hammond
POWER SOLUTIONS

HPS ENDURACOIL™

Cast Resin Transformer

power to conserve

hammondpowersolutions.com

energizing our world

HPS EnduraCoil™ Cast Resin Transformer

Cast Resin Transformers

Hammond Power Solutions Inc. (HPS) is a leading manufacturer of standard and custom dry-type transformers in North America. Every HPS product is built with the quality and dependability you count on.

HPS EnduraCoil™ is designed for many demanding and diverse applications, while minimizing both installation and maintenance costs. Coils are precision wound with copper or aluminum conductors that are electrically balanced to minimize axial forces during short-circuit conditions. The coils are formed with mineral-filled epoxy, reinforced with fiberglass, and cast to provide complete, void-free resin impregnation throughout the entire insulation system.

Meets North American Energy Efficiency Regulations

Improving the energy efficiency of new transformers is a primary goal for the U.S. Department of Energy (DOE), Natural Resources Canada (NRCan) and the Secretariat of Economy (NMX*) in Mexico. New and more stringent energy efficiency regulations have been in effect since:

- US: January 1st, 2016
- Canada: April 30th, 2019 (NRCan has extended the scope to include up to 7,500 kVA)
- Mexico: August 10th, 2022

HPS EnduraCoil™ meets all North American efficiency regulations.

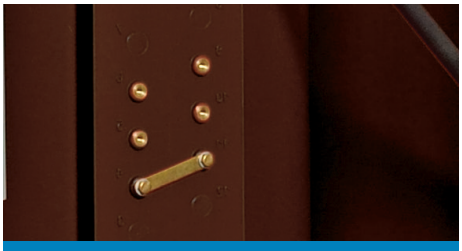
**HPS will be referring to the NMX-J-351-1-ANCE-2021 standard as NMX 2021.*

power to conserve

Applications

HPS EnduraCoil™ is suitable for any commercial, industrial, or renewable energy application. Encapsulated cast resin windings are durable for the most demanding environments typically found in marine, pulp & paper and petrochemical industries.

- Industrial
- Commercial
- Renewable Energy
- Marine
- Pulp & Paper
- Petrochemical



Off load tap changer

Low voltage bus

Primamry Connections

Features

Core Construction:

- Manufactured from quality non-aging, cold rolled, silicon steel laminations
- Cores are precision cut to close tolerances to eliminate burrs and improve performance
- Core is coated for corrosion protection

Coil Construction:

- Precision wound with copper or aluminum conductors that are electrically balanced to minimize axial forces during short-circuit conditions
- Formed with mineral-filled epoxy reinforced with fiberglass and cast to provide complete, void-free resin impregnation throughout the entire insulation system

Benefits

- Designed for indoor or outdoor applications
- Encapsulated cast resin windings are durable for the most demanding environments
- Minimal maintenance required beyond removing surface contaminants, such as dust
- Can be energized immediately after installation
- Greater resistance to short circuits
- Self-extinguishing in the unlikely event of fire
- Environmentally friendly

Hinged doors for easy removal

Lifting eyes for core & coil assembly

Built-in enclosure forklift capability

HPS EnduraCoil™ Cast Resin Transformer

Standard Specifications

kVA:	300 to 3000 ANN, 4000 AFN
High Voltage (Primary):	Up to 34.5 kV Class Up to 150 kV BIL (BIL per CSA/UL and IEEE/ANSI standards) Standard taps +/- 2.5%, +/- 5%
Low Voltage (Secondary):	208Y/120V to 600Y/347V & 2.4-5kV up to 60kV BIL Options available upon request
Frequency:	50, 60 Hz or 50/60 Hz
Insulation System:	180°C/185°C
Enclosure:	Open core & coil or enclosed versions. NEMA 1, NEMA 3/3R, NEMA 4/4X or NEMA 12 available. HPS Type 3RE Plus enclosure option available for improved outdoor performance[1].
Enclosure Finish:	ANSI 61 Grey Compliant with UL 50
Neutral:	Neutral terminal for field connection (on applicable units)
Temperature Rise:	80°C temperature rise Options available upon request

Termination:	Front accessible separate high and low voltage terminals; connectors suitable for aluminum and copper are provided for easy cable installation.
Winding Format:	Pri. cast/Sec. cast, Pri. cast/Sec VPI
Impedance:	Three Phase: Typically 4-7%
Seismic:	Seismically qualified according to the International Building Code (IBC) 2018, and the American Society of Civil Engineers ASCE 7-16 specifications, with the following design parameters: Spectral acceleration: SDS ≤2.0 g Importance factor: Ip = 1.5 Attachment/height ratio: z/h =0 OSHPD compliance available upon request.
Sound Level:	Meets IEEE C57.12.01 (optional low noise units available)
Altitude:	Standard up to 1000 meters (de-rated above 1000 meters)
Ambient:	-20 to 40°C (de-rating above 40°C)

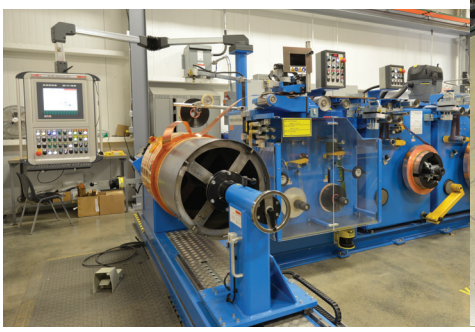
Other ratings and options available upon request
[1] For more details on our HPS Type 3RE Plus enclosure features please visit https://americas.hammondpowersolutions.com/en/products/enclosure-types#3RE_enhancements

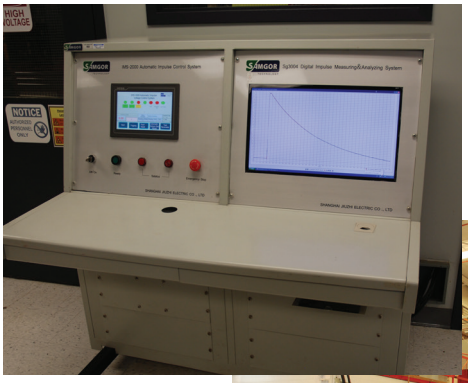
Optional Accessories

- Forced air-cooling (or provisions for later)
- Lightning arrestors rated for system voltage (Station, Intermediate or Distribution)
- Grounding resistor
- Neutral Ground Monitor
- Thermal sensing & indication
  - Thermocouples
  - Thermometers (analog / digital)
  - Thermostat alarm / trip (N.O. / N.C. contacts)
- Current transformers
- Potential transformers
- Key interlock to prevent unauthorized access
- Electrostatic shielding
- Rated to handle current harmonics [K4] [K9] [K13]
- Strip heater (powered from separate source)
- Surge protection devices
- Air terminal chamber to facilitate HV and/or LV connection

Superior Manufacturing

You benefit from HPS' use of precision coil winding machines, tightly regulated casting technology and rigorous quality testing. The end result is a superior product that will deliver years of reliable service.





Testing

All cast resin transformers are tested at HPS prior to shipment. They must meet very stringent quality criteria prior to release. The following tests are performed on each cast resin transformer:

- Resistance Measurement*
- Voltage Ratio
- Polarity & Phase-Relation Test
- No-Load Loss and Excitation Current Test
- Induced Voltage
- Impedance Voltage & Load Loss Test*
- Partial Discharge
- Power frequency voltage-withstand each winding

**typically not performed for units ≤ 500kVA*

Compliance & Approvals

HPS EnduraCoil™ is CSA Certified and UL Listed. It meets the following standards:

- CSA C22.2 No. 47, up to 3MVA
- CSA C9-02
- UL 1562, up to 3MVA
- Seismic qualified IBC 2018 (ASCE 7-16)/OSHPD

Compliant to the following industry standards:

- DOE 10 CFR PART 431 (DOE 2016)
- NMX-J-351-1-ANCE-2021 (NMX 2021)
- NRCan SOR/2018-201 Amd. 14 (NRCan 2019)
- IEC 60076 (on request)
- IEEE C57.12.01, C57.12.50, C57.12.51, C57.12.59,C57.12.70, C57.12.91, C57.12.96, C57.124

Competitive Edge

North American leader for the design and manufacture of standard & custom engineered dry-type transformers.

- Globally recognized and respected for product performance
- Highly regarded for our engineering expertise
- Commitment to Continuous Improvement and Quality Systems (ISO 9001)

HPS ENDURACOIL

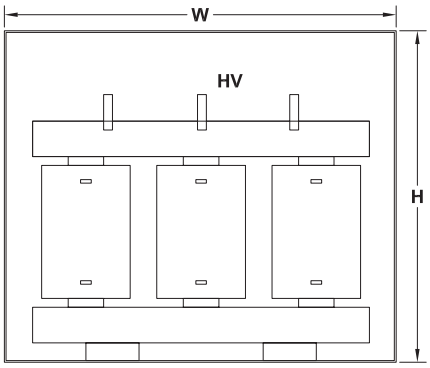
Cast Resin Transformer

Typical Dimensions & Weights - Copper

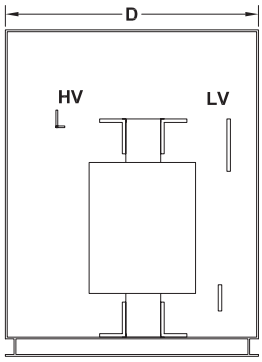
kVA	kV Class	kV BIL	Enclosure with Stubs Up Fig. 1					Enclosure with Bus-To-End Fig.2				
			Width Inches [mm]	Depth Inches [mm]	Height Inches [mm]	Type 1 Weight Lbs [kg]	Type 2 Weight Lbs [kg]	Width Inches [mm]	Depth Inches [mm]	Height Inches [mm]	Type 1 Weight Lbs [kg]	Type 2 Weight Lbs [kg]
500	5	60	-	-	-	-	-	84 [2134]	54 [1372]	91.5 [2325]	6400 [2910]	6775 [3080]
	15	95	84 [2134]	54 [1372]	91.5 [2325]	6600 [3000]	6975 [3170]	84 [2134]	60 [1524]	91.5 [2325]	6625 [3010]	7000 [3180]
	25	125	90 [2286]	60 [1524]	91.5 [2325	6865 [3120]	7290 [3310]	96 [2439]	72 [1829]	91.5 [2325]	7000 [3180]	7450 [3380]
	34.5	150	102 [2591]	72 [1829]	91.5 [2325]	9430 [4280]	9900 [4500]	102 [2591]	72 [1829]	91.5 [2325]	9430 [4280]	9900 [4500]
750	5	60	84 [2134]	54 [1372]	91.5 [2325]	8500 [3860]	8875 [4030]	84 [2134]	54 [1372]	91.5 [2325]	8500 [3860]	8875 [4030]
	15	95	90 [2286]	54 [1372]	91.5 [2325]	8725 [3960]	9150 [4160]	90 [2286]	60 [1524]	91.5 [2325]	8765 [3980]	9190 [4170]
	25	125	96 [2439]	60 [1524]	91.5 [2325]	9000 [4090]	9450 [4290]	96 [2439]	72 [1829]	91.5 [2325]	9100 [4130]	9550 [4340]
	34.5	150	108 [2744]	72 [1829]	91.5 [2325]	12865 [5840]	13355 [6060]			Consult HPS		
1000	5	60	84 [2134]	54 [1372]	91.5 [2325]	9800 [4450]	10175 [4620]	84 [2134]	54 [1372]	91.5 [2325]	9800 [4450]	10175 [4620]
	15	95	96 [2439]	54 [1372]	91.5 [2325]	10675 [4850]	11125 [5050]	96 [2439]	60 [1524]	91.5 [2325]	10700 [4860]	11150 [5060]
	25	125	102 [2591]	72 [1829]	91.5 [2325]	11730 [5330]	12200 [5540]	108 [2744]	72 [1829]	91.5 [2325]	11765 [5340]	12255 [5560]
	34.5	150	120 [3048]	72 [1829]	91.5 [2325]	15590 [7080]	16075 [7300]			Consult HPS		
1500	5	60	90 [2286]	54 [1372]	91.5 [2325]	13525 [6140]	13950 [6330]	96 [2439]	60 [1524]	91.5 [2325]	13600 [6170]	14050 [6380]
	15	95	108 [2744]	60 [1524]	91.5 [2325]	15850 [7190]	16340 [7420]	108 [2744]	72 [1829]	91.5 [2325]	15965 [7250]	16455 [7470]
	25	125	120 [3048]	72 [1829]	91.5 [2325]	16990 [7710]	17475 [7930]	120 [3048]	72 [1829]	91.5 [2325]	16990 [7710]	17475 [7930]
	34.5	150	Consult HPS							Consult HPS		
2000	5	60	96 [2439]	54 [1372]	91.5 [2325]	17375 [7890]	17825 [8090]	102 [2591]	60 [1524]	91.5 [2325]	17425 [7910]	17895 [8120]
	15	95	108 [2744]	60 [1524]	91.5 [2325]	18950 [8600]	19440 [8820]	108 [2744]	72 [1829]	91.5 [2325]	19065 [8650]	19555 [8870]
	25	125	120 [3048]	72 [1829]	91.5 [2325]	19390 [8800]	19875 [9020]	120 [3048]	72 [1829]	91.5 [2325]	19390 [8800]	19875 [9020]
	34.5	150	Consult HPS							Consult HPS		
2500	5	60	102 [2591]	54 [1372]	91.5 [2325]	21600 [9800]	22060 [10010]	102 [2591]	60 [1524]	91.5 [2325]	21625 [9810]	22095 [10030]
	15	95	108 [2744]	60 [1524]	91.5 [2325]	22050 [10010]	22540 [10230]	108 [2744]	72 [1829]	91.5 [2325]	22165 [10060]	22655 [10280]
	25	125	120 [3048]	72 [1829]	110 [2794]	22775 [10340]	23420 [10630]			Consult HPS		
	34.5	150	Consult HPS							Consult HPS		

Type 3R & 3RE available
Weight and dimensions are typical for 80°C average winding rise.
kVA ranges >2500kVA consult HPS.
Not for construction purposes. Approval drawings can be provided as needed.
Add 20 inch for ATC up to 95kV BIL designs and 24 inch for ATC with 125/150kV BIL designs.
Add approx. 400 lbs. per ATC.
Please note that the product weights, dimensions and typical performance data in the EnduraCoil brochure apply to product that is compliant to DOE 2016, NRCan 2019 and NMX 2021 efficiency levels only. For typical product information related to other efficiency requirements, please contact HPS.

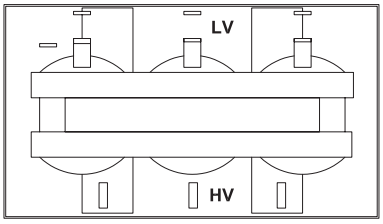
STUBS UP (Figure 1)



FRONT VIEW

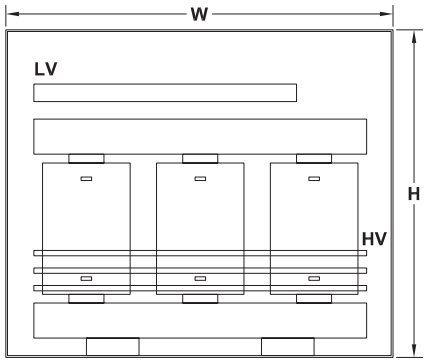


RIGHT SIDE VIEW

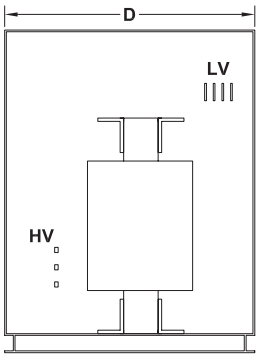


PLAN VIEW

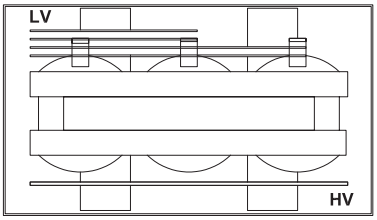
BUS-TO-END (Figure 2)



FRONT VIEW



RIGHT SIDE VIEW



PLAN VIEW

TYPICAL PERFORMANCE DATA – COPPER

5KV, 4160V DELTA (60 KV BIL) - 480 WYE/277V (10 KV BIL), 60 HZ OR 600 WYE/347 V (10KV BIL), 60 HZ

kVA	No Load Losses (W)	Full Load Loss (W)[1]	Impedance	Resistance	Reactance	X/R Ratio	Regulation				%Efficiency at different loads			
							at 50% load		at 100% load					
							pf=1	pf=0.8	pf=1	pf=0.8	25%	50%*	75%	100%
500	1600	3853	5.75%	0.83%	5.69%	6.9	0.43%	2.04%	0.93%	4.11%	98.55%	98.99%	99.01%	98.92%
750	2120	4909	5.75%	0.70%	5.71%	8.1	0.37%	2.00%	0.82%	4.03%	98.72%	99.12%	99.14%	99.07%
1000	2480	6262	5.75%	0.67%	5.71%	8.5	0.35%	1.99%	0.79%	4.02%	98.86%	99.20%	99.21%	99.13%
1500	3120	8807	5.75%	0.63%	5.72%	9.1	0.33%	1.97%	0.75%	3.99%	99.03%	99.30%	99.29%	99.21%
2000	3930	10229	5.75%	0.55%	5.72%	10.5	0.30%	1.94%	0.68%	3.93%	99.09%	99.36%	99.36%	99.30%
2500	4070	13642	5.75%	0.58%	5.72%	9.9	0.31%	1.96%	0.71%	3.96%	99.22%	99.41%	99.38%	99.30%

**Meets DOE 10 CFR PART 431- 2016, NRCan 2019/ON Reg. 404/12 and NMX-J-351-1-ANCE-2021 Energy Efficiency Regulations for MVDT Transformers*
[1]At a reference temperature of 75°C

15KV, 12470V DELTA (95 KV BIL) - 480 WYE/277V (10 KV BIL), 60 HZ OR 600 WYE/347 V (10KV BIL), 60 HZ

kVA	No Load Losses (W)	Full Load Loss (W)[1]	Impedance	Resistance	Reactance	X/R Ratio	Regulation				%Efficiency at different loads			
							at 50% load		at 100% load					
							pf=1	pf=0.8	pf=1	pf=0.8	25%	50%*	75%	100%
500	1620	3760	5.75%	0.81%	5.69%	7.0	0.42%	2.03%	0.91%	4.10%	98.54%	98.99%	99.01%	98.94%
750	2060	5119	5.75%	0.73%	5.70%	7.8	0.38%	2.01%	0.85%	4.05%	98.75%	99.12%	99.13%	99.05%
1000	2610	5776	5.75%	0.62%	5.72%	9.3	0.33%	1.97%	0.74%	3.98%	98.83%	99.20%	99.22%	99.17%
1500	3240	8339	5.75%	0.59%	5.72%	9.6	0.32%	1.96%	0.72%	3.97%	99.01%	99.30%	99.30%	99.23%
2000	3630	11431	5.75%	0.61%	5.72%	9.4	0.33%	1.97%	0.73%	3.98%	99.14%	99.36%	99.33%	99.25%
2500	4000	13924	5.75%	0.59%	5.72%	9.7	0.32%	1.96%	0.72%	3.97%	99.23%	99.41%	99.37%	99.29%

**Meets DOE 10 CFR PART 431- 2016, NRCan 2019/ON Reg. 404/12 and NMX-J-351-1-ANCE-2021 Energy Efficiency Regulations for MVDT Transformers*
[1]At a reference temperature of 75°C

Please note that the product weights, dimensions and typical performance data in the EnduraCoil brochure apply to product that is compliant to DOE 2016, NRCan 2019 and NMX 2021 efficiency levels only. For typical product information related to other efficiency requirements, please contact HPS.

TYPICAL PERFORMANCE DATA – COPPER

25KV, 24940V DELTA (125 KV BIL) - 480 WYE/277V (10 KV BIL), 60 HZ OR 600 WYE/347 V (10KV BIL), 60 HZ

kVA	No Load Losses (W)	Full Load Loss (W)[1]	Impedance	Resistance	Reactance	X/R Ratio	Regulation				%Efficiency at different loads			
							at 50% load		at 100% load					
							pf=1	pf=0.8	pf=1	pf=0.8	25%	50%*	75%	100%
500	1750	4271	6.25%	0.92%	6.18%	6.7	0.47%	2.22%	1.05%	4.49%	98.41%	98.89%	98.90%	98.81%
750	2350	5491	6.25%	0.79%	6.20%	7.9	0.41%	2.18%	0.92%	4.41%	98.58%	99.02%	99.04%	98.97%
1000	2960	6215	6.25%	0.67%	6.21%	9.3	0.36%	2.14%	0.81%	4.33%	98.68%	99.11%	99.15%	99.09%
1500	3800	8807	6.25%	0.63%	6.22%	9.9	0.34%	2.13%	0.78%	4.31%	98.85%	99.21%	99.23%	99.17%
2000	4400	11590	6.25%	0.62%	6.22%	10.1	0.34%	2.12%	0.77%	4.30%	98.99%	99.28%	99.28%	99.21%
2500	5170	13265	6.25%	0.56%	6.22%	11.0	0.31%	2.11%	0.72%	4.27%	99.05%	99.33%	99.33%	99.27%

**Meets DOE 10 CFR PART 431- 2016, NRCan 2019/ON Reg. 404/12 and NMX-J-351-1-ANCE-2021 Energy Efficiency Regulations for MVDT Transformers*
[1]At a reference temperature of 75°C

34.5KV, 34500V DELTA (150 KV BIL) - 480 WYE/277V (10 KV BIL), 60 HZ OR 600 WYE/347 V (10KV BIL), 60 HZ

kVA	No Load Losses (W)	Full Load Loss (W)[1]	Impedance	Resistance	Reactance	X/R Ratio	Regulation				%Efficiency at different loads			
							at 50% load		at 100% load					
							pf=1	pf=0.8	pf=1	pf=0.8	25%	50%*	75%	100%
500	1780	4085	6.50%	0.88%	6.44%	7.3	0.46%	2.29%	1.02%	4.63%	98.40%	98.89%	98.92%	98.84%
750	2180	6143	6.50%	0.88%	6.44%	7.3	0.46%	2.29%	1.03%	4.63%	98.65%	99.02%	99.01%	98.90%
1000	2710	7196	6.50%	0.77%	6.45%	8.4	0.41%	2.25%	0.93%	4.56%	98.75%	99.11%	99.11%	99.02%
1500	3780	8901	6.50%	0.63%	6.47%	10.2	0.35%	2.21%	0.80%	4.47%	98.86%	99.21%	99.23%	99.16%
2000	4440	11449	6.50%	0.61%	6.47%	10.6	0.34%	2.20%	0.78%	4.46%	98.98%	99.28%	99.28%	99.21%
2500	5100	13171	6.50%	0.56%	6.48%	11.6	0.32%	2.18%	0.74%	4.43%	99.06%	99.33%	99.34%	99.27%

**Meets DOE 10 CFR PART 431- 2016, NRCan 2019/ON Reg. 404/12 and NMX-J-351-1-ANCE-2021 Energy Efficiency Regulations for MVDT Transformers*
[1]At a reference temperature of 75°C

Please note that the product weights, dimensions and typical performance data in the EnduraCoil brochure apply to product that is compliant to DOE 2016, NRCan 2019 and NMX 2021 efficiency levels only. For typical product information related to other efficiency requirements, please contact HPS.

Technical Information

Altitude Derating Factor

Altitude (FT)	kVA Correction		BIL Correction
	VPI (AA)	Forced Air (FA)	
3300	1.00	1.00	1.00
4000	0.994	0.989	0.98
5000	0.985	0.974	0.95
6000	0.975	0.959	0.92
7000	0.966	0.944	0.89
8000	0.957	0.929	0.86
9000	0.948	0.914	0.83
10,000	0.939	0.898	0.80
11,000	0.930	0.883	0.77
12,000	0.921	0.868	0.75
13,000	0.912	0.853	0.72
14,000	0.903	0.838	0.70
15,000	0.894	0.823	0.67

3.28 = 1 meter

System Voltage and Transformer BIL Ratings

Nominal System Voltage	Standard and Optional Transformer BIL Ratings									
(kV)	10	30	45	60	75	95	110	125	150	200
1.2		S	1							
2.5			S	1						
5.0				S	1					
8.7					S	1				
15.0						S	1			
25.0								S	1	
34.5								2	S	Consult HPS

S = Standard
1 = Optional higher levels where exposure to overvoltage occurs and improved protective margins are required.
2 = Lower levels where protective characteristic of applied surge arresters have been evaluated and found to provide appropriate surge protection.

Please note that the product weights, dimensions and typical performance data in the EnduraCoil brochure apply to product that is compliant to DOE 2016, NRCan 2019 and NMX 2021 efficiency levels only. For typical product information related to other efficiency requirements, please contact HPS.

Typical Heat Contribution

HIGH VOLTAGE 13800 V DELTA, 95 KV BIL,
LOW VOLTAGE 480/277 V WYE, 30 KV BIL, COPPER
COMPLYING DOE-10 CFR PART 431-2016, NRCAN 2019 AND NMX 2021

kVA	Typical heat contribution (BTU/Hr) at 100°C at different loads % of rated kVA					
	25%	50%	75%	100%	125%	133%
225	620	2470	5570	9900	15460	-
300	610	2430	5470	9720	15190	-
500	930	3710	8350	14840	23190	-
750	1280	5120	11520	20470	31990	-
1000	1250	4990	11230	19960	31190	35310
1500	2050	8190	18430	32760	51180	57940
2000	2450	9810	22070	39240	61310	69410
2500	2740	10960	24660	43850	68510	77560

Note: 133% loads are allowed for transformer equipped with fans/blower only.

Loading

ANSI/IEEE LOADING GUIDE
DAILY LOADS ABOVE RATING TO GIVE NORMAL LIFE EXPECTANCY.
FOLLOWING AND FOLLOWED BY A CONSTANT LOAD OF:

Peak Load Time in Hours	Times Rated kVA		
	90%	70%	50%
0.5	1.47	1.59	1.65
1	1.30	1.36	1.39
2	1.20	1.23	1.25
4	1.13	1.15	1.16
8	1.07	1.09	1.09

Please note that the product weights, dimensions and typical performance data in the EnduraCoil brochure apply to product that is compliant to DOE 2016, NRCan 2019 and NMX 2021 efficiency levels only. For typical product information related to other efficiency requirements, please contact HPS.

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