Energy Efficient Transformers

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Understand the impact
Select the correct energy efficient transformer

ENERGY STAR

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Total Power Quality Solutions
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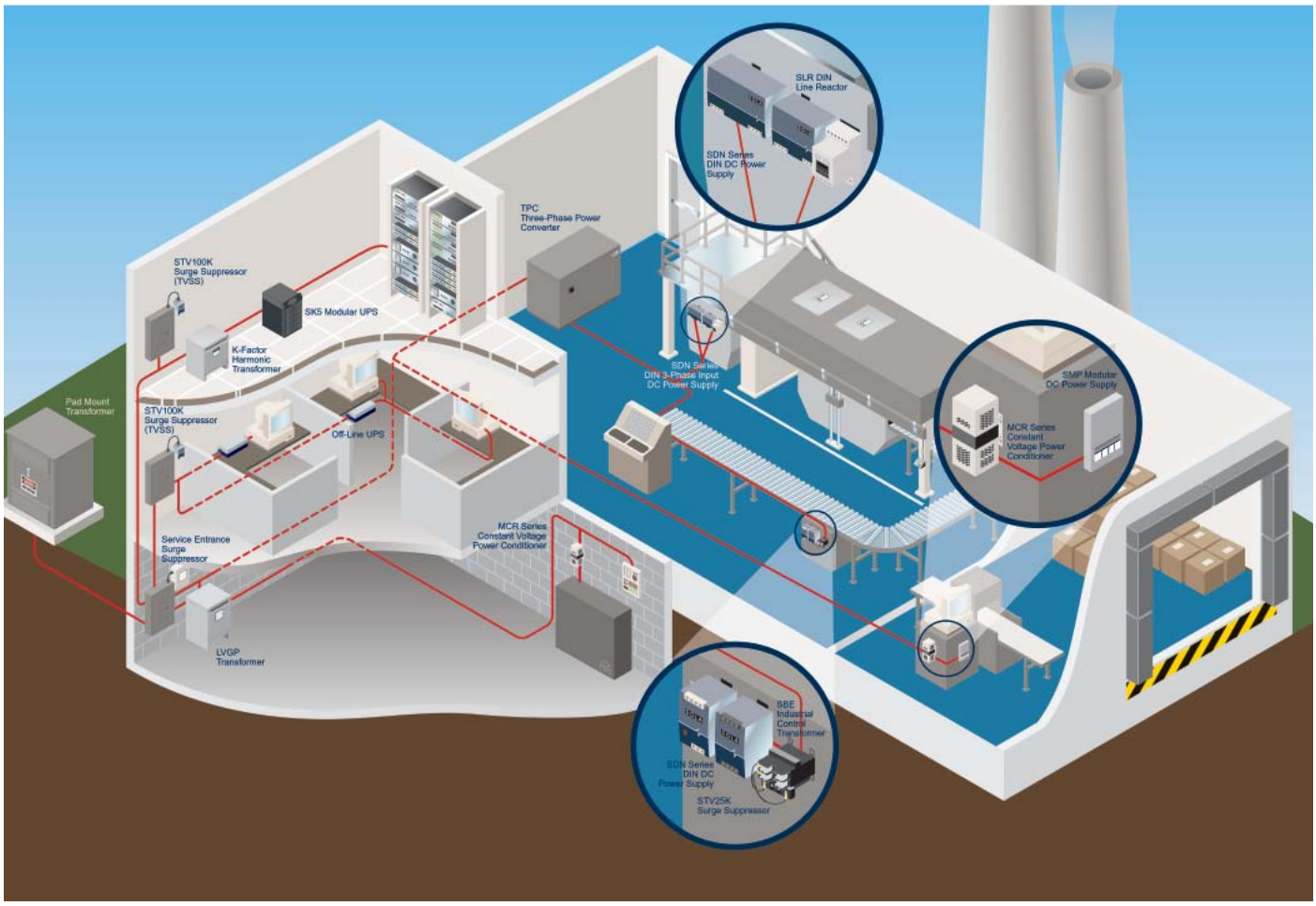
Sola/Hevi-Duty is at work for you on the facility floor, service entrance, branch panel, power distribution points and point of use applications.

Our products power the most demanding applications and can be used in conjunction or alone to ensure controlled, reliable power to any part of the factory floor or machinery.



	Industrial Power Conversion and Protection					
	Power Conditioning	Line Reactors	Surge Suppression	Transformers	Power Supplies	UPS
Service Entrance			X	X		
Branch Panels			X	X		
Networks	X		X		X	X
Large Machinery	X	X	X	X	X	X
Process Rooms	X		X			X
PLC's & Industrial PC's	X		X	X	X	X
Ethernet & Communications			X		X	X
DeviceNet			X		X	X
Motion Control			X		X	
Drives	X	X	X	X		
Analog I/O			X		X	

Introduction

Hevi-Duty Transformers

Energy Star™ Transformers

The Impact of the Energy Policy Act of 2005 on Hevi-Duty Transformers

As the world's largest energy consumer, the United States uses 3.7 trillion kilo-watt-hours per year of power. Even with the recent surge in energy prices and a greater awareness of the need to protect the environment, this number will continue to increase until consumers and businesses see the benefits of choosing more energy efficient product designs.

Congress, understanding that people can be financially enticed to change behaviors and business practices, created the Energy Policy Act of 2005 (H.R. 6). There are many areas impacted by the Act, one of them is Distribution Transformers. According to the policy, pertaining to *low voltage dry-type distribution transformers,* the responsibility has been placed on the transformer manufacturers to comply or face civil penalties. This will ensure that all new and replacement transformers will meet the new efficiency requirements by removing the option of using a lower efficiency unit.

The Act requires Distribution Transformers manufactured after January 1, 2007 to meet specific energy efficiency requirements. The requirements are based on a specification developed by the National Electrical Manufacturers Association (NEMA) with assistance from transformer manufacturers and the U.S. Department of Energy (DOE). The DOE has incorporated this standard, known as NEMA TP-1 and its' associated testing (NEMA TP-2) into the new Federal Rule (10 CFR Part 431 in the Federal Register / Vol. 71, No. 81 dated April 27, 2006).

The term Distribution Transformer is clearly defined in the Federal Rule and specific exclusions are provided for some types of transformers. The exclusions only apply to designs where compliance would not be economically justifiable or would be technically difficult to accomplish. If in practice some of these exclusions are abused, the law will be modified to prevent such abuse.

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EPAct 2005 defines the term "distribution transformers" as any transformer which:

- Has an input voltage of 34.5 kV or less
- Has an output voltage of 600 V or less
- Is rated for operation at a frequency of 60 Hz
- Has a capacity of 10 kVA to 2500 kVA for liquid-immersed units and 15 kVA to 2500 kVA for dry-type units

The following special purpose transformers are excluded from the definition of "distribution transformers" and are, therefore, not required to meet the energy efficiency standards at this time:

- Autotransformers
- Drive (isolation) transformers
- Grounding transformers
- Machine-tool (control) transformers
- Non-ventilated transformers
- Rectifier transformers
- Regulating transformers
- Sealed transformers
- Special-impedance transformers
- Testing transformers
- Transformer with tap range of 20 percent or more
- Uninterruptible power supply transformers
- Welding transformers

Product lines affected by the new requirements include; Low Voltage General Purpose (LVGP) transformers (ventilated units only), K-factor, and Low Temperature rise units. Non-compliant designs in these product categories will become obsolete effective 12/31/06. Any units produced on or before that date can still be shipped and used by customers. All standard units in Sola/Hevi-Duty's product line which are non-compliant with the new Federal Rule will be replaced with a new compliant design.

A majority of the units affected are included in this brochure. Custom units affected by the rule will be replaced on a case-by-case basis using the Custom Transformer Quote Request process. While the compliant transformers will add to the cost of construction and maintenance projects, the end user will save this cost over the life of the transformer.

Reference Condition		Temperature		% of Nameplate Load			
Low Voltage		75ºC		35%			
Medium Voltage		75ºC		50%			
Single Phase Efficiency				Three Phase Efficiency			
kVA	Low Voltage	Medium Voltage		kVA	Low Voltage	Medium Voltage	
		<60 kV BIL	>60 kV BIL			<60 kV BIL	>60 kV BIL
15	97.7	97.6	97.6	15	97	96.8	96.8
25	98	97.9	97.9	30	97.5	97.3	97.3
37.5	98.2	98.1	98.1	45	97.7	97.6	97.6
50	98.3	98.2	98.2	75	98	97.9	97.9
75	98.5	98.4	98.4	112.5	98.2	98.1	98.1
100	98.6	98.5	98.5	150	98.3	98.2	98.2
167	98.7	98.8	98.7	225	98.5	98.4	98.4
250	98.8	98.9	98.8	300	98.6	98.6	98.5
333	98.9	99	98.9	500	98.7	98.8	98.7
500	—	99.1	99	750	98.8	98.9	98.8
667	—	99.2	99	1000	98.9	99	98.9
833	—	99.2	99.1	1500	—	99.1	99
				2000	—	99.2	99
				2500	—	99.2	99.1

NEMA CLASS 1 EFFICIENCY LEVELS FOR DRY-TYPE DISTRIBUTION TRANSFORMERS

Benefiting from Higher Energy Efficiencies

Increasing the energy efficiency of a transformer allows the unit to operate at the same level of power with less energy being wasted in the process. This has a large impact on the consumption and distribution of energy because the reduction in energy usage improves the nation's energy independence, reduces environmental impacts, lessens infrastructure investment, and protects and strengthens the economy.

Decreasing usage through reduced waste by just .03% over the next 20 years cuts the need for new power generation by 60 to 66 million kw. That drop would eliminate the need for construction of 11 new 400-megawatt power plants by 2038. Electrical power generation accounts for 35% of all U.S. emissions of carbon dioxide, 75% of sulfur dioxide and 38% of nitrogen oxides. With higher-efficiency transformers, the country will see reduced emissions of CO_2, NOx and Hg of 678.8 Mt, 187.7 kt, and 6.48 t over the next 30 years. Curbing energy imports also bolsters the U.S. economy by reducing the current $65 billion trade deficit and mitigating fuel prices through decreased demand.

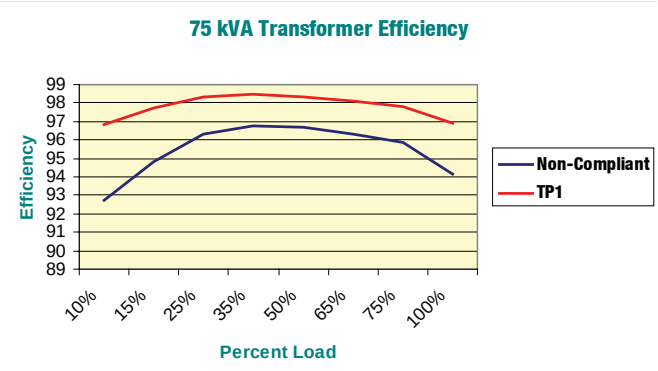

Figure 1

As your full-range provider of power conversion and power quality related products, Sola/Hevi-Duty has been engineering and producing energy efficient transformers for the past six years.

Our experienced engineers provide the best performing, most cost-effective designs on the market. The Sola/Hevi-Duty E version transformers are optimized to meet NEMA's TP-1 limits for load losses calculated to 35% of the name plate rating, yet are the same compact size and footprint as its' conventional 150˚C rise units.

All units in this brochure meet or exceed the required Class 1 efficiency levels. On the surface the absolute change seems insignificant, however the reduction in lost energy is dramatic when you consider that almost all of the energy consumed goes through at least one distribution transformer.

The example pictured in Figure 1 shows the differences in efficiency for the old standard model compared to the compliant model. At 35% load, the absolute difference in efficiency is only 1.7%. However, that represents a 52% reduction in wasted energy. Taking that 52% reduction in wasted energy and multiplying it across all the energy consumed results in substantial savings.

Hevi-Duty is pleased to offer the following family of transformers that meet the strict efficiency standards required by the Energy Policy Act of 2005. The efficiencies of these transformers are optimized for the load losses calculated at 35% of the name plate rating. This 35% represents an industry average load of most LVGP transformers.

Description

Energy efficient dry-type transformers (encapsulated, ventilated or non-ventilated), 600 Volt Class, isolation type, single and three phase, through 500 kVA. Indoor and outdoor models available.

Applications

Any situation where the available voltage must be changed to accommodate the voltage required by the specific electrical circuit or connected equipment. For many electrical circuits, the National Electrical Code (NEC) requires a separately derived neutral secondary connection provided by Delta-Wye connected transformers. Typical applications include:

- Hospitals
- Industrial Plants
- Commercial Buildings
- Apartment Buildings
- Institutional Buildings
- Office Buildings
- Schools
- Shopping Centers
- High Rise Buildings

Distribution transformers can be located close to the load. No vaults are required for installation and no long, expensive feeder lines are needed. Common applications include inductive and resistive loads such as motors, lighting and heating.

Hevi-Duty transformers are manufactured to meet applicable industry standards, are listed in accordance with UL 506 and UL 1561 specifications and are classified as isolation transformers.

General Purpose Transformers

Transformers designed to meet the high energy efficiencies required by NEMA Standard TP-1, T2, T5 and S5.

Low Temperature Rise Transformers

Transformers designed to limit the temperature rise of the core and coil assembly to either 80°C or 115°C above a 40°C ambient. Reduction in temperature rise increases reliability.

K-Factor Transformers

Transformers designed to withstand the electrical anomalies associated with solid state equipment and DC power supplies (excluding SCR variable speed motor drives).

Copper Wound Transformers

Hevi-Duty offers a selection of general purpose transformers with copper windings.

ENERGY STAR Listed Certified

Our online Transformer Product Selector is available at www.solaheviduty.com to help select the appropriate transformer. Enter your electrical requirements and hit the "Submit" button. Any matching transformers will list with links to exact specifications.

Contact Technical Services at (800) 377-4384 if you need any assistance selecting the right transformer for your needs. Hevi-Duty offers custom transformers that are quoted upon request.

Use the following steps below to manually select a transformer.

A. Find the electrical load requirements:

1. Load operating voltage.
2. Load frequency (expressed in Hz).
3. Determine load size - usually expressed in kVA, amperage or horsepower.
4. Is the load designed to operate on single phase or three phase power?

This information is available from the equipment manufacturer and is typically listed on the nameplate of the equipment.

B. Know the supply voltage conditions:

1. Available source voltage.
2. Available source frequency (a transformer will not change frequency. The frequency of the supply voltage and the needed load voltage must be equal).
3. Number of phases on power source.

C. Determine the transformer kVA rating:

1. If the load is expressed in kVA, select the appropriate transformer from the following selection charts (make sure the selected transformer's kVA rating is equal to or greater than the required load kVA).
2. If the load is expressed in amperage, use either the appropriate kVA formula listed below or the appropriate sizing chart on the next page.

$$kVA\ (1\text{Ø}) = \frac{Volts \times Amps}{1000}$$

$$kVA\ (3\text{Ø}) = \frac{Volts \times Amps \times 1.732}{1000}$$

3. If the load is expressed in wattage, either utilize the formula below to convert to kVA or refer to the equipment nameplate to obtain amperage requirement.

$$kVA = \frac{Wattage}{(1000 \times Power\ Factor\ of\ the\ load)}$$

4. If the load is a motor and expressed in horsepower, refer to the Motor Horsepower charts on the next page.

Always size the transformer to the load requirements.

Are there any special application considerations?

A. For ambient conditions over 40°C, derate the transformer nameplate kVA by 8% for each 10°C above 40°C.

B. For high altitude applications, derate the transformer nameplate kVA by 0.3% for every 330 feet over 3,300 feet above sea level. This assures proper transformer convection cooling.

C. Some applications may require a transformer design that limits the BTU output of the unit at full load or a design to withstand and mitigate specific electrical anomalies.

For these applications, see the following transformers:

- Low Temperature Rise
- K-Factor
- Copper Wound

Three things to keep in mind:

A. Motor horsepower charts are based on 1800 RPM squirrel cage induction motors. If using another type of motor, check running amperage against the chart and adjust as necessary.

B. Increase required transformer kVA by 20% if motors are started more than once per hour.

C. If your motor service factor is greater than 1, proportionally increase full load amperage. (i.e. – if service factor is 1.10, increase full load amperage by 10%).

Single Phase: Full Load Current Chart

kVA Rating	Volts					
	120	208	240	277	480	600
	Amperes					
0.05	0.42	0.24	0.21	0.18	0.1	0.08
0.075	0.63	0.36	0.31	0.27	0.16	0.13
0.1	0.83	0.48	0.42	0.36	0.21	0.17
0.15	1.3	0.72	0.63	0.54	0.31	0.25
0.25	2.1	1.2	1	0.9	0.52	0.42
0.5	4.2	2.4	2.1	1.8	1.4	0.83
0.75	6.3	3.6	3.1	2.7	1.6	1.3
1	8.3	4.8	4.2	3.6	2.1	1.7
1.5	12.5	7.2	6.3	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	6.3	5
5	41.7	24	20.8	18.1	10.4	8.3
7.5	62.5	36.1	31.3	27.1	15.6	12.5
10	83.3	48.1	41.7	36.1	20.8	16.7
15	125	72.1	62.5	54.2	31.3	25.0
25	208.3	120.2	104.2	90.3	52.1	41.7
37.5	312.5	180.3	156.3	135.4	78.1	62.5
50	416.7	240.4	208.3	180.5	104.2	83.3
75	625	361	313	271	156	125
100	833	481	417	361	208	167
167	1392	803	696	603	348	278
200	1667	962	833	722	417	333
250	2083	1202	1042	903	521	417

Three Phase: Full Load Current Chart

kVA Rating	208 V	240 V	480 V	600 V
	Amperes			
3	8.3	7.2	3.6	2.9
6	16.7	14.4	7.2	5.8
9	25	21.7	10.8	8.7
15	41.6	36.1	18	14.4
30	83.3	72.2	36.1	28.9
45	125	108.3	54.1	43.3
75	208.2	180.4	90.2	72.2
112.5	312	271	135	108.0
150	416	361	180	144.0
225	625	541	271	217.0
300	833	722	361	289.0
500	1388	1203	601	481.0

Single Phase Motor Chart: AC, Motor Horsepower Amperage

Horse Power	Volts					Min. kVA	Std. NEMA kVA
	115	208	230	460	575		
	Amperes						
1/6	4.4	2.4	2.2	1.1	0.9	0.53	0.75
¼	5.8	3.2	2.9	1.4	1.2	0.7	0.75
1/3	7.2	4	3.6	1.8	1.4	0.87	1
½	9.8	5.4	4.9	2.5	2	1.2	1.5
¾	13.8	7.6	6.9	3.5	2.8	1.7	2
1	16	8.8	8	4	3.2	1.9	2
1½	20	11	10	5	4	2.4	3
2	24	13.2	12	6	4.8	2.9	3
3	34	18.7	17	8.5	6.8	4.1	5
5	56	30.8	28	14	11.2	6.7	7.5
7.5	80	44	40	21	16	9.6	10
10	100	55	50	26	20	12	15

Three Phase Motor Chart: AC, Motor Horsepower Amperage

Horse Power	Volts				Min. kVA	Std. NEMA kVA
	208	230	460	575		
	Amperes					
½	2.2	2	1	0.8	0.9	3.0
¾	3.1	2.8	1.4	1.1	1.2	3.0
1	4	3.6	1.8	1.4	1.5	3.0
1½	5.7	5.2	2.6	2.1	2.1	3.0
2	7.5	6.8	3.4	2.7	2.7	3.0
3	10.7	9.6	4.8	3.9	3.8	6.0
5	16.7	15.2	7.6	6.1	6.3	9.0
7½	24	22	11	9	9.2	15.0
10	31	28	14	11	11.2	15.0
15	46	42	21	17	16.6	30.0
20	59	54	27	22	21.6	30.0
25	75	68	34	27	26.6	30.0
30	88	80	40	32	32.4	45.0
40	114	104	52	41	43.2	45.0
50	143	130	65	52	52	75.0
60	170	154	77	62	64	75.0
75	211	192	96	77	80	112.5
100	273	248	124	99	103	112.5
125	342	312	156	125	130	150.0
150	396	360	180	144	150	150.0
200	528	480	240	192	200	225.0

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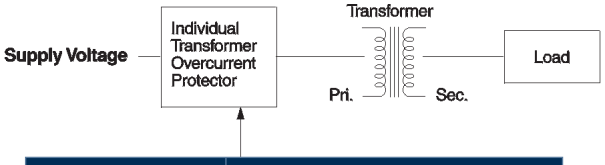
Fusing and circuit breaker protection. How to overcurrent protect 600 Volt Class transformers and associated wiring per NEC 450-3(b) and NEC 240-3.

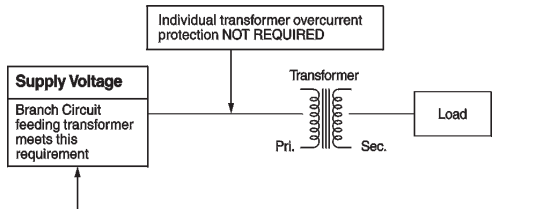
1. Primary protection only is required if the transformer is single-phase and the secondary has only two wires. Overcurrent protection rating and location are shown in Diagram A.



Primary Current	Overcurrent Protection Rating
Less than 2 amps	300% maximum
2 to 9 amps	167% maximum
9 amps or more	125% of rated primary current (or next highest standard rating)

Diagram A

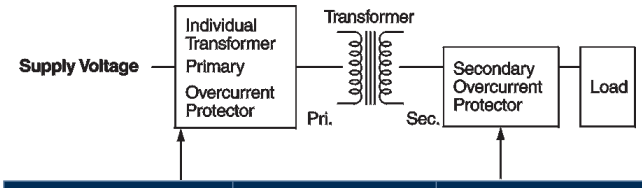
2. If the branch circuit feeding the transformer has overcurrent protection to meet the individual protection requirements in Example 1, then individual transformer protection is not required.



Primary Current	Overcurrent Protection Rating
Less than 2 amps	300% maximum
2 to 9 amps	167% maximum
9 amps or more	125% of rated primary current (or next highest standard rating)

Diagram B

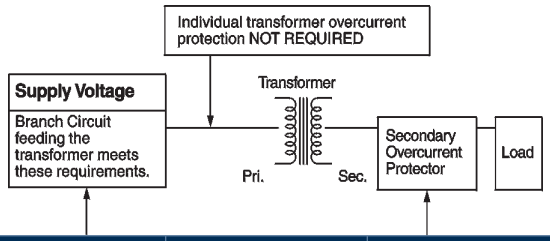
3. Primary and secondary protection is required if the transformer has more than two wires on the secondary circuit.



Primary Current	Secondary Current	Overcurrent Protection Rating
250% primary current	Less than 9 amps	167% maximum
Not more than 250%	9 amps or more	125% (or next higher standard rating)

Diagram C

4. If the branch circuit feeding the transformer has overcurrent protection to meet the individual primary overcurrent protection requirements in Example 3, then individual primary protection is not required. Secondary OCP is required as shown below.



Primary Current	Secondary Current	Overcurrent Protection Rating
250% primary current	Less than 9 amps	167% maximum
Not more than 250%	9 amps or more	125% (or next higher standard rating)

Diagram D

Section 240.6 (a) of the 2005 National Electrical Code*

The standard ampere ratings for fuses and inverse time circuit breakers shall be considered 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 110, 125, 150, 175, 200, 225, 250, 300, 350, 400, 450, 500, 600, 700, 800, 1000, 1200, 1600, 2000, 2500, 3000, 4000, 5000 and 6000 amperes. Additional standard ratings for fuses shall be considered 1, 3, 6, 10 and 601. The use of fuses and inverse time circuit breakers with nonstandard ampere ratings shall be permitted.

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Primary Fuse Recommendations

	Primary Voltage												
V_{in}	120	200	208	220	230	240	277	440	460	480	550	575	600
VA													
50	1.25 (2)	.75 (1.25)	.6 (1.13)	.6 (1.13)	.6 (1)	.6 (1)	.5 (.8)	.3 (.5)	.3 (.5)	.3 (.5)	.25 (.4)	.25 (.4)	.25 (.4)
75	1.8 (3)	1.13 (1.8)	1 (1.8)	1 (1.6)	.8 (1.6)	.8 (1.5)	.8 (1.25)	.5 (.8)	.4 (.8)	.4 (.75)	.4 (.6)	.3 (.6)	.3 (.6)
100	2.5 (4)	1.5 (2.5)	1.4 (2.25)	1.25 (2.25)	1.25 (2)	1.25 (2)	1 (1.8)	.6 (1.13)	.6 (1)	.6 (1)	.5 (.8)	.5 (.8)	.5 (.8)
150	3.5 (6.25)	2.25 (3.5)	2 (3.5)	2 (3.2)	1.8 (3.2)	1.8 (3)	1.6 (2.5)	1 (1.6)	.8 (1.6)	.8 (1.5)	.8 (1.25)	.75 (1.25)	.75 (1.25)
200	5 (8)	3 (5)	2.8 (4.5)	2.5 (4.5)	2.5 (4)	2.5 (4)	2 (3.5)	1.25 (2.25)	1.25 (2)	1.25 (2)	1 (1.8)	1 (1.5)	1 (1.6)
250	3 (5)	3.5 (6.25)	3.5 (6)	3.2 (5.6)	3.2 (5)	3 (5)	2.5 (4.5)	1.6 (2.8)	1.6 (2.5)	1.5 (2.5)	1.25 (2.25)	1.25 (2)	1.25 (2)
300	4 (6.25)	4.5 (7.5)	4 (7)	4 (6.25)	3.5 (6.25)	3.5 (6.25)	3.2 (5)	2 (3.2)	1.8 (3.2)	1.8 (3)	1.6 (2.5)	1.5 (2.5)	1.5 (2.5)
350	4.5 (7)	5 (8)	5 (8)	4.5 (7.5)	4.5 (7.5)	4 (7)	3.5 (6.25)	2.25 (3.5)	2.25 (3.5)	2 (3.5)	1.8 (3)	1.8 (3)	1.75 (2.5)
500	6.25 (10)	4 (6.25)	4 (6)	3.5 (5.6)	3.5 (5)	3 (5)	5 (9)	3.2 (5.6)	3.2 (5)	3 (5)	2.5 (4.5)	2.5 (4)	2.5 (4)
750	10 (15)	6.25 (9)	6 (9)	5.6 (8)	5 (8)	5 (7.5)	8 (12)	5 (8)	4.5 (8)	4.5 (7.5)	4 (6.25)	3.5 (6.25)	3.5 (6.25)
1000	12 (20)	8 (12)	8 (12)	7.5 (10)	7 (10)	6.25 (10)	10 (17.5)	3.5 (5.6)	3.6 (5)	3 (5)	5 (9)	5 (8)	5 (8)
1500	17.5 (30)	12 (15)	12 (15)	10 (15)	10 (15)	10 (15)	15 (25)	5.6 (8)	5 (8)	5 (7.5)	4.5 (6.25)	4.5 (6.25)	4.5 (6.25)
2000	25 (40)	15 (25)	15 (20)	15 (20)	12 (20)	12 (20)	20 (35)	7.5 (10)	7 (10)	6.25 (10)	6 (9)	5.6 (8)	5 (8)
3000	35 (60)	20 (35)	20 (35)	17.5 (30)	17.5 (30)	20 (30)	35 (50)	10 (15)	10 (15)	10 (15)	9 (12)	8 (12)	8 (12)
5000	60 (100)	35 (60)	30 (60)	30 (50)	30 (50)	30 (50)	60 (90)	15 (25)	15 (25)	15 (25)	12 (20)	12 (20)	12 (20)
7500	80 (150)	50 (90)	45 (90)	45 (80)	45 (80)	40 (70)	90 (125)	25 (40)	25 (40)	20 (35)	20 (30)		
10K	110 (200)	70 (125)	60 (110)	60 (110)	60 (110)	60 (100)	110 (175)	30 (50)	30 (50)	30 (50)	25 (45)		
15K	175 (300)	100 (175)	90 (175)	90 (150)	90 (150)	80 (150)	175 (250)	45 (80)	45 (80)	40 (70)	35 (60)		
25K	300 (500)	175 (300)	150 (300)	150 (250)	150 (250)	150 (250)	90 (250)	60 (70)	70 (125)	70 (125)	60 (110)		
37K						200 (350)				100 (175)			80 (150)
50K						300 (500)				150 (250)			110 (200)
75K						400 (750)				200 (350)			175 (300)
100K						600 (1000)				300 (500)			225 (400)
167K						900 (1600)				450 (850)			350 (650)

Fuse = I*300% next size smaller if primary current is less than 2 amp. No secondary fusing required.
(Fuse) = (I*500%) next size smaller if used for a motor control circuit per NEC 430-72[C] exception No. 4

Fuse = I*167% next size smaller if primary current is less than 9 amp. No secondary fusing required.
(Fuse) = (I*250%) next size smaller if primary current is less than 9 Amps. and secondary fusing is required see chart for size.

Fuse = I*125% next size higher if primary current is 9 amp. or higher. No secondary fusing required.
(Fuse) = (I*250%) next size smaller if primary current is 9 Amps. or higher. Secondary fusing is required see chart for size.

Recommended fuse sizes per UL 508 and NEC450-3 (B) (1), NED 430-72 and commercially available type fuses.

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Secondary Fuse Recommendations

Secondary Voltage							
V_{OUT}	24	110	115	120	220	230	240
VA	Secondary Time Delay Dual Element Slow-Blow Fuse						
50	3.2	0.75	0.6	0.6	0.3	0.3	0.3
75	5	1.125	1	1	0.5	0.5	0.5
100	6.25	1.5	1.4	1.25	0.75	0.6	0.6
150	10	2.25	2	2	1.13	1	1
200	12	3	2.8	2.5	1.5	1.4	1.25
250	15	3.5	3.5	3.2	1.8	1.8	1.6
300	20	4.5	4	4	2.25	2	2
350	20	5	5	4.5	2.5	2.5	2.25
500	30	7.5	7	6.25	3.5	3.5	3.2
750	40	10	10	10	5.6	5	5
1000		12	12	12	7	7	6.25
1500		17.5	17.5	17.5	10	10	10
2000		25	25	25	12	12	12
3000		35	35	35	17.5	17.5	17.5
5000		60	60	60	30	30	30
7500		90	90	80	45	45	40
10K		125	110	110	60	60	60
15K		175	175	175	90	90	80
25K		300	300	300	150	150	150
37.5K				400			200
50K				600			300
75K				800			400
100K				1200			600
167K				1800			900

Fuse = I*167% next size smaller if secondary current is less than 9 amp.

Fuse = I*125% next size smaller if secondary current is 9 amp. or higher.

Primary Overcurrent Protection

A transformer has all the same component parts as a motor, and like a motor, exhibits an inrush when energized. This inrush current is dependent upon where in the sine wave the transformer was last turned off in relation to the point of the sinewave you are when you energize the transformer. Although transformer inrush could run up to 30 to 35 times full load current under no load, it typically is the same as a motor...about 6 to 8 times normal running current. For this reason it is important to use a dual element slow blow type fuse - the same type of fuse you would use with a motor. If using a circuit breaker, select a breaker with a time delay – again the same type you would use with a motor. If the time delay is not sufficient, you may experience “nuisance tripping” – a condition where the breaker trips when energizing the transformer but when you try it again, it works fine.

Secondary Overcurrent Protection

Overcurrent devices are used between the output terminals of the transformer and the load for three reasons:

1. Protect the transformer from load electrical anomalies.
2. Since short circuit current is minimized, a smaller gauge wire may be used between the transformer and the load.
3. Per NEC, a larger primary fuse may be used to reduce nuisance tripping.

Dry-type transformers, 600V Class, isolation type, single and three phase, through 500 kVA. Indoor and outdoor models available.

Accessories and Optional Design Styles*

- Wall mounting brackets (500 lbs maximum)
- Weather Shields (UL-3R)
- Stainless Steel Enclosures
- Totally enclosed non-ventilated designs (TENV)
- Open core and coil designs
- Copper Wound designs
- NEMA 4/12 or 4X Encapsulated Enclosures
- Low temperature designs

Features

- UL-3R ventilated outdoor enclosures when used with optional weather shields (order separately)
- UL Class 220°C insulation system, 150°C temperature rise under full load
- Electrostatically shielded for quality power
- Terminal board connections and spacious wiring compartment
- Panel enclosure design reduces labor time. Wiring diagram on inside front cover.

ENERGY STAR Listed Certified

- High efficiency for low cost operation
- Compliant to NEMA TP-1 Standards
- Class 220°C insulation system
- Single and three phase availability
- Fast delivery
- 10 years + 2 warranty

* Not all optional designs are UL listed. Contact Technical Services.

Selection Tables: Single Phase

Group 1 – 240 x 480 Volt Primary, 120/240 Secondary, 60 Hz

kVA	Catalog Number	NEMA 3R Weather Shield*	Height (inch)	Width (inch)	Depth (inch)	Approx. Ship Weight (lbs)	Design Style**	Elec Conn**	Primary Amps	Secondary Amps
15	**ES5H15S**	**WS-15**	23	16	16	175	1	1	62.5/31.3	125/62.5
25	**ES5H25S**	**WS-15**	28	16	16	265	1	1	104/52.1	208/104
37.5	**ES5H37S**	**WS-17**	31	18	18	340	1	1	156/78	313/156
50	**ES5H50S**	**WS-17**	31	18	18	425	1	1	208/104	416/208
75	**ES5H75S**	**WS-09**	44	23	21	655	1	1	313/156	625/313
100	**ES5H100S**	**WS-09**	44	23	21	750	1	1	417/208	833/417
167	**ES5H167S**	**WS-16**	46	26	24	980	1	1	695/348	1392/695

Group 2 – 600 Volt Primary, 120/240 Secondary, 60 Hz

kVA	Catalog Number	NEMA 3R Weather Shield*	Height (inch)	Width (inch)	Depth (inch)	Approx. Ship Weight (lbs)	Design Style**	Elec Conn**	Primary Amps	Secondary Amps
15	**ES10H15S**	**WS-15**	23	16	16	175	1	4	25	125/62.5
25	**ES10H25S**	**WS-15**	28	16	16	265	1	4	41.7	208/104
37.5	**ES10H37S**	**WS-17**	31	18	18	340	1	4	62.5	313/156
50	**ES10H50S**	**WS-17**	31	18	18	425	1	4	83.3	416/208
75	**ES10H75S**	**WS-09**	44	23	21	655	1	4	125	625/313
100	**ES10H100S**	**WS-09**	44	23	21	750	1	4	167	833/417
167	**ES10H167S**	**WS-16**	46	26	24	980	1	4	278	1392/695

* Weather shields (set of two) must be ordered separately.

**Design Style and Electrical Connections can be found on pages 20 & 21.

Selection Tables: Three Phase

Group A – 480 Volt Δ Primary, 208/120 Secondary, 60 Hz

kVA	Catalog Number	NEMA 3R Weather Shield*	Height (inch)	Width (inch)	Depth (inch)	Approx. Ship Weight (lbs)	Design Style**	Elec Conn**	Primary Amps	Secondary Amps
15	ET2H15S	WS-02	23	18	14	205	1	2	18.1	41.7
30	ET2H30S	WS-14	28	23	16	305	1	2	36.1	83.4
45	ET2H45S	WS-14	28	23	16	405	1	2	54.2	125
75	ET2H75S	WS-30	34	28	22	535	1	2	90.3	208
112.5	ET2H112S	WS-30	34	28	22	805	1	2	135	313
150	ET2H150S	WS-10	44	33	21	972	1	2	181	417
225	ET2H225S	WS-11	46	36	24	1350	1	2	271	625
300	ET2H300S	WS-11	46	36	24	1515	1	2	361	834
500	ET2H500S	WS-12	65	45	35	2460	1	2	602	1390

Group B – 480 Volt Δ Primary, 240 Volt Δ, Secondary with reduced capacity center tap, 60 Hz

kVA	Catalog Number	NEMA 3R Weather Shield**	Height (inch)	Width (inch)	Depth (inch)	Approx. Ship Weight (lbs)	Design Style**	Elec Conn**	Primary Amps	Secondary Amps
15	ET5H15S	WS-02	23	19	14	205	1	3	18.1	36.1
30	ET5H30S	WS-14	28	23	16	305	1	3	36.1	72.3
45	ET5H45S	WS-14	28	23	16	405	1	3	54.2	108
75	ET5H75S	WS-30	34	28	22	535	1	3	90.3	181
112.5	ET5H112S	WS-30	34	28	22	805	1	3	135	271
150	ET5H150S	WS-10	44	33	21	972	1	3	181	361
225	ET5H225S	WS-11	46	36	24	1325	1	3	271	542
300	ET5H300S	WS-11	46	36	24	1515	1	3	361	723
500	ET5H500S	WS-12	65	45	35	2460	1	3	602	1204

Group C – 480 Volt Δ Primary, 480Y/277 Secondary, 60 Hz

kVA	Catalog Number	NEMA 3R Weather Shield*	Height (inch)	Width (inch)	Depth (inch)	Approx. Ship Weight (lbs)	Design Style**	Elec Conn**	Primary Amps	Secondary Amps
15	ET81H15S	WS-02	23	18	14	205	1	5	18.1	18.1
30	ET81H30S	WS-14	28	23	16	305	1	5	36.1	36.1
45	ET81H45S	WS-14	28	23	16	405	1	5	54.2	54.2
75	ET81H75S	WS-30	34	28	22	535	1	5	90.3	90.3
112.5	ET81H112S	WS-30	34	28	22	805	1	5	135	135
150	ET81H150S	WS-10	44	33	21	972	1	5	181	181
225	ET81H225S	WS-11	46	36	24	1325	1	5	271	271
300	ET81H300S	WS-11	46	36	24	1515	1	5	361	361
500	ET81H500S	WS-12	65	45	35	2460	1	5	602	602

* Weather shields (set of two) must be ordered separately.

**Design Style and Electrical Connections can be found on pages 20 & 21.

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Group D – 208 Volt Δ Primary, 208Y/120 Secondary, 60 Hz

kVA	Catalog Number	NEMA 3R Weather Shield*	Height (inch)	Width (inch)	Depth (inch)	Ship Weight Approx. (lbs)	Design Style**	Elec Conn**	Primary Amps	Secondary Amps
15	ET3H15S	WS-02	23	18	14	205	1	6	41.7	41.7
30	ET3H30S	WS-14	28	23	16	305	1	6	83.4	83.4
45	ET3H45S	WS-14	28	23	16	405	1	6	125	125
75	ET3H75S	WS-30	34	28	22	535	1	6	208	208
112.5	ET3H112S	WS-30	34	28	22	805	1	6	313	313

Group E – 208 Volt Δ Primary, 480Y/277 Secondary, 60 Hz

kVA	Catalog Number	NEMA 3R Weather Shield*	Height (inch)	Width (inch)	Depth (inch)	Ship Weight Approx. (lbs)	Design Style**	Elec Conn**	Primary Amps	Secondary Amps
15	ET84H15S	WS-02	23	18	14	205	1	7	41.7	18.1
30	ET84H30S	WS-14	28	23	16	305	1	7	83.4	36.1
45	ET84H45S	WS-14	28	23	16	405	1	7	125	54.2
75	ET84H75S	WS-30	34	28	22	535	1	7	208	90.3
112.5	ET84H112S	WS-30	34	28	22	805	1	7	313	135
150	ET84H150S	WS-10	44	33	21	972	1	7	417	181

Group F – 240 Volt Δ Primary, 208Y/120 Secondary, 60 Hz

kVA	Catalog Number	NEMA 3R Weather Shield*	Height (inch)	Width (inch)	Depth (inch)	Ship Weight Approx. (lbs)	Design Style**	Elec Conn**	Primary Amps	Secondary Amps
15	ET6H15S	WS-02	23	18	14	205	1	8	36.1	41.7
30	ET6H30S	WS-14	28	23	16	305	1	8	72.3	83.4
45	ET6H45S	WS-14	28	23	16	405	1	8	108	125
75	ET6H75S	WS-30	34	28	22	535	1	8	181	208
112.5	ET6H112S	WS-30	34	28	22	805	1	8	271	313
150	ET6H150S	WS-10	44	33	21	972	1	8	361	417

Group G – 240 Volt Δ Primary, 480Y/277 Secondary, 60 Hz

kVA	Catalog Number	NEMA 3R Weather Shield*	Height (inch)	Width (inch)	Depth (inch)	Ship Weight Approx. (lbs)	Design Style**	Elec Conn**	Primary Amps	Secondary Amps
15	ET85H15S	WS-02	23	18	14	205	1	9	18.1	41.7
30	ET85H30S	WS-14	28	23	16	305	1	9	36.1	83.4
45	ET85H45S	WS-14	28	23	16	405	1	9	54.2	125.0
75	ET85H75S	WS-30	34	28	22	535	1	9	90.3	208.0
112.5	ET85H112S	WS-30	34	28	22	805	1	9	135	313.0
150	ET85H150S	WS-10	44	33	21	972	1	9	181	417.0
225	ET85H225S	WS-11	46	36	24	1325	1	9	271	625.0
300	ET85H300S	WS-11	46	36	24	1515	1	9	361	834.0
500	ET85H500S	WS-12	65	45	35	2460	1	9	602	1390.0

* Weather shields (set of two) must be ordered separately.

**Design Style and Electrical Connections can be found on pages 20 & 21.

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Group H – 600 Volt Δ Primary, 208Y/120 Secondary, 60 Hz

kVA	Catalog Number	NEMA 3R Weather Shield*	Height (inch)	Width (inch)	Depth (inch)	Approx. Ship Weight (lbs)	Design Style**	Elec Conn**	Primary Amps	Secondary Amps
15	**ET7H15S**	**WS-02**	23	18	14	205	1	10	14.5	41.7
30	**ET7H30S**	**WS-14**	28	23	16	305	1	10	28.9	83.4
45	**ET7H45S**	**WS-14**	28	23	16	405	1	10	43.4	125
75	**ET7H75S**	**WS-30**	34	28	22	535	1	10	72.3	208
112.5	**ET7H112S**	**WS-30**	34	28	22	805	1	10	108	313
150	**ET7H150S**	**WS-10**	44	33	21	972	1	10	145	417
225	**ET7H225S**	**WS-11**	46	36	24	1325	1	10	217	625
300	**ET7H300S**	**WS-11**	46	36	24	1515	1	10	289	834
500	**ET7H500S**	**WS-12**	65	45	35	2460	1	10	482	1390

Group I – 600 Volt Δ Primary, 480Y/277 Secondary, 60 Hz

kVA	Catalog Number	NEMA 3R Weather Shield*	Height (inch)	Width (inch)	Depth (inch)	Ship Weight Approx. (lbs)	Design Style**	Elec Conn**	Primary Amps	Secondary Amps
15	**ET71H15S**	**WS-02**	23	18	14	205	1	11	14.5	18.1
30	**ET71H30S**	**WS-14**	28	23	16	305	1	11	28.9	36.1
45	**ET71H45S**	**WS-14**	28	23	16	405	1	11	43.4	54.2
75	**ET71H75S**	**WS-30**	34	28	22	535	1	11	72.3	90.3

Group J – 480 Volt Δ Primary, 208Y/120 Secondary, 60 Hz, Copper-Wound

kVA	Catalog Number	NEMA 3R Weather Shield*	Height (inch)	Width (inch)	Depth (inch)	Ship Weight Approx. (lbs)	Design Style**	Elec Conn**	Primary Amps	Secondary Amps
15	**ET2H15SCU**	**WS-02**	23	18	14	205	1	2	18.1	41.7
30	**ET2H30SCU**	**WS-14**	28	23	16	305	1	2	36.1	83.4
45	**ET2H45SCU**	**WS-14**	28	23	16	405	1	2	54.2	125.0
75	**ET2H75SCU**	**WS-30**	34	28	22	535	1	2	90.3	208.0
112.5	**ET2H112SCU**	**WS-30**	34	28	22	805	1	2	135	313.0
150	**ET2H150SCU**	**WS-10**	44	33	21	972	1	2	181	417.0
225	**ET2H225SCU**	**WS-11**	46	36	24	1325	1	2	271	625.0
300	**ET2H300SCU**	**WS-11**	46	36	24	1515	1	2	361	834.0
500	**ET2H500SCU**	**WS-12**	65	45	35	2460	1	2	602	1390.0

* Weather shields (set of two) must be ordered separately.

**Design Style and Electrical Connections can be found on pages 20 & 21.

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Hevi-Duty low temperature rise transformers feature a 220°C insulation system and temperature rise of only 80°C or 115°C under full nameplate load. The result is 13-21% lower operating losses than conventional 150°C rise units. Reduction in temperature rise increases reliability.

The 35°C thermal reserve on 115°C rise units and 70°C reserve on 80°C rise units definitely mean higher reliability. The extra benefit is being able to operate either of these transformers as a 150°C rise unit and have an overload capability of 15-30% *without* compromising normal life expectancy (See Figure 2).

Low temperature rise transformers are designed for any critical application requiring extra overload capability, lower than average total losses and/or cooler operating temperatures. All are available with either a 115°C or 80°C thermal rise and a class 220°C insulation system.

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Accessories and Optional Design Styles*

- Wall mounting brackets (500 lbs maximum)
- Weather Shields (UL-3R)
- Stainless Steel Enclosures
- Totally enclosed non-ventilated designs (TENV)
- Open core and coil designs
- Copper Wound designs

* Not all optional designs are UL listed. Contact Technical Services.

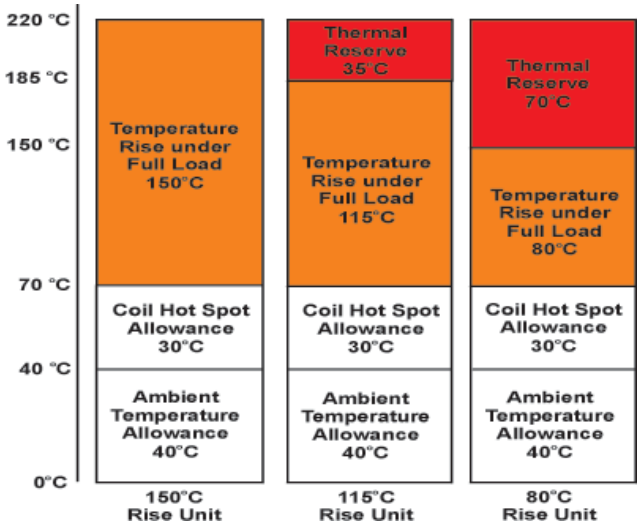

Figure 2

Selection Tables: Low Temperature Rise Single Phase

Listed Certified

Group 1 – 240 x 480 Volt Primary, 120/240 Secondary, 60 Hz

kVA	Catalog Number 80°C Rise	Catalog Number 115°C Rise	NEMA 3R Weather Shield*	Height (inch)	Width (inch)	Depth (inch)	Approx. Ship Weight (lbs)	Design Style**	Elec Conn**	Primary Amps	Secondary Amps
15	**ES5HB15S**	**ES5HF15S**	**WS-15**	28	16	16	265	1	1	62.5/31.3	125/62.5
25	**ES5HB25S**	**ES5HF25S**	**WS-17**	31	18	18	340	1	1	104/52.1	208/104
37.5	**ES5HB37S**	**ES5HF37S**	**WS-17**	31	18	18	425	1	1	156/78	313/156
50	**ES5HB50S**	**ES5HF50S**	**WS-09**	44	23	21	655	1	1	208/104	416/208
75	**ES5HB75S**	**ES5HF75S**	**WS-09**	44	23	21	750	1	1	313/156	625/313
100	**ES5HB100S**	**ES5HF100S**	**WS-16**	46	26	24	980	1	1	417/208	833/417

Group 2 – 600 Volt Primary, 120/240 Secondary, 60 Hz

kVA	Catalog Number 80°C Rise	Catalog Number 115°C Rise	NEMA 3R Weather Shield*	Height (inch)	Width (inch)	Depth (inch)	Approx. Ship Weight (lbs)	Design Style**	Elec Conn**	Primary Amps	Secondary Amps
15	**ES10HB15S**	**ES10HF15S**	**WS-15**	28	16	16	265	1	4	25	125/62.5
25	**ES10HB25S**	**ES10HF25S**	**WS-17**	31	18	18	340	1	4	41.7	208/104
37.5	**ES10HB37S**	**ES10HF37S**	**WS-17**	31	18	18	425	1	4	62.5	313/156
50	**ES10HB50S**	**ES10HF50S**	**WS-09**	44	23	21	655	1	4	83.3	416/208
75	**ES10HB75S**	**ES10HF75S**	**WS-09**	44	23	21	750	1	4	125	625/313
100	**ES10HB100S**	**ES10HF100S**	**WS-16**	46	26	24	980	1	4	167	833/417

* Weather shields (set of two) must be ordered separately.

**Design Style and Electrical Connections can be found on page.

Selection Tables: Low Temperature Rise Three Phase

Group A – 480 Δ Primary, 208Y/120 Secondary, 60 Hz

kVA	Catalog Number 80°C Rise	Catalog Number 115°C Rise	NEMA 3R Weather Shield*	Height (inch)	Width (inch)	Depth (inch)	Approx. Ship Weight (lbs)	Design Style**	Elec Conn**	Primary Amps	Secondary Amps
15	**ET2HB15S**	**ET2HF15S**	WS-14	28	23	16	305	1	2	18.1	41.7
30	**ET2HB30S**	**ET2HF30S**	WS-14	28	23	18	405	1	2	36.1	83.4
45	**ET2HB45S**	**ET2HF45S**	WS-30	34	28	22	535	1	2	54.2	125
75	**ET2HB75S**	**ET2HF75S**	WS-30	34	28	22	805	1	2	90.3	208
112.5	**ET2HB112S**	**ET2HF112S**	WS-10	44	33	21	972	1	2	135	313
150	**ET2HB150S**	**ET2HF150S**	WS-11	46	36	24	1325	1	2	181	417
225	**ET2HB225S**	**ET2HF225S**	WS-11	46	36	24	1515	1	2	271	625
300	**ET2HB300S**	**ET2HF300S**	WS-12	65	45	35	2460	1	2	361	834

* Weather shields (set of two) must be ordered separately.

**Design Style and Electrical Connections can be found on pages 20 & 21.

K-Factor transformers are designed to reduce the heating effects of harmonic currents created by loads like those shown in Chart A. The K-Factor rating is an index of the transformer's ability to withstand harmonic content while operating within the temperature limits of its insulating system. Hevi-Duty K-Factor transformers have UL ratings of K-4, K-13, and K-20.

The Hevi-Duty K-Factor design is a specialized transformer that offers these benefits:

- Conductors capable of carrying the harmonic currents of non-linear loads without exceeding the temperature rating of the insulation system.
- A transformer design that takes into account the increase in naturally occurring "stray" losses caused by non-linear loads. These losses cause standard transformers to dramatically overheat and substantially shorten design life.
- A core and coil design that manages the DC flux caused by triplen harmonics. As these harmonics increase, they cause additional current to circulate in the delta winding. This produces a DC flux in the core which leads to core saturation, voltage instability and overheating.

Features

- Conductors to carry harmonics of a K-rated load without exceeding insulation temperature ratings.
- UL 1561 listed up to K-20 rated protection.
- Rated temperature rise of 150°C, 220°C insulation.
- Shielded for quality power.
- Basic design takes "stray losses" into account and functions within safe operating temperatures.
- Core and coil design engineered to manage the zero sequence flux caused by triplen harmonics.
- Provides 100% rated current without overheating the windings or saturating the core.

ENERGY STAR UL Listed CSA Certified

Accessories and Optional Design Styles*

- Wall mounting brackets (500 lbs maximum)
- Weather Shields (UL-3R)
- Totally enclosed non-ventilated designs (TENV)
- Low temperature rise units available
- Open core and coil designs
- Copper Wound designs

* Not all optional designs are UL listed. Contact Technical Services.

Typical Load K-Factors

Load	K-Factor
Electric discharge lighting	K-4
UPS with optional input filtering	K-4
Welders	K-4
Induction heating equipment	K-4
PLCs and solid state controls (other than variable speed drives)	K-4
Telecommunications equipment (e.g.. PBX)	K-13
UPS without input filtering	K-13
Multiwire receptacle circuits in general care areas of health care facilities and classrooms of schools, etc.	K-13
Multiwire receptacle circuits supplying inspection or testing equipment on an assembly or production line	K-13
Mainframe computer loads	K-20
Solid state motor drives (variable speed drives)	K-20
Multiwire receptacle circuits in critical care areas and operating/recovery rooms of hospitals	K-20

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Listed Certified

Group A – K-4 Rated 480 Δ Primary, 208Y/120 Secondary, 60 Hz

kVA	Catalog Number	NEMA 3R Weather Shield*	Height (inch)	Width (inch)	Depth (inch)	Approx. Ship Weight (lbs)	Design Style**	Elec Conn**	Primary Amps	Secondary Amps
15	3H4T2H15S	WS-02	23	18	14	180	1	2	18.1	41.7
30	3H4T2H30S	WS-14	28	23	16	329	1	2	36.1	83.4
45	3H4T2H45S	WS-14	28	23	16	357	1	2	54.2	125
75	3H4T2H75S	WS-30	34	28	22	647	1	2	90.3	208
112.5	3H4T2H112S	WS-10	44	33	21	890	1	2	135	313
150	3H4T2H150S	WS-10	44	33	21	1045	1	2	181	417
225	3H4T2H225S	WS-11	46	36	24	1230	1	2	271	625
300	3H4T2H300S	WS-11	46	36	24	1420	1	2	361	834
500	3H4T2H500S	WS-12	65	45	35	2460	1	2	602	1390

Group B – K-13 Rated 480 Δ Primary, 208Y/120 Secondary, 60 Hz

kVA	Catalog Number	NEMA 3R Weather Shield*	Height (inch)	Width (inch)	Depth (inch)	Ship Weight (lbs)	Design Style**	Elec Conn**	Primary Amps	Secondary Amps
15	3H13T2H15S	WS-14	28	23	16	305	1	2	18.1	41.7
30	3H13T2H30S	WS-30	34	28	22	405	1	2	36.1	83.4
45	3H13T2H45S	WS-30	34	28	22	535	1	2	54.2	125
75	3H13T2H75S	WS-30	34	28	22	805	1	2	90.3	208
112.5	3H13T2H112S	WS-10	44	33	21	972	1	2	135	313
150	3H13T2H150S	WS-11	46	36	24	1325	1	2	181	417
225	3H13T2H225S	WS-11	46	36	24	1515	1	2	271	625
300	3H13T2H300S	WS-12	65	45	35	2460	1	2	361	834

Group C – K-20 Rated 480 Δ Primary, 208Y/120 Secondary, 60 Hz

kVA	Catalog Number	NEMA 3R Weather Shield*	Height (inch)	Width (inch)	Depth (inch)	Ship Weight (lbs)	Design Style**	Elec Conn**	Primary Amps	Secondary Amps
15	3H20T2H15S	WS-14	28	23	16	305	1	2	18.1	41.7
30	3H20T2H30S	WS-30	34	28	22	405	1	2	36.1	83.4
45	3H20T2H45S	WS-30	34	28	22	535	1	2	54.2	125
75	3H20T2H75S	WS-30	34	28	22	805	1	2	90.3	208
112.5	3H20T2H112S	WS-10	44	33	21	972	1	2	135	313
150	3H20T2H150S	WS-11	46	36	24	1325	1	2	181	417
225	3H20T2H225S	WS-11	46	36	24	1515	1	2	271	625
300	3H20T2H300S	WS-12	65	45	35	2460	1	2	361	834

Hevi-Duty is pleased to offer the broadest range of transformers on the market including many custom designs. If you can't find what you are looking for here, please fill out the information below and submit to our Technical Services Group. We are happy to provide a quote on a custom transformer if available.

Date:

Customer Information

Contact:	Phone/Fax:
Address:	Email:
City/State:	

Specifications*

*Size (Required)		*Quantity		Temperature Rise (Check One)
	☐ kVA		☐ One Time Buy	☐ 80°C ☐ 115°C ☐ 150°C
	☐ VA		☐ Annual Usage	

Check all that apply:

Three Phase	Single Phase
☐ 50 Hz	☐ 60 Hz (Standard)
☐ Copper Windings	☐ Aluminum Windings (Standard)
No Electrostatic Shield	
☐ LVGP	☐ SCR Drive Isolation
☐ Energy Star	☐ K-Factor 13
☐ K-Factor 4	☐ K-Factor 20
☐ Other:	

Enclosure Type (Check One)

VENTILATED	ENCAPSULATED	ENCLOSED (NON-UL)
☐ Open Coil **	☐ NEMA 3R	☐ TENV
☐ NEMA 1	☐ NEMA 3R (SS)	☐ TENV (SS)
☐ NEMA 1 (SS)	☐ NEMA 4/12 (SS)	
☐ NEMA 3R (WSXX)	☐ NEMA 4X (SS)	
☐ NEMA 3R (SS)		
(SS) STAINLESS STEEL GRADE: ☐ Standard (304) ☐ Optional (316)		

Industrial Control Transformers

☐ ICE ☐ HSZ Series ☐ Other:

*Primary Voltage			*Secondary Voltage		
☐ 120	Taps:	☐ Standard	☐ 120		
☐ 208		☐ Other	☐ 208		
☐ 240			☐ 240		
☐ 480	If 3 Phase:	☐ Delta (Standard)	☐ 480	If 3 Phase:	☐ Delta (Standard)
☐ 600		☐ Wye	☐ 600		☐ Wye
☐ Other Voltage: _____			☐ Other Voltage: _____		

Agency Certifications

Check all that apply: ☐ UL ☐ CSA or cUL ☐ CE ☐ Other: _____

Additional Information

Please quote a Catalog or Design Number ☐ Similar to :

(if "similar to" note changes above) ☐ Exactly Like:

*Does this request pertain to a bid specification? ☐ Yes ☐ No

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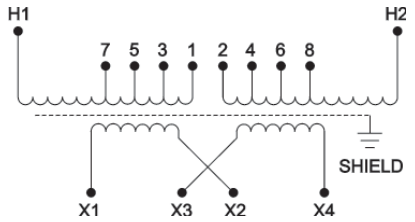
240 x 480 Volt Primary,
120/240 Volt Secondary
Taps: 2, 2½% FCAN; 4, 2½% FCBN

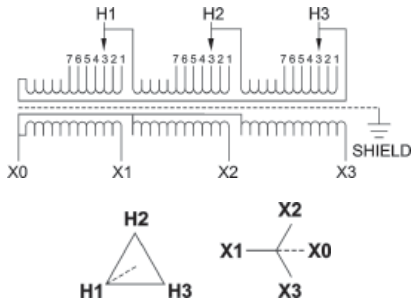
1



Primary Voltage	Interconnect	Connect Lines To
504	1 to 2	H1 & H2
492	2 to 3	H1 & H2
480	3 to 4	H1 & H2
468	4 to 5	H1 & H2
456	5 to 6	H1 & H2
444	6 to 7	H1 & H2
432	7 to 8	H1 & H2
252	H1 to 2 H2 to 1	H1 & H2
240	H1 to 4 H2 to 3	H1 & H2
228	H1 to 6 H2 to 5	H1 & H2
216	H1 to 8 H2 to 7	H1 & H2
Secondary Voltage	**Interconnect**	**Connect Lines To**
240	X2 to X3	X1 & X4
120-0-120	X2 to X3 X2 to ⏚	X1-X2-X4
120	X1 to X3 X2 to X4	X1 & X4

480 Δ Volt Primary,
208Y/120 Volt Secondary
Taps: 2, 2½% FCAN; 4, 2½% FCBN

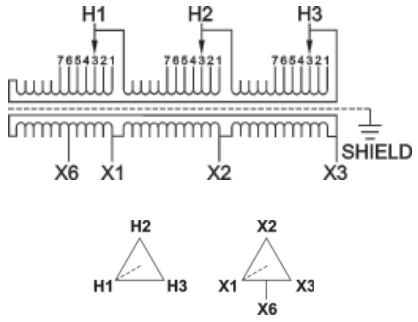
2



Primary H1-H2-H3		Secondary Voltage	
@ Tap	Voltage	X1, X2, X3	X0- X1, X2, X3
1	504	208	120
2	492		
3	480		
4	468		
5	456		
6	444		
7	432		

480 Δ Volt Primary,
240 Δ W/120 CT Volt Secondary
Taps: 2, 2½% FCAN; 4, 2½% FCBN

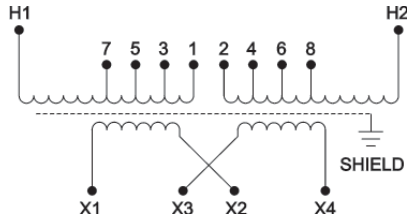
3



Primary H1-H2-H3		Secondary Voltage	
@ Tap	Voltage	X1, X2, X3	X6-X1, X6-X3
1	504	240	120
2	492		
3	480		
4	468		
5	456		
6	444		
7	432		

600 Volt Primary,
120/240 Volt Secondary
Taps: 2, 2½% FCAN; 4, 2½% FCBN

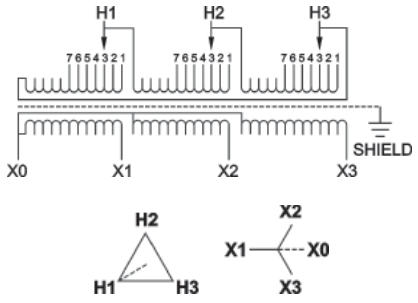
4



Primary H1-H2-H3	Interconnect	Connect Lines To
630	1 to 2	H1 & H2
615	2 to 3	H1 & H2
600	3 to 4	H1 & H2
585	4 to 5	H1 & H2
570	5 to 6	H1 & H2
555	6 to 7	H1 & H2
540	7 to 8	H1 & H2
Secondary Voltage	**Interconnect**	**Connect Lines To**
240	X2 to X3	X1 & X4
120-0-120	X2 to X3 X2 to ⏚	X1-X2-X4
120	X1 to X3 X2 to X4	X1 & X4

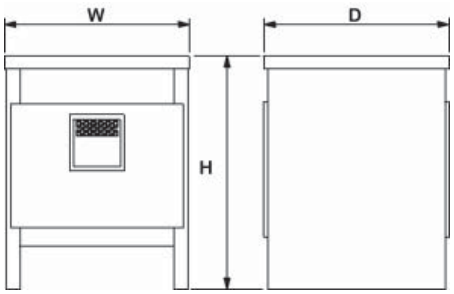
480 Δ Volt Primary
480Y/277 Volt Secondary
Taps: 2, 2½% FCAN; 4, 2½% FCBN

5



Primary H1-H2-H3		Secondary Voltage	
@ Tap	Voltage	X1, X2, X3	X0- X1, X2, X3
1	504	480	277
2	492		
3	480		
4	468		
5	456		
6	444		
7	432		

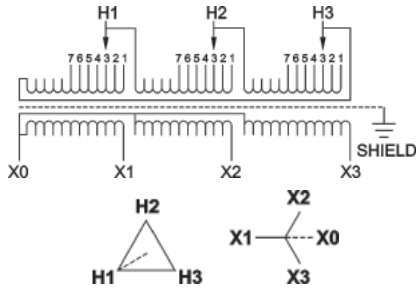
Design Style



Ventilated Design Style 1

208 Δ Volt Primary
208Y/120 Volt Secondary
Taps: 2, 2½% FCAN; 4, 2½% FCBN

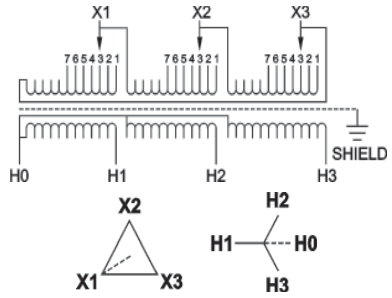
6



Primary H1-H2-H3		Secondary Voltage	
@ Tap	Voltage	X1, X2, X3	X0- X1, X2, X3
1	218	208	120
2	213		
3	208		
4	203		
5	198		
6	192		
7	187		

208 Δ Volt Primary,
480Y/277 Volt Secondary
Taps: 2, 2½% FCAN; 4, 2½% FCBN

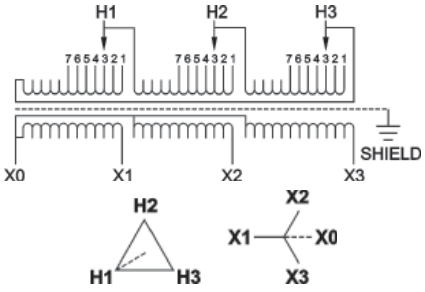
7



Primary H1-H2-H3		Secondary Voltage	
@ Tap	Voltage	H1-H2-H3	H0-H1, H2, H3
1	218	480	277
2	213		
3	208		
4	203		
5	198		
6	192		
7	187		

240 Δ Volt Primary
208Y/120 Volt Secondary
Taps: 2, 2½% FCAN; 4, 2½% FCBN

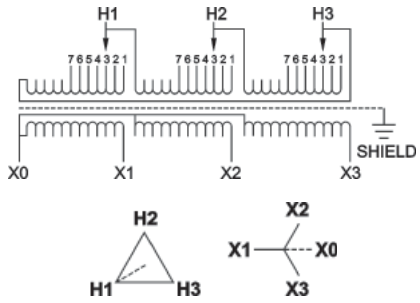
8



Primary H1-H2-H3		Secondary Voltage	
@ Tap	Voltage	X1, X2, X3	X0- X1, X2, X3
1	252	208	120
2	246		
3	240		
4	234		
5	228		
6	222		
7	216		

240 Δ Volt Primary
480Y/277 Volt Secondary
Taps: 2, 2½% FCAN; 4, 2½% FCBN

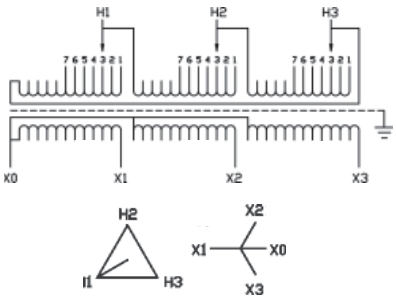
9



Primary H1-H2-H3		Secondary Voltage	
@ Tap	Voltage	X1, X2, X3	X0- X1, X2, X3
1	252	480	277
2	246		
3	240		
4	234		
5	228		
6	222		
7	216		

600 Δ Volt Primary
208Y/120 Volt Secondary
Taps: 2, 2½% FCAN; 4, 2½% FCBN

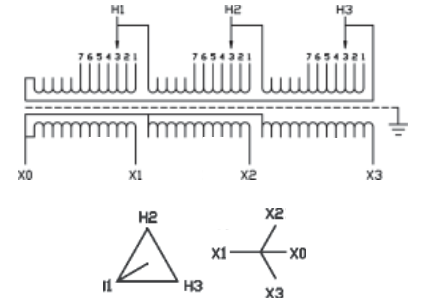
10



Primary H1-H2-H3		Secondary Voltage	
@ Tap	Voltage	X1, X2, X3	X0- X1, X2, X3
1	630	480	277
2	615		
3	600		
4	585		
5	570		
6	555		
7	540		

600 Δ Volt Primary
480Y/277 Volt Secondary
Taps: 2, 2½% FCAN; 4, 2½% FCBN

11



Primary H1-H2-H3		Secondary Voltage	
@ Tap	Voltage	X1, X2, X3	X0- X1, X2, X3
1	630	208	120
2	615		
3	600		
4	585		
5	570		
6	555		
7	540		

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Specification Guide for Low Voltage, General Purpose, Dry Type Transformers (600 Volt Class) - 15 kVA and larger

General

Single and three phase distribution transformers (600 Volt and below)

- Provide and install, as referenced on the electrical plans, enclosed dry type transformers as manufactured by Sola/Hevi-Duty or approved equal.

Standards

- Transformers must be listed by Underwriters Laboratory, certified with Canadian Standards Association and designed, constructed and rated in accordance with NEMA ST 20 and applicable IEEE & OSHA specifications.

Construction

Cores

- All transformer cores shall be constructed of low loss, high quality, electrical grade laminate steel. By design, the flux density is to be kept well below the saturation level to reduce audible sound level and minimize core losses. The core volume shall allow operation at 10% above rated primary voltage at no load without exceeding the temperature rise of the unit.

Coils

- Coil conductors shall be either aluminum or copper and must be continuous. The entire core and coil assembly shall be impregnated with a thermal setting varnish and cured to reduce hot spots in the coils and seal out moisture. Coils with exposed magnet wire will not be acceptable. Transformers shall have common core construction.

- All transformers shall incorporate a faraday (electrostatic) shield between primary and secondary windings for the attenuation of voltage spikes, line noise and voltage transients.

- Transformers shall be provided with six 2.5% full capacity taps – two above and four below primary rated voltage.

- General purpose transformers are classified as isolation transformers.

Enclosures

- Transformer enclosures shall be constructed of heavy gauge sheet steel and coated with a grey powder paint finish (ANSI 61). Ventilated transformer enclosures shall be UL/NEMA Type 1 rated and UL/NEMA Type 3R rated for outdoor use with the addition of a weather shield. This information must be listed on the transformer nameplate.

- Maximum transformer enclosure temperature will not exceed 65°C rise above a 40°C ambient under full load.

- Transformers must have vibration isolators located between the core and coil assembly and the transformer enclosure to reduce audible sound levels caused from magnetostriction of the transformer core. No externally located vibration dampening pads shall be used as they tend to increase audible noise. Ventilated transformers are to be floor mounted to a concrete pad.

- The transformer enclosure must be grounded by the installer in accordance with the latest edition of the National Electric Code and any local codes or ordinances.

Performance

- Audible sound levels will not exceed limits established in NEMA ST20:

10 to 50 kVA	45 db
51 to 150 kVA	50 db
151 to 300 kVA	55 db
301 to 500 kVA	60 db

- Transformers, 15 kVA to 500 kVA, shall incorporate a UL recognized 220°C insulation system and exhibit a maximum 150°C temperature rise above a maximum ambient of 40°C under full load.

Warranty

- Transformers are warranted against material, performance and workmanship defects for a period of ten (10) years from date of manufacture with the provision for an additional two (2) years.

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AC (Alternating Current)

Current that reverses direction in response to voltage that is changing polarity.

Attenuation

Decrease in signal voltage or power.

CE Mark (Conformité Européenne)

A marking that shows the product meets the fundamental safety, health, environmental and consumer protection requirements of the European Community.

Common-Mode Noise

Noise that occurs between the current carrying conductors and ground.

CVT (Constant Voltage Transformer)

A power conditioner that provides a stable and regulated sinewave output voltage.

Continuous Duty

The service requirement that demands operation at a constant load for an indefinite period of time.

Control Transformer

Usually referred to as an Industrial Control transformer. Designed for good voltage regulation characteristics when low power factor and /or large inrush currents are drawn (5 to 15 times normal).

CSA Canadian Standard Association.

DC (Direct Current)

Current that flows in only one direction.

Derating

The specified reduction in an operating parameter to improve reliability.

Dynamic Load Regulation

The ratio of change in output voltage to change in load current.

Eddy Currents

Additional currents caused by a magnetic field.

Efficiency

A measure of energy loss in a circuit.

EMC (Electromagnetic Compatibility)

A directive necessary to get the CE Mark, which shows the electrical device will not create high levels of EMI and will not fail due to normal levels of EMI.

Encapsulated

A method of sealing a device with epoxy to resist environmental effects.

EPACT 2005

Energy Policy Act of 2005.

Energy Star

Department of Energy program promoting energy efficient appliances and apparatus.

Force Air Cooled

A means of accelerating heat dissipation to lower the temperature rise of an electrical device.

Frequency (Hertz)

Cycles per second.

Harmonics Distortion

The distortion of the AC waveform due to the addition of sine waves of different frequencies being added to the AC voltage.

Input Voltage Range

The high and low input voltage limits within which a device meets its specifications.

kVA Rating

A measurement of apparent power. 1 kVA = 1000 VA.

KW Rating (kilowatts)

A measurement of real power delivered to a load
1 KW = 1000 VA x Power Factor

Line Regulation

The change in output voltage due to a variation in input voltage.

Load Regulation

The change in output voltage due to a variation in load.

NEMA TP1, TP2, TP3

NEMA TP-1 is the National Electrical Manufacturer Association's Guide for Determining Energy Efficiency for Distribution Transformers. TP-2 is a related Test Method for Measuring the Energy Consumption of Transformers. TP-3 is a related Standard for the Labeling of Transformer Efficiency.

Noise/Electrical Noise

Also called electromagnetic interference, or EMI. Unwanted electrical signals that produce undesirable effects and otherwise disrupt the control system circuits.

Output Current Limiting

An output protection feature which limits the output current to a predetermined value in order to prevent damage to the device under overload conditions.

Output Voltage

The nominal value of the voltage at the output terminals of a device.

PE (Protective Earthing)

The incoming earthing conductor provided by the utility.

Rated Output Current

The continuous load current that a device was designed to provide.

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Thermal Protection

An internal safeguard circuit that shuts down the unit in the event of excess internal temperatures.

THD (Total Harmonic Distortion)

The ratio of the harmonic content to the fundamental frequency expressed as a percent of the fundamental.

Transformer

An electrical device that changes AC voltage from one level to another.

UL (Underwriters Laboratories)

Acronym for Underwriters Laboratories tested.

UL Recognized

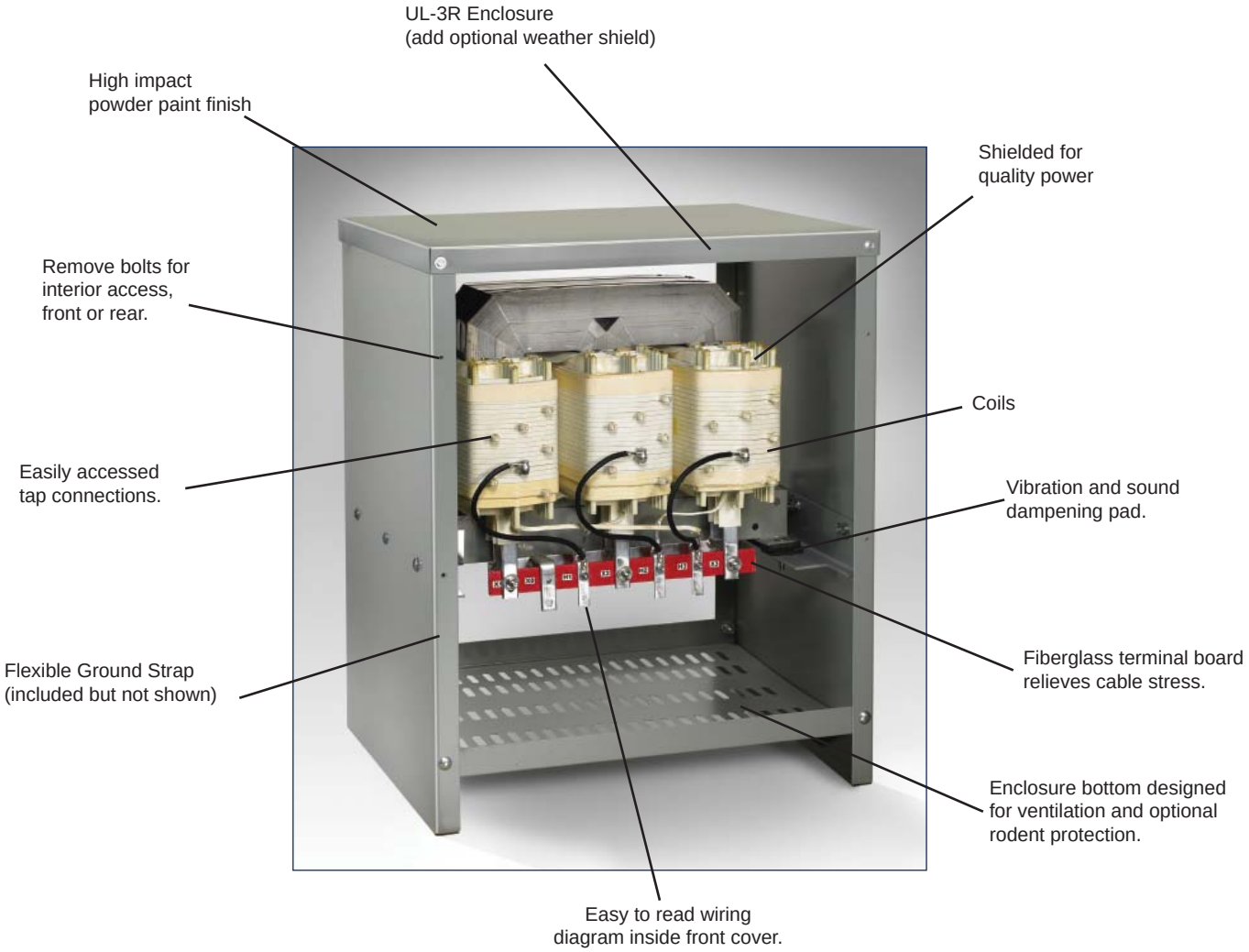
Designation given to components that when used properly in an end product are deemed to be safe.

UL Listed

Designation given to products ready for end use.

VA (Voltamp)

A measure of power. 1000 VA = 1 kVA.



Notes

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Notes

www.solaheviduty.com

EGS Electrical Group

Sola/Hevi-Duty is our premium line of industrial power quality solutions under the EGS Electrical Group family of brands.

Electrical Construction Materials
This group manufactures a broad range of electrical products including conduit and cable fittings, plugs and receptacles, enclosures and controls, conduit bodies, and industrial lighting. Whether the application is hazardous location, industrial, or commercial, the ECM group has the products to meet your needs

Power Quality Solutions
These offerings include the broadest power quality line including UPS, power conditioners, voltage regulators, shielded transformers, surge suppression devices and power supplies.

Heating Cable Systems
These brands offer a broad range of electrical heating cable products for residential, commercial, and industrial applications.

EGS Electrical Group is a worldwide manufacturer of electrical products for virtually every type of environment. For more than 150 years, our brands have been providing a rich tradition of long-term, practical, high-quality solutions.

Distributors, contractors, engineers, electricians and site maintenance professionals around the world trust EGS brands to make electrical installations safer, more productive, and more reliable.

EGS is organized into three focused businesses that provide distributors and end-users expert knowledge and excellent service.

Ensure your productivity with Quality Power.

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O-Z/GEDNEY

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Fax: (800) 367-4384

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