Three-phase pad-mounted compartmental type transformer

General

At Eaton, we are constantly striving to introduce new innovations to the transformer industry, bringing you the highest quality, most reliable transformers. Eaton's Cooper Power™ series transformer products are ISO® 9001 compliant, emphasizing process improvement in all phases of design, manufacture, and testing. In order to drive this innovation, we have invested both time and money in the Thomas A. Edison Technical Center, our premier research facility in Franksville, Wisconsin. Such revolutionary products as distribution-class UltraSIL™ Polymer-Housed Evolution™ surge arresters and Envirotemp™ FR3™ fluid have been developed at our Franksville lab.

Eaton transformer sizes range from 45 kVA to 12 MVA with high-voltage ratings from 2400 V to 38 kV. From fabrication of the tanks and cabinets to winding of the cores and coils, to production of arresters, switches, tap changers, expulsion fuses, current-limiting fuses, bushings (live and dead) and molded rubber goods, Eaton has the products to meet your application needs. Eaton's Cooper Power series transformers are available with electrical grade mineral oil or Envirotemp™ FR3™ fluid, a less-flammable and bio-degradable fluid. Electrical codes recognize the advantages of using Envirotemp™ FR3™ fluid both indoors and outdoors for fire-sensitive applications. The bio-based fluid meets Occupational Safety and Health Administration (OSHA) and Section 450.23 NEC® requirements.

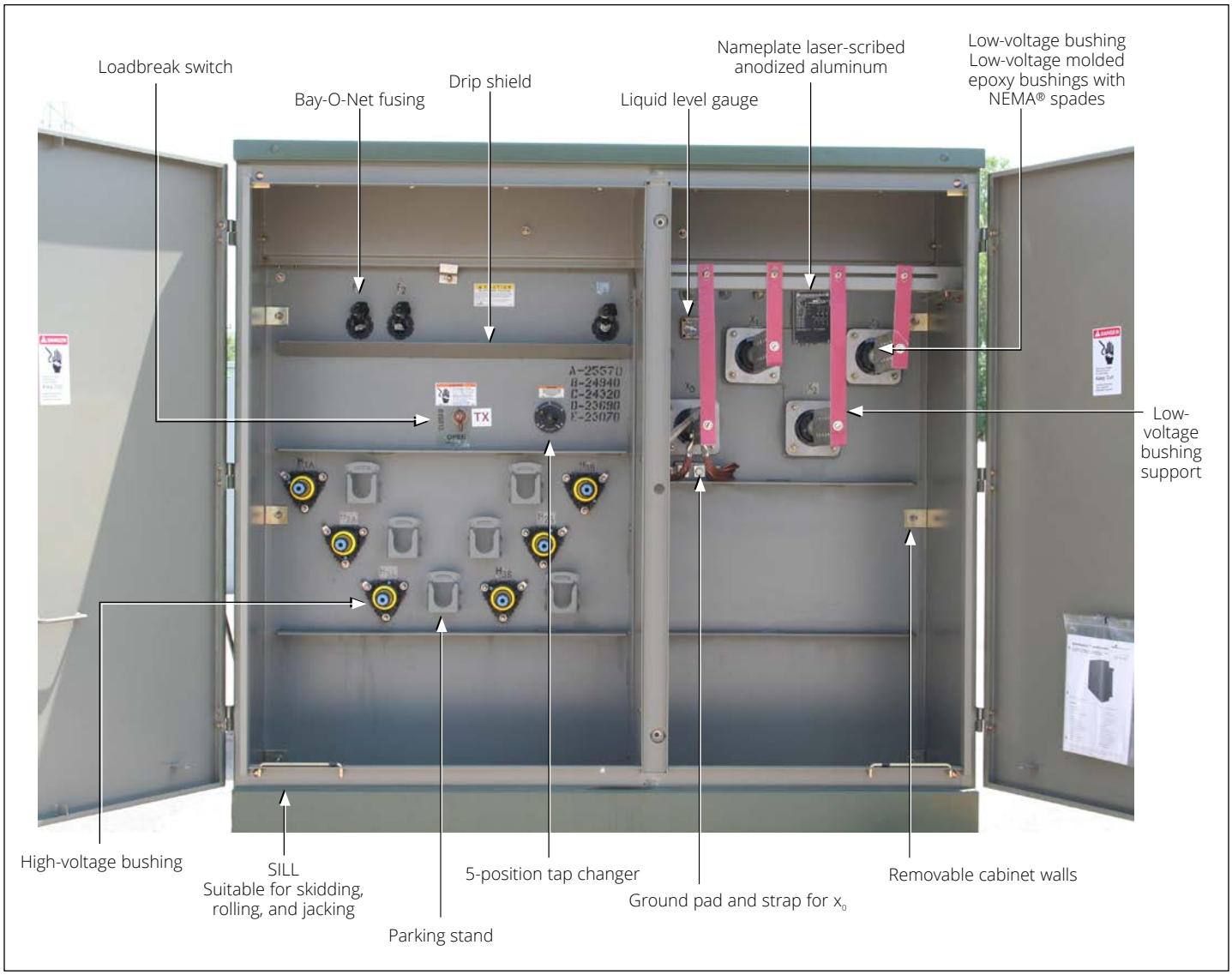

Figure 1. Three-phase pad-mounted compartmental type transformer

Table 1. Product scope

Description	Specification
Type	Three-phase, 50 or 60 Hz, 65 °C Rise (55 °C, 55/65 °C), 65/75 °C, 75 °C
Fluid type	Mineral oil or Envirotemp™ FR3™ fluid
Coil configuration	2-winding or 4-winding or 3-winding (Low-High-Low), 3-winding (Low-Low-High)
Size	45–10,000 kVA
Primary voltage	2400–46,000 V
Secondary voltage	208Y/120 V to 14,400 V
Specialty designs	Inverter/rectifier bridge
	K-Factor (up to K-19)
	Vacuum fault interrupter (VFI)
	UL® Listed and labeled and classified
	Factory Mutual (FM) Approved®
	Solar/wind designs
	Differential protection
	Seismic applications (including OSHPD)
	Hardened data center

Table 2. Three-phase ratings

Three-phase 50 Hz or 60 Hz
kVA available ①
45, 75, 112.5, 150, 225, 300, 500, 750, 1000, 1500, 2000, 2500, 3000, 3750, 5000, 7500, 10,000

① Transformers are available in the standard ratings and configurations shown or can be customized to meet specific needs.

Table 3. Impedance voltage

	Low-voltage rating		
Rating (kVA)	**≤ 600 V**	**2400–4800 V delta**	**6900 V delta – 13,800GY/7970 or 13,800 V delta**
45–75	2.70–5.75	2.70–5.75	2.70–5.75
112.5–300	3.10–5.75	3.10–5.75	3.10–5.75
500	4.35–5.75	4.35–5.75	4.35–5.75
750–2500	5.75	5.75	5.75
3750	5.75	5.75	6.00
5000	—	6.00	6.50

Note: The standard tolerance is ±7.5%.

Table 4. Audible sound levels

	NEMA TR-1 average
Self-cooled, two-winding kVA rating	**Decibels (dB)**
45–500	56
501–700	57
701–1000	58
1001–1500	60
1501–2000	61
2001–2500	62
2501–3000	63
3001–4000	64
4001–5000	65
5001–6000	66
6001–7500	67
7501–10,000	68

Table 5. Insulation test levels

kV class	**Induced test 180 Hz or 400 Hz 7200 cycle**	**kV BIL distribution**	**Applied test 60 Hz (kV)**
1.2	Twice rated voltage	30	10
2.5	Twice rated voltage	45	15
5	Twice rated voltage	60	19
8.7	Twice rated voltage	75	26
15	Twice rated voltage	95	34
25	Twice rated voltage	125	40
34.5	Twice rated voltage	150	50

Table 6. Temperature rise ratings 0–3300 ft (0–1000 m)

	Standard	**Optional**
Unit rating (temperature rise winding)	65 °C	55 °C, 55/65 °C, 75 °C
Ambient temperature maximum	40 °C	50 °C
Ambient temperature 24-hour average	30 °C	40 °C
Temperature rise hotspot	80 °C	65 °C

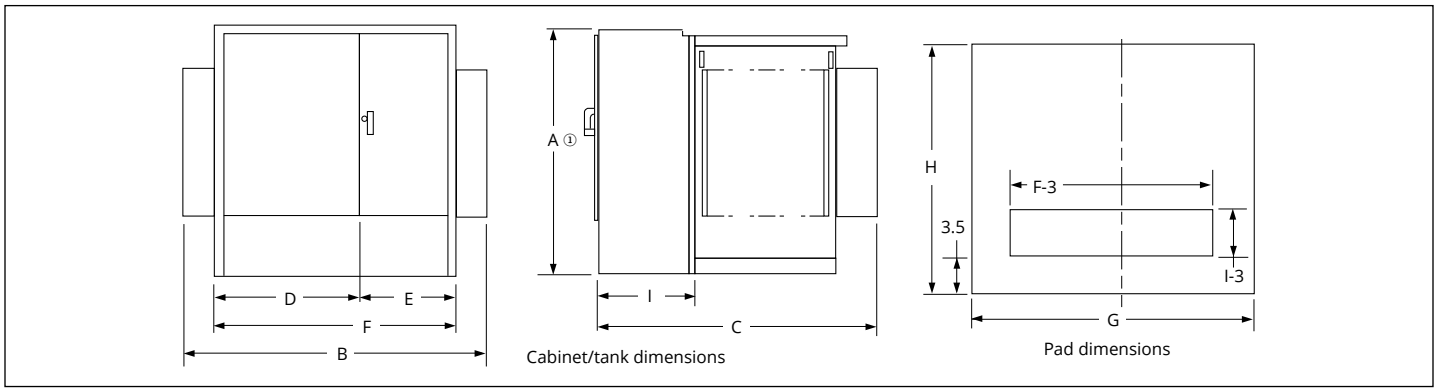

Figure 2. Transformer and pad dimensions

① Add 9 inches for Bay-O-Net fusing.

Table 7. Fluid-filled—aluminum windings 55/65 °C rise ①

	Dead-front—loop or radial feed—Bay-O-Net fusing oil-filled—aluminum windings										
	Outline dimensions (inches)										
65° rise kVA rating	A ②	B	C	D	E	F	G	H	I	Gallons of fluid	Approx. total weight (lb)
45	50	68	39	42	26	68	72	43	20	110	2,100
75	50	68	39	42	26	68	72	43	20	115	2,250
112.5	50	68	49	42	26	68	72	53	20	120	2,350
150	50	68	49	42	26	68	72	53	20	125	2,700
225	50	72	51	42	30	72	76	55	20	140	3,150
300	50	72	51	42	30	72	76	55	20	160	3,650
500	50	89	53	42	30	72	93	57	20	190	4,650
750	64	89	57	42	30	72	93	61	20	270	6,500
1000	64	89	59	42	30	72	93	63	20	350	8,200
1500	73	89	86	42	30	72	93	90	24	410	10,300
2000	73	72	87	42	30	72	76	91	24	490	12,500
2500	73	72	99	42	30	72	76	103	24	530	14,500
3000	73	84	99	46	37	84	88	103	24	620	16,700
3750	84	85	108	47	38	85	88	112	24	660	19,300
5000	84	96	108	48	48	96	100	112	24	930	25,000
7500	94	102	122	54	48	102	100	126	24	1,580	41,900

① Weights, gallons of fluid, and dimensions are for reference only and not for construction. Please contact Eaton for exact dimensions.

② Add 9 inches for Bay-O-Net fusing.

Table 8. Fluid-filled—copper windings 55/65 °C rise ①

	Dead-front—loop or radial feed—Bay-O-Net fusing oil-filled—copper windings										
	Outline dimensions (inches)										
65° rise kVA rating	A ②	B	C	D	E	F	G	H	I	Gallons of fluid	Approx. total weight (lb)
45	50	64	39	34	30	64	69	43	20	110	2,100
75	50	64	39	34	30	64	69	43	20	115	2,350
112.5	50	64	49	34	30	64	69	53	20	115	2,500
150	50	64	49	34	30	64	69	53	20	120	2,700
225	50	64	51	34	30	64	73	55	20	140	3,250
300	50	64	51	34	30	64	75	55	20	160	3,800
500	50	81	53	34	30	64	85	57	20	200	4,800
750	64	89	57	42	30	72	93	61	20	255	6,500
1000	64	89	59	42	30	72	93	63	20	300	7,800
1500	73	89	86	42	30	72	93	90	24	410	10,300
2000	73	72	87	42	30	72	76	91	24	420	11,600
2500	73	72	99	42	30	72	76	103	24	500	14,000
3000	73	84	99	46	37	84	88	103	24	720	18,700
3750	84	85	108	47	38	85	88	112	24	800	20,500
5000	84	96	108	48	48	96	100	112	24	850	25,000
7500	94	102	122	54	48	102	100	126	24	1,620	46,900

① Weights, gallons of fluid, and dimensions are for reference only and not for construction. Please contact Eaton for exact dimensions.

② Add 9 inches for Bay-O-Net fusing.

Standard features

Connections and neutral configurations

- Delta–Wye: Low-voltage neutral will be a fully insulated X0 bushing with removable ground strap
- Grounded Wye–Wye: High-voltage neutral will be internally tied to the low-voltage neutral and brought out as the H0X0 bushing in the secondary compartment with a removable ground strap
- Delta–Delta: Transformer will be provided without a neutral bushing
- Wye–Wye: High-voltage neutral will be brought out as the H0 bushing in the primary compartment and the low-voltage neutral will be brought as the X0- bushing in the secondary compartment
- Wye–Delta: High-voltage neutral will be brought out as the H0 bushing in the primary compartment. No ground strap will be provided (line-to-line rated fusing is required)

High- and low-voltage bushings

- 200 A bushing wells (15 kV, 25 kV, and 35 kV)
- 200 A, 35 kV large interface
- 600 A (15 kV, 25 kV, and 35 kV) integral bushings (dead-front)
- Electrical-grade wet-process porcelain bushings (live-front)

Tank/cabinet features

- Bolted cover for tank access (45–2500 kVA)
- Welded cover with hand hole (>2500 kVA)
- Three-point latching door for security
- Removable sill for easy installation
- Lifting lugs (four)
- Stainless steel cabinet hinges and mounting studs
- Steel divider between high- and low-voltage compartment
- 20-inch-deep cabinet (45–1000 kVA)
- 24-inch-deep cabinet (1500–7500 kVA)
- 30-inch-deep cabinet (34.5/19.92 kV)
- Pentahead captive bolt
- Stainless steel one-hole ground pads (45–500 kVA)
- Stainless steel two-hole ground pads (750–10,000 kVA)
- Parking stands (dead-front)

Valves/plugs

- 1-inch upper filling plug
- 1-inch drain plug (45–500 kVA)
- 1-inch combination drain valve with sampling device in low-voltage compartment (750–10,000 kVA)
- Automatic pressure relief valve

Nameplate

- Laser-scribed anodized aluminum nameplate

Figure 3. Drain valve with sampler

Figure 4. Automatic pressure relief valve

Figure 5. Liquid level gauge

Figure 6. External gauges

Figure 7. External visible break with gauges

Optional features

High- and low-voltage bushings

- 200 A (15, 25 kV) bushing inserts
- 200 A (15, 25 kV) feed thru inserts
- 200 A (15, 25 kV) (HTN) bushing wells with removable studs
- High-voltage 600 A (15, 25, 35 kV) deadbreak one-piece bushings
- Low-voltage 6-, 8-holes spade
- Low-voltage 12-, 16-, 20-holes spade (750–2500 kVA)
- Low-voltage bushing supports

Tank/cabinet features

- Stainless steel tank base and cabinet
- Stainless steel tank base, cabinet sides and sill
- 100% stainless steel unit
- Service entrance (2-inch) in sill or cabinet side
- Touch-up paint (domestic)
- Copper ground bus bar
- Kirk-Key provisions
- Nitrogen blanket
- Bus duct cutout

Special designs

- Factory mutual (FM)
- UL classified
- Triplex
- High altitude
- K-Factor
- Step-up
- Critical application
- Modulation transformers
- Seismic applications (including OSHPD)

Switches

- One, two, or three On/Off loadbreak switches
- Four-position loadbreak V-blade switch or T-blade switch
- Delta-wye switch
- Three-position V-Blade selector switch
- 100 A, 150 A, 300 A tap changers
- Dual-voltage switch
- Visible disconnect with VFI / VFI-XD interlock
- External visible break (15 kV, 25 kV, and 35 kV, up to 3 MVA)
- External visible break with gauges (15 kV, 25 kV, and 35 kV, up to 3 MVA)

Gauges and devices

- Liquid-level gauge (optional contacts)
- Pressure vacuum gauge (optional contacts and bleeder)
- Dial-type thermometer (optional alarm contacts)
- Cover-mounted pressure relief device (optional alarm contacts)
- Ground connectors
- Hexhead captive bolt
- Molded case circuit breaker mounting provisions
- External gauges in padlockable box

Overcurrent protection

- Bay-O-Net fusing (current sensing, dual sensing, dual element, high amperage overload)
- Bay-O-Net expulsion fuse in series with a partial range under-oil ELSP current-limiting fuse (below 23 kV)
- Cartridge fusing in series with a partial range under-oil ELSP current-limiting fuse (above 23 kV)
- MagneX™ interrupter with ELSP current-limiting fuse
- Vacuum fault interrupter (VFI)—12.5 kA / 16 kA
- Vacuum fault interrupter extreme duty (VFI-XD)—25 kA
- Visible break window
- Fuse/switch interlock

Valves/plugs

- Drain/sampling valve in high-voltage compartment
- Globe type upper fill valve

Overvoltage protection

- Distribution-, intermediate-, or station-class surge arresters
- Elbow arresters (for dead-front connections)

Metering/fan/control

- Full metering package
- Current transformers (CTs)
- Metering socket
- NEMA 4 control box (optional stainless steel)
- NEMA 7 control box (explosion proof)
- Fan packages

Testing

- Customer test witness
- Customer final inspection
- Zero sequence impedance test
- Heat run test
- ANSI impulse test
- Audible sound level test
- RIV (Corona) test
- Dissolved Gas Analysis (DGA) test
- 8- or 24-hour leak test

Coatings (paint)

- ANSI Bell Green
- ANSI #61 Light Gray
- ANSI #70 Sky Gray
- Special paint available per request

Nameplate

- Stainless steel

Decals and labels

- High voltage warning signs
- Mr. Ouch
- Bi-lingual warning
- DOE compliant
- Customer stock code
- Customer stenciling
- Shock and arc flash warning decal
- Non-PCB decal

Construction

Core

The three-legged, step-lap mitered core construction is manufactured using a high-quality cutting machine. For maximum efficiency, cores are precisely stacked, virtually eliminating gaps in the corner joints.

Five-legged wound core or shell-type triplex designs are used for wye-wye connected transformers, and other special transformer designs.

Cores are manufactured with precision-cut, burr-free, grain-oriented silicon steel or amorphous metal, depending on customer preference or optimal material based upon performance requirements. Many grades of core steel are available for optimizing core loss efficiency.

Coils

Pad-mounted transformers feature a rectangular coil configuration with wire-wound, high-voltage primaries and sheet-wound secondaries. The design minimizes axial stress developed by short circuits and provides for magnetic balancing of tap connections.

Coils are wound using the highest quality winding machines providing exacting tension control and conductor placement for superior short-circuit strength and maximum efficiency.

Extra mechanical strength is provided by diamond pattern, epoxy-coated paper insulation, used throughout the coil, with additional epoxy at heavy stress points. The diamond pattern distribution of the epoxy and carefully arranged ducts, provide a network of passages through which cooling fluid can freely circulate.

Coil assemblies are heat-cured under calculated hydraulic pressure to ensure performance against short-circuit forces.

Core and coil assemblies

Pad-mounted transformer core and coil assemblies are braced with heavy steel ends to prevent the rectangular coil from distorting under short-circuit conditions. Plates are clamped in place using presses, and welded or bolted to form a solid core and coil assembly. Core and coil assemblies exceed ANSI and IEEE requirements for short-circuit performance. Due to the rigidity of the design, impedance shift after short-circuit is comparable to that of circular wound assemblies.

Tanks

Transformer tanks are designed for high strength and ease of handling, installation, and maintenance. Tanks are welded using precision-cut, hot rolled, pickled, and oiled steel. They are sealed to protect the insulating fluid and other internal components.

Transformer tanks are pressure-tested to withstand 7 psig without permanent distortion and 15 psig without rupture.

Tank finish

An advanced multi-stage finishing process exceeds IEEE Std C57.12.28™-2014. The eight-stage pre-treatment process ensures coating adhesion and slows corrosion. It converts tank surfaces to a nonmetallic, water-insoluble iron-phosphate coating.

The paint method consists of two distinct layers of paint. The first is an epoxy primer (E-coat) layer that provides a barrier against moisture, salt, and corrosives. The two-component urethane final coat seals and adds ultraviolet protection.

Vacuum processing

Transformers are dried and filled with filtered insulating fluid under vacuum, while secondary windings are energized. Coils are heated to drive out moisture, ensuring maximum penetration of fluid into the coil insulation system.

Insulating fluid

Eaton's Cooper Power series transformers are available with electrical-grade mineral insulating oil or Envirotemp™ FR3™ fluid. The highly refined fluids are tested and degassed to ensure a chemically inert product with minimal acid ions. Special additives minimize oxygen absorption and inhibit oxidation. To ensure high dielectric strength, the fluid is re-tested for dryness and dielectric strength, refiltered, heated, dried, and stored under vacuum before being added to the completed transformer.

Eaton's Cooper Power series transformers filled with Envirotemp™ FR3™ fluid feature unique fire safety, environmental, electrical, and chemical advantages, including insulation life extending properties.

A bio-based, sustainable, natural ester dielectric coolant, Envirotemp™ FR3™ fluid quickly and thoroughly biodegrades in the environment and is non-toxic per acute aquatic and oral toxicity tests.

Building for Environmental and Economic Sustainability (BEES) total life cycle assessment software, utilized by the US Dept. of Commerce, reports its overall environmental performance impact score at 1/4th that reported for mineral oil. Envirotemp™ FR3™ fluid has also earned the EPA Environmental Technology Verification of transformer materials.

With a fire point of 360 °C, Envirotemp™ FR3™ fluid is FM Approved® and UL® Classified "Less-Flammable" per NEC Article 450.23, fitting the definition of a Listed Product per NEC.

Figure 8. VFI-XD transformer with visible break

Pad-mounted VFI transformer

Eaton's Cooper Power series VFI transformer combines a conventional distribution transformer with the proven vacuum fault interrupter (VFI). This combination provides both voltage transformation and transformer overcurrent protection in one space saving and money saving package. The pad-mounted VFI protects the transformer and provides proper coordination with upstream protective devices. When a fault or overload condition occurs, the VFI trips and isolates the transformer or faulted section of the loop.

The three-phase VFI breaker has independent single-phase initiation, but is three-phase mechanically gang-tripped. A trip signal on any phase will open all three phases. This feature eliminates single-phasing of three-phase loads. It also enables the VFI breaker to be used as a three-phase loadbreak switch.

Due to the resettable characteristics of the VFI breaker, restoring three-phase service is faster and easier.

The sealed visible break window and switch is an option that can be installed to provide visible break contact. This feature provides enhanced safety and allows an operator to see if the loadbreak switch contacts are in an open or closed position before performing maintenance.

Envirotran™ FM Approved special protection transformer

Eaton's Cooper Power series Envirotran™ transformer is FM Approved and suitable for indoor locations. Factory Mutual Research Corporation's (FMRC) approval of the Envirotran transformer line makes it easy to comply with and verify compliance with Section 450.23, 2008 NEC, less-flammable liquid-filled transformer requirements for both indoor and outdoor locations.

Envirotran FM Approved transformers offer the user the benefit of a transformer that can be easily specified to comply with NEC, and makes FM Safety Data Sheet compliance simpler, while also providing maximum safety and flexibility for both indoor and outdoor installations.

Because the "FM Approved" logo is readily visible on the transformer and its nameplate, NEC compliance is now easily verifiable by the inspector.

Envirotran FM Approved transformers are manufactured under strict compliance with FMRC Standard 3990 and are filled with FM Approved Envirotemp™ FR3™ fluid, a fire-resistant dielectric coolant.

FM
APPROVED

Special application transformers

Data center transformer

With focus rapidly shifting from simply maximizing uptime and supporting demand to improving energy utilization, the data center industry is continually looking for methods to increase its energy efficiency and reliability. A solution—Eaton's Cooper Power series Hardened Data Center (HDC) liquid-filled transformers are designed to provide surge protection and superior performance under the harshest electrical environments. Contrary to traditional dry-type units, HDC transformers provide unsurpassed reliability, overloadability, operational life, efficiency, thermal loading, and installed footprint. These units have reliably served more than 100 MW of critical data center capacity for a total of more than 6,000,000 hours without any reported downtime caused by a thermal or short-circuit coil failure.

The top priority in data center operations is uninterrupted service. Envirotran HDC transformers from Eaton, having substantially higher levels of insulation, are less susceptible to voltage surges. Eaton has experienced zero failures due to switching transients. The ANSI and IEEE standard impulse withstand ratings are higher for liquid-filled transformers, making them less susceptible to insulation failure. The Envirotran HDC transformer provides ultimate protection by increasing the BIL rating one level higher than standard liquid-filled transformer ratings. The cooling system of liquid-filled transformers provides better protection from severe overloads—overloads that can lead to significant loss of life or equipment failure.

Data center design typically includes multiple layers of redundancy, ensuring maximum uptime for the critical IT load. When best-in-class transformer manufacturing lead times are typically weeks, not days, an unexpected transformer failure can adversely affect the facility's reliability and profitability. Therefore, the ability to determine the electrical and mechanical health of a transformer can reduce the probability of costly, unplanned downtime. Routine diagnostic tests, including key fluid properties and dissolved gas analysis (DGA), can help determine the health of a liquid-filled transformer. Although sampling is not required for safe operation, it provides the user with valuable information, leading to scheduled repair or replacement, and minimizing the duration and expense of an outage. With a dry-type transformer, there is no reliable way to measure the health or likelihood of an impending failure.

Solar transformer

As a result of the increasing number of states that are adopting aggressive Renewable & Alternative Energy Portfolio Standards, the solar energy market is growing—nearly doubling year over year. Eaton, a key innovator and supplier in this expanding market, is proud to offer its Cooper Power series Envirotran transformers specifically designed for solar photovoltaic medium-voltage applications. Eaton is working with top solar photovoltaic developers, integrators, and inverter manufacturers to evolve the industry and change the way we distribute power.

In accordance with this progressive stance, every Envirotran Solar transformer is filled with non-toxic, biodegradable Envirotemp™ FR3™ dielectric fluid, made from renewable seed oils. On top of its biodegradability, Envirotemp™ FR3™ fluid substantially extends the life of the transformer insulation, saving valuable resources. What better way to distribute green power than to use a green transformer. In fact, delaying conversion to Envirotran transformers places the burden of today's environmental issues onto tomorrow's generations.

Eaton can help you create a customized transformer, based on site specific characteristics including: temperature profile, site altitude, solar profile, and required system life. The benefits gained from this custom rating include:

- Reduction in core losses
- Improved payback on investment
- Reduction in footprint
- Improved fire safety
- Reduced environmental impact

For the solar photovoltaic industry, Eaton offers standard step-up transformers and dual secondary designs, including 4-winding, 3-winding (Low-High-Low), and 3-winding (Low-Low-High) designs.

Wind transformer

Eaton offers custom designs for renewable energy power generation. Eaton manufactures its Cooper Power series Generator Step-Up (GSU) transformers for installation at the base of every wind turbine. Additionally, grounding transformers are available for wind power generation.

DOE efficiency

The United States Department of Energy (DOE) has mandated efficiency values for most liquid type, medium-voltage transformers. As a result, all applicable Eaton transformers 2500 kVA and below conform to efficiency levels as specified in the DOE ruling "10 CFR Part 431 Energy Conservation Program".

UL Listed and Labeled/Classified

The Envirotran transformer can be specified as UL Listed and Labeled, and/or UL Classified. UL listing is a verification of the design and construction of the transformer to ANSI and IEEE standards. UL listing generally is the most efficient, cost-effective solution for complying with relevant state and local electrical codes. UL Combination Classification/Listing is another way to comply with Section 450.23, 2008 NEC requirements. This combines the UL listed transformer with a UL Classified Less-Flammable Liquid and complies with the use restrictions found within the liquid classification.

K-Factor transformer

With a drastic increase in the use of ferromagnetic devices, arcing devices, and electric power converters, higher frequency loads have increased significantly. This harmonic loading has the potential to generate higher heat levels within a transformer's windings and leads by as much as 300%. Harmonic loading has the potential to induce premature failure in standard-design distribution transformers.

In addition to standard UL "K-Factor" ratings, transformers can be designed to customer-provided specifications detailing precise loading scenarios. Onsite measurements of magnitude and frequency, alongside harmonic analysis of the connected load can be performed by Eaton engineers or a third-party consultant. These field measurements are used to determine exact customer needs and outline the transformer specifications.

Eaton can design harmonic-resistant transformers that will be subjected to the unique harmonic loads. These units are designed to maintain normal temperature rise under harmonic, full-load conditions. Standard UL "K-Factor" designs can result in unnecessary costs when the "next-highest" K-Factor must be selected for a calculated design factor. To save the customer these unnecessary costs, Eaton can design the transformer to the specific harmonic spectrum used in the application. Eaton's Cooper Power series K-Factor transformers are filled with mineral oil or Envirotemp™ FR3™ fluid and have the added benefits of dielectric cooling such as higher efficiencies than dry-type transformers.

Modulation transformer

Bundled with an Outboard Modulation Unit (OMU) and a Control and Receiving Unit (CRU), a Modulation Transformer Unit (MTU) is designed to remotely achieve two-way communication.

The use of an MTU reduces travel time and expense versus traditional meter reading performed by high-voltage electricians. Additionally, with MTU it is possible to manage and evaluate energy consumption data, providing reduced metering costs and fewer tenant complaints.

An MTU uses the existing utility infrastructure, therefore eliminating the need to engineer and construct a dedicated communication network.

Figure 9. Modulation transformer

Inverter/rectifier bridge

Eaton complements its range of applications for transformers by offering dual winding designs intended for connection to 12-pulse rectifier bridges.

Product attributes

Eaton includes the following guarantees with every three-phase pad-mounted transformer.

Engineered to order (ETO)

Using customer specifications, Eaton will provide a well-developed, cost-effective solution to fit the customer's needs. Whether it is application specific, site specific, or a uniquely specified unit, Eaton will provide transformers with the best-in-class value and performance, saving the customer time and money.

Made in the U.S.A.

Eaton's three-phase pad-mounted transformers are produced in the U.S. with manufacturing facilities positioned strategically for rapid shipment of products. Furthermore, should the need arise, Eaton has a broad network of authorized service repair shops throughout the U.S.

Superior paint performance

Eaton's E-coat system protects transformers from nature's elements, provides unrivaled transformer paint life, and exceeds IEEE Std C57.12.28™-2014 and IEEE Std C57.12.29™-2005. In addition to the outside of the unit, each transformer receives a gray E-coat covering in the interior of the tank and cabinet, providing superior rust resistance and greater visibility during service.

If the wide range of standard paint selections does not suit the customer's needs, Eaton will customize the paint color to meet their requirements.

Rectangular coil design

Eaton utilizes a rectangular coil design. This winding technique results in a smaller overall unit footprint as well as reduced transformer weight without compromising the transformer's performance. Units have proven short circuit withstand capabilities up to 10 MVA.

Testing

Eaton performs routing testing on each transformer manufactured including the following:

- **Insulation power factor:** This test verifies that vacuum processing has thoroughly dried the insulation system to required limits
- **Ratio, polarity, and phase relation:** Assures correct winding ratios and tap voltages and confirms insulation of high-voltage and low-voltage circuits; checks entire insulation system to verify all live-to-ground clearances
- **Resistance:** This test verifies the integrity of internal high-voltage and low-voltage connections; provides data for loss upgrade calculations
- **Routine impulse:** The most severe test, simulating a lightning surge; applies one reduced wave and one full wave to verify the BIL rating
- **Applied potential:** Applied to both high-voltage and low-voltage windings, this test stresses the entire insulation system to verify all live-to-ground clearances
- **Induced potential:** 3.46 times normal plus 1000 V for reduced neutral designs
- **Loss test:** These design verification tests are conducted to assure that guaranteed loss values are met and that test values are within design tolerances; tests include no-load loss and excitation current along with impedance voltage and load loss
- **Leak test:** Pressurizing the tank to 7 psig ensures a complete seal, with no weld or gasket leaks, to eliminate the possibility of moisture infiltration or fluid oxidation

Design performance tests

The design performance tests include the following:

- **Temperature rise:** Our automated heat run facility ensures that any design changes meet ANSI and IEEE temperature rise criteria
- **Audible sound level:** Ensures compliance with NEMA requirements
- **Lightning impulse:** To assure superior dielectric performance, this test consists of one reduced wave, two chopped waves, and one full wave in sequence, precisely simulating the harshest conditions

Thomas A. Edison Research and Test Facility

We are constantly striving to introduce new innovations to the transformer industry, bringing you the highest quality transformer for the lowest cost. Eaton's Cooper Power series transformer products are ISO 9001 compliant, emphasizing process improvement in all phases of design, manufacture, and testing. We have invested millions of dollars in the Thomas A. Edison Technical Center, our premier research facility in Franksville, Wisconsin, affirming our dedication to introducing new innovations and technologies to the transformer industry. This research facility is fully available for use by our customers to utilize our advanced electrical and chemical testing labs.

Eaton
1000 Eaton Boulevard
Cleveland, OH 44122
United States
Eaton.com

Eaton's Cooper Power Systems Division
2300 Badger Drive
Waukesha, WI 53188
United States
Eaton.com/cooperpowerseries

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