level limits are ordered. Testing is done in accordance with NEMA standards.

Sound Levels 600 Volts and Below	
kVA	NEMA Standard Sound Levels
0–9	40 dB
10–50	45 dB
51–150	50 dB
151–300	55 dB
301–500	60 dB
501–700	62 dB
701–1000	64 dB

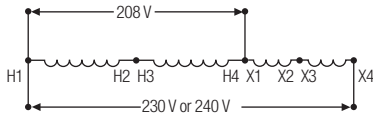
NOTE: Lower sound levels than those shown above are available at a slight additional charge.

Buck and Boost

The nameplate rating on buck and boost transformers indicates the load they will handle as an isolation transformer. (Pri. 120 x 240, Sec. 12/24*, Ex.: A 1kVA buck and boost will reduce 120 or 240V to 12 or 24V and be able to carry a continuous load of 1kVA.) The majority of buck and boost transformers sold, however, are used to boost 208V to either 230V or 240V, or buck these voltages down to 208V. To use these transformers in this way, the primary and secondary windings are connected to form an auto transformer as follows:

Single Phase

Connect H2 to H3
X1 to H4
X2 to X3



Connect 208V to H1 and H4-X1
Connect 230V or 240V to H1 and X4

Buck/Boost	Secondary	kVA Capacity
208-230	12/24	10 x nameplate rating
208-240	16/32	7.5 x nameplate rating

Three Phase, Open Delta – Power-Loads Only

(Use 2 Single Phase Units)

Connect

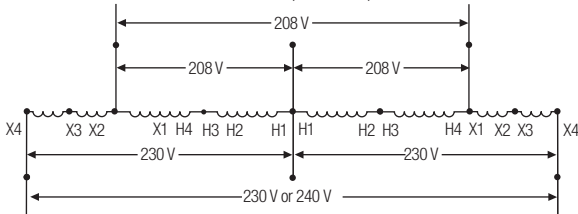
On each unit X3 to X2
X1 to H4
H3 to H2

NOTE: This connection for power loads only. Three phase lighting loads require (3) transformers and source neutral must be carried through to load.

Then connect H1's from each unit.

Connect 208V to X1-H4, H1-H1, H4-X1

Connect 230V or 240V to X4, H1-H1, X4



Three Phase kVA Rating

Buck/Boost	Secondary	kVA Capacity
208-230	12/24	nameplate kVA x 1.73 x 10
208-240	16/32	nameplate kVA x 1.73 x 7.5

NOTE: When used as an auto transformer, the buck and boost unit will carry greater loads than shown on the nameplate. For other uses and connections, ask your distributor for a copy of the Product Data Bulletin (7414SP9901) or a "Buck-Boost Slide Rule" or use the online calculator. Visit <http://www.us.squared.com> and search for "Buck and Boost." Check local codes relative to the use of auto transformers before applying buck and boost transformers.

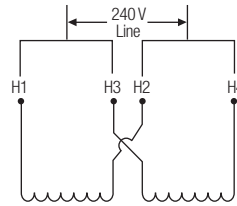
Single phase connections

Note: Non-standard ratings – increase to next larger standard.

Single Phase 240 x 480 to 120/240V

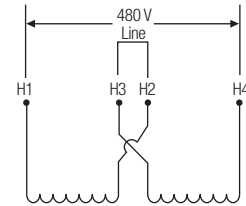
Primary Connections

240V Service



Connect H1 & H3
Connect H2 & H4
Connect lines to H1-H3 & H2-H4

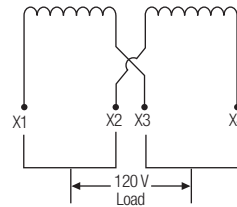
480V Service



Connect H3 & H2
Connect H1 & H4
Connect lines to H1 & H4

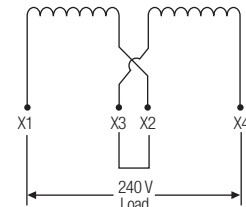
Secondary Connections

120V 2-Wire Circuit



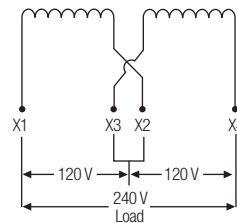
Connect X1 & X3
Connect X2 & X4
Connect Load to X1-X3 & X2-X4

240V 2-Wire Circuit



Connect X3 & X2
Connect Load to X1 & X4

120/240V 3-Wire Circuit



The junction of X3-X2 may be used as the neutral of a 3-wire system and must be bonded to the nearest earth ground per NEC requirements.

Note: Non-standard ratings – increase to next larger standard.

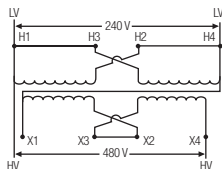
The following diagrams show special ways that standard 240 x 480-120/240 single phase transformers can be connected for special applications.

Single Unit Connected as Auto Transformer

240V to 480V

kVA Capacity = 2 x Nameplate kVA

$$\frac{\text{Load kVA}}{2} = \text{kVA Rating of Transformer Required}$$

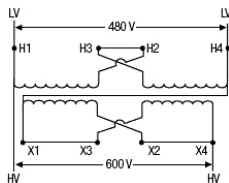


Single Unit Connected as Auto Transformer

480V to 600V

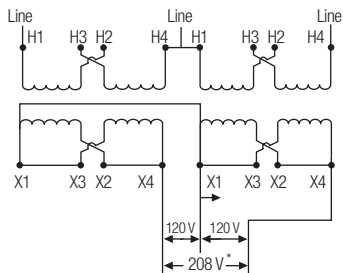
kVA Capacity = 5 x Nameplate kVA

$$\frac{\text{Load kVA}}{5} = \text{kVA Rating of Transformer Required}$$



Two unit transformers connected in “Hoppy Hookup” for single phase lighting and single phase power loads from three phase supply.

This connection allows changeover of existing single phase service to three phase service without changing existing lighting panels or secondary neutrals. The neutral current will be the same as with the original single phase service rather than increasing by the factor of 1.73 ($=\sqrt{3}$).



NOTE: The primary common current will be the $\sqrt{3}$ x the current in the other two lines.

For 480V Primary – Connect H2 to H3 in Each Unit

For 240V Primary – Connect H3 to H1 and H2 to H4 in Each Unit

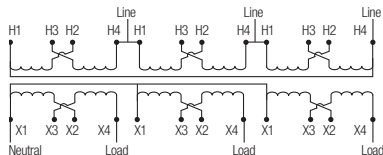
Secondary kVA Capacity = Total Nameplate kVA of Both Transformers

* Secondary voltage is 120/208V, 3-wire only. NOT 120/240V, 3-wire.

Three Phase Connections

Note: For non-standard kVA ratings – increase to next larger standard kVA, using single phase 240 x 480 to 120/240.

Three Units Connected Delta-Wye, for Three Phase Operation



For 480V Delta Primary – Connect H3 to H2 in Each Phase

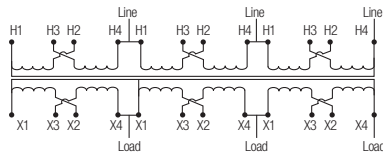
For 240V Delta Primary – Connect H3 to H1 and H2 to H4 in Each Phase

For 416Y/240V Secondary – Connect X3 to X2 in Each Phase

For 208Y/120V Secondary – Connect X3 to X1 and X2 to X4 in Each Phase

Three Phase kVA Capacity = Total kVA of Three Units

Three Units Connected Delta-Delta, for Three Phase Operation



For 480V Delta Primary – Connect H3 to H2 in Each Phase

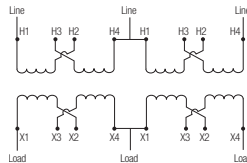
For 240V Delta Primary – Connect H3 to H1 and H2 to H4 in Each Phase

For 240V Delta Secondary – Connect X3 to X2 in Each Phase

For 120V Delta Secondary – Connect X3 to X1 and X2 to X4 in Each Phase

Three Phase kVA Capacity = Total kVA of Three Units

Two Units Connected Open-Delta, for Three Phase Operation



For 480V Delta Primary – Connect H3 to H2 in Each Phase

For 240V Delta Primary – Connect H3 to H1 and H2 to H4 in Each Phase

For 240V Delta Secondary – Connect X3 to X2 in Each Phase

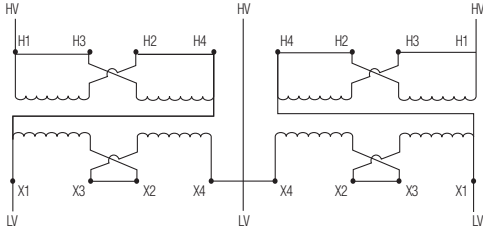
For 120V Delta Secondary – Connect X3 to X1 and X2 to X4 in Each Phase

Three Phase kVA Capacity = Total kVA of Two Units x 0.86

$$\frac{\text{Load kVA}}{1.73} = \text{kVA of Each Single Phase Unit}$$

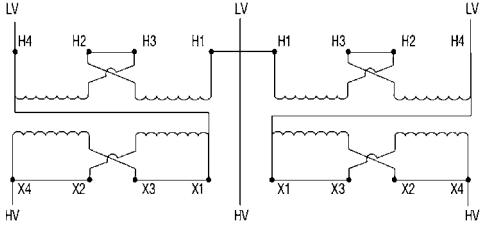
Note: For non-standard kVA ratings – increase to next larger standard kVA, using single phase 240 x 480 to 120/240.

Two Units Connected as Open Delta Auto Transformer for Three Phase Operation for 240–480; 480–240 Three Phase kVA Capacity = (Total kVA of Both Units x 2) x .86



$$\frac{\text{Load kVA}}{3.44} = \frac{\text{kVA of Each}}{\text{Single Phase Unit}}$$

Two Units Connected as Open-Delta Auto Transformer for Three Phase Operation for 600–480; 480–600; 480–380; 380–480

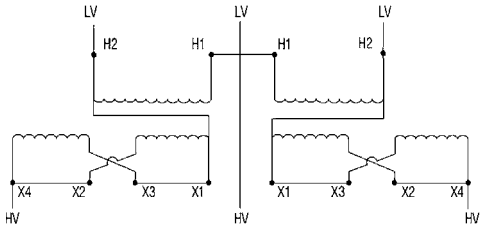


kVA Capacity 480-600; 600-480 kVA Capacity 480-380; 380-480

$$\frac{\text{Load kVA}}{8.6} = \frac{\text{kVA of Each}}{\text{Single Phase Unit}} \quad \frac{\text{Load kVA}}{6.88} = \frac{\text{kVA of Each}}{\text{Single Phase Unit}}$$

The following diagram shows special ways that standard 600-120/240 single phase transformers can be connected for special applications.

Two Units Connected as Open-Delta Auto Transformer for Three Phase Operation for 575–480 or 480–400



$$\frac{\text{Load kVA}}{8.3} = \frac{\text{kVA of Each}}{\text{Single Phase Unit}} \quad \frac{\text{Load kVA}}{6.92} = \frac{\text{kVA of Each}}{\text{Single Phase Unit}}$$

Energy Efficient Transformers

Square D® general purpose and lighting transformers are known as the industry standard.



Harmonic Mitigating and Non-Linear Transformers

Schneider Electric expertise in power management is evident with the broad line of transformers for non-linear loads.



Control Power Transformers

Schneider Electric's complete line of control power transformers offer a variety of options for panel builders and OEMs.



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