



# HPS EnduraCoil™ Cast Resin Transformer

power to perform



Hammond  
Power Solutions

# 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.

## COMPLIANT WITH NA EFFICIENCY REGULATIONS

HPS EnduraCoil™ meets the latest North American efficiency regulations. In the US, the Department of Energy (DOE) established new efficiency levels effective January 1<sup>st</sup>, 2016 known as DOE 2016. Natural Resources Canada (NRCAN) has announced that in early 2018 efficiency levels in Canada will align with those mandated by DOE 2016 (NRCAN has extended the scope to include up to 7,500 kVA).



## 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.

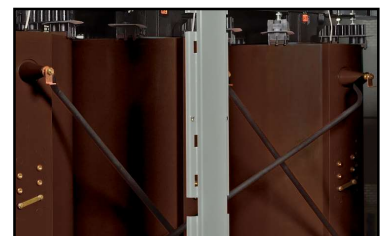
- Industrial
- Commercial
- Renewable Energy
- Marine
- Pulp & Paper
- Petrochemical



Off load tap changer



Low voltage bus



Primary connections



## FEATURES

### Core Construction:

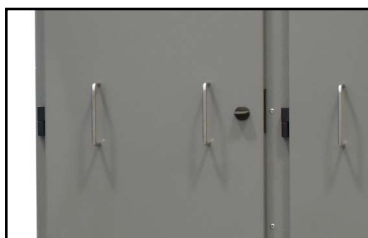
- Manufactured from quality non-aging, cold rolled, silicon steel laminations
- Cores are precision cut to close tolerances to eliminate burrs and improve performance
- Core is coated for corrosion protection

### 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

# Specifications & Accessories

## STANDARD SPECIFICATIONS

<b>kVA:</b>	300 to 3000 ANN, 4000 AFN	<b>Termination:</b>	Front accessible separate high and low voltage terminals; connectors suitable for aluminum and copper are provided for easy cable installation.
<b>High Voltage (Primary):</b>	Up to 34.5 kV Class Up to 150 kV BIL (BIL per CSA/UL and IEEE/ANSI standards) Standard taps +/- 2.5%, +/- 5%	<b>Winding Format:</b>	Pri. cast/Sec. cast, Pri. cast/Sec VPI
<b>Low Voltage (Secondary):</b>	208Y/120V to 600Y/347V & 2.4-5kV up to 60kV BIL Options available upon request	<b>Impedance:</b>	Three Phase: Typically 4-7%
<b>Frequency:</b>	50, 60 Hz or 50/60 Hz	<b>Seismic:</b>	Seismically qualified according to the International Building Code (IBC) 2012, and the American Society of Civil Engineers ASCE 7-10 specifications, with the following design parameters (valid for floor mounting of enclosures only): Spectral acceleration: $S_{DS} \leq 2.0$ g Importance factor: $I_p = 1.5$ Attachment/height ratio: $z/h = 1.0$ "
<b>Insulation System:</b>	180°C/185°C	<b>Sound Level:</b>	Meets IEEE C57.12.01 (optional low noise units available)
<b>Enclosure:</b>	Open core & coil or enclosed versions. NEMA 1, NEMA 3/3R, NEMA 4/4X or NEMA 12 available.	<b>Altitude:</b>	Standard up to 1000 meters (de-rated above 1000 meters)
<b>Enclosure Finish:</b>	ANSI 61 Grey Compliant with UL 50	<b>Ambient:</b>	-20 to 40°C (de-rating above 40°C)
<b>Neutral:</b>	Neutral terminal for field connection (on applicable units)		
<b>Temperature Rise:</b>	80°C temperature rise Options available upon request		

Other ratings and options available upon request

## 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





# HPS EnduraCoil™

## Cast Resin Transformer

### 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  $\leq 500\text{kVA}$

### 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 2012/ASCE 7-10/CBC 2013



Compliant to the following industry standards:

- DOE 10 CFR Part 431, DOE 2016 levels
- NRCAN SOR/94-651
- 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)

# Typical Dimensions & Weights - Copper

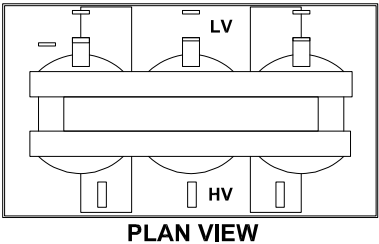
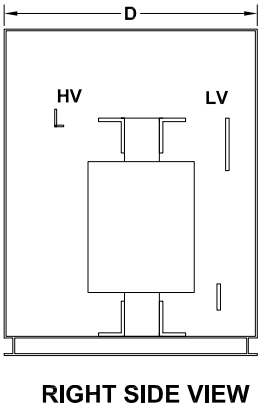
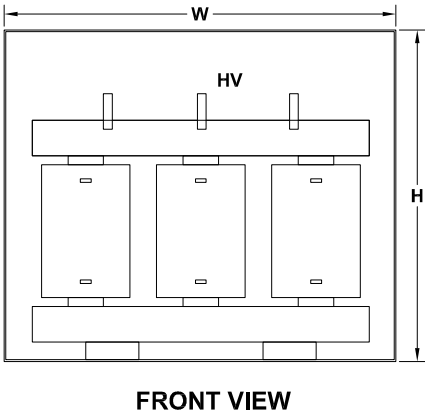
Ratings			Enclosure with Stubs Up (Figure 1)					Enclosure with Bus-To-End (Figure 2)				
kVA	kV Class	kV BIL	Width (W)	Depth (D)	Height (H)	Type 1 Weight (Lbs.)	Type 2 Weight (Lbs.)	Width (W)	Depth (D)	Height (H)	Type 1 Weight (Lbs.)	Type 2 Weight (Lbs.)
500	5	60	-	-	-	-	-	84	54	91.5	6400	6775
	15	95	84	54	91.5	6600	6975	84	60	91.5	6625	7000
	25	125	90	60	91.5	6865	7290	96	72	91.5	7000	7450
	34.5	150	102	72	91.5	9430	9900	102	72	91.5	9430	9900
750	5	60	84	54	91.5	8500	8875	84	54	91.5	8500	8875
	15	95	90	54	91.5	8725	9150	90	60	91.5	8765	9190
	25	125	96	60	91.5	9000	9450	96	72	91.5	9100	9550
	34.5	150	108	72	91.5	12865	13355	Consult HPS				
1000	5	60	84	54	91.5	9800	10175	84	54	91.5	9800	10175
	15	95	96	54	91.5	10675	11125	96	60	91.5	10700	11150
	25	125	102	72	91.5	11730	12200	108	72	91.5	11765	12255
	34.5	150	120	72	91.5	15590	16075	Consult HPS				
1500	5	60	90	54	91.5	13525	13950	96	60	91.5	13600	14050
	15	95	108	60	91.5	15850	16340	108	72	91.5	15965	16455
	25	125	120	72	91.5	16990	17475	120	72	91.5	16990	17475
	34.5	150	Consult HPS					Consult HPS				
2000	5	60	96	54	91.5	17375	17825	102	60	91.5	17425	17895
	15	95	108	60	91.5	18950	19440	108	72	91.5	19065	19555
	25	125	120	72	91.5	19390	19875	120	72	91.5	19390	19875
	34.5	150	Consult HPS					Consult HPS				
2500	5	60	102	54	91.5	21600	22060	102	60	91.5	21625	22095
	15	95	108	60	91.5	22050	22540	108	72	91.5	22165	22655
	25	125	120	72	110	22775	23420	Consult HPS				
	34.5	150	Consult HPS					Consult HPS				

Type 3R & 3RE available

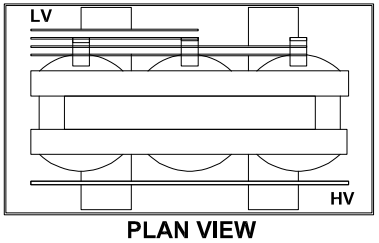
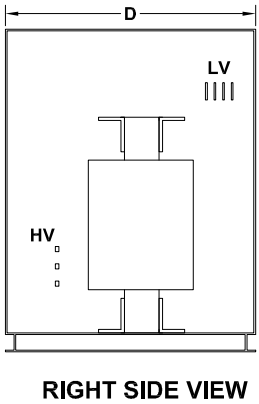
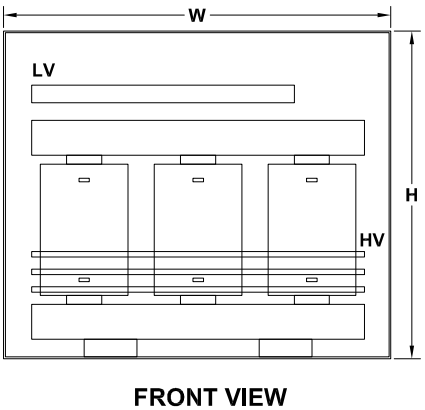
Weight & dimensions are typical for 80°C av. wdg. rise.

Coordinated Bus-To-End available upon request

**STUBS UP (Figure 1)**



**BUS-TO-END (Figure 2)**



# Typical Performance Data - Copper

## 5kV, 4160V Delta (60 kV BIL) - 480 Wye/277V (10 kV BIL), 60 Hz

kVA	No Load Loss (W)	Full Load Loss (W) <sup>1</sup>	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 Energy Efficiency Regulation for MVDT Transformers

<sup>1</sup> At a reference temperature of 75°C

## 15kV, 12470V Delta (95 kV BIL) - 480 Wye/277V (10 kV BIL), 60 Hz

kVA	No Load Loss (W)	Full Load Loss (W) <sup>1</sup>	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 Energy Efficiency Regulation for MVDT Transformers

<sup>1</sup> At a reference temperature of 75°C



**25kV, 24940V Delta (125 kV BIL) -  
480 Wye/277V (10 kV BIL), 60 Hz**

kVA	No Load Loss (W)	Full Load Loss (W) <sup>1</sup>	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 Energy Efficiency Regulation for MVDT Transformers

<sup>1</sup> At a reference temperature of 75°C

**34.5kV, 34500V Delta (150 kV BIL) -  
480 Wye/277V (10 kV BIL), 60 Hz**

kVA	No Load Loss (W)	Full Load Loss (W) <sup>1</sup>	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 Energy Efficiency Regulation for MVDT Transformers

<sup>1</sup> At a reference temperature of 75°C

# 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 feet = 1 meter

## System Voltage and Transformer BIL Ratings

Nominal System Voltage (kV)	Standard and Optional Transformer BIL Ratings									
	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.

# 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 431.196 (2016)

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



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