

Three-phase Pad-mounted Transformer



EATON

Powering Business Worldwide

Eaton's vision is to improve quality of life and the environment through the use of power management technologies and services.

- We are dedicated to developing our employees by helping them succeed not just at work, but in life as well.
- We delight our customers by understanding their challenges and proactively delivering real solutions.
- We deliver for our shareholders by doing what's right, so investors want to own more shares in our company.
- We support our communities by providing products and solutions that can improve quality of life and the environment; we also offer our time, talent and resources to satisfy social and economic needs where we work and live.



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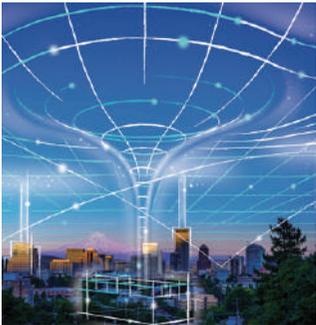
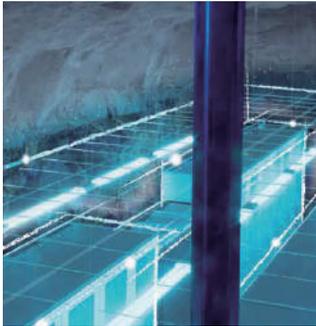
Eaton Corporation is an intelligent power management company dedicated to protecting the environment and improving the quality of human life. Our products serve the data center, utility, industrial, commercial, mechanical manufacturing, residential, aerospace, and vehicle markets. Whether now or in the future, we promise to operate legitimately, sustainably, and help customers better manage their motivation. With the support of global trends in electrification and digitization, we are accelerating the world's transition to renewable energy, helping customers solve the most urgent power management challenges, and creating a more sustainable society for today and future humanity.

Eaton Corporation was founded in 1911 and has been listed on the New York Stock Exchange for over a century. In 2023, Eaton's sales reached \$23.2 billion and its business covers over 160 countries. Eaton entered the Chinese market in 1993 and has since rapidly developed its business in China. In 2004, the company's Asia Pacific headquarters moved from Hong Kong to Shanghai. In China, Eaton Company currently has approximately 8000 employees and 19 manufacturing bases.



Eaton Transformer (Jiangsu) Co., Ltd.

We make what matters.*



Eaton's Electrical Sector provides customized comprehensive services by:

- Providing data centers with efficient and safe energy-saving solutions to protect your information and data.
- Providing photovoltaic, wind power, and hybrid solutions to help you convert new energy into daily power.
- Improving the reliability and uninterrupted running time of smart grids.
- Providing continuous, clean, reliable power and life cycle management services to improve project efficiency.
- Helping enterprises to reduce operating costs and complexity, enhancing the predictability of operational failures, and ensuring personnel safety.
- Assisting production equipment manufacturers in making machinery production management simpler, more reliable, safer, and more energy-efficient.

Eaton Transformer



In 1892

Eaton transformer technology can be traced back to 1892 in which the first dry type transformer was developed.

For over a century

Eaton is committed to innovating and iterating

In 2012

The acquisition of Cooper makes Eaton one of the world's leading manufacturers of electrical equipment.

In 2023

Established in 2023

[Eaton Transformer Jiangsu](#)

Key products: Dry type transformer, Oil immersed transformer, Prefabricated substation, Integrated power conversion and step-up unit.

Full series of Eaton transformer solutions

- Complying with GB, IEC and UL standards.
- Hundred years of technology heritage.
- Customized manufacturing capabilities.
- Rapid response to customer demand.





Overview

Pad-mounted transformer has outstanding features including reliable compact structure, quick and flexible installation, convenient operation, small size, etc., it can be widely used in industrial areas, residential communities, commercial centres, urban roads, skyscrapers and other premises. The difference between this kind of product and prefabricated transformer is : pad-mounted transformer is designed with integration of transformer part, high-voltage load switch, protective fuse and other devices, and placed in an oil tank for relatively comparably smaller size. It is suitable for both looped and radial network and can be changed conveniently for an enhanced reliability of power supply.

Advantages

- Strong overload capacity without affecting service life.
- Energy conservation and environmental protection. Stable operation, maintenance free for 20 years. The cable connector has an isolation switch function, which is convenient and flexible to operate, and can be operated with 200A load.
- The entire set adopts cooper pad-mounted transformer accessories and cable connector, with superior overall matching performance; Can be equipped with fully shielded and fully insulated elbow type lightning arresters, which can be directly installed on the double conduit joint of the transformer without occupying a separate position.
- The Dyn1 connection method adopts a three-phase three column structure, while the YNyn0 connection method adopts a three-phase five column structure, which has high voltage quality, no drift of the neutral point, no heating of the enclosure, low noise, and good lightning protection performance.
- High strength enclosure design, capable of withstanding 7 pounds per square inch (approximately 49kPa) without oil leakage or permanent deformation, capable of withstanding 15 pounds per square inch (approximately 105kPa) without bursting.
- The surface of the enclosure adopts anti-corrosion design and special paint treatment, which can be widely used in various harsh environments, such as areas with frequent blizzards, high pollution, etc.
- High ignition point oil (FR3 oil, biodegradable, with a ignition point of up to 360°C) can be selected and placed in multi story or high-rise buildings to eliminate fire hazards.

Three-phase Pad-mounted Transformer

Structure



The structure of pad-mounted transformer structure is divided into two parts: front and rear. The front is the high and low voltage operation interval, which includes high and low voltage terminals, load switches, no-load voltage tap changers, plug-in fuses, pressure relief valves, oil temperature gauges, oil level gauges, oil injection holes, and oil discharge valves. The rear part is equipped with an oil injection box and heat dissipation fins. The transformer winding and iron core, high-voltage load switch, and protective fuse are all located in the oil injection box. The box body is a fully sealed structure, using concealed high-strength bolts and oil resistant nitrile rubber washers to seal the box cover. It can withstand 7 Psig air pressures (pounds/inch²), equivalent to approximately 0.5Kg/cm² gauge pressure.

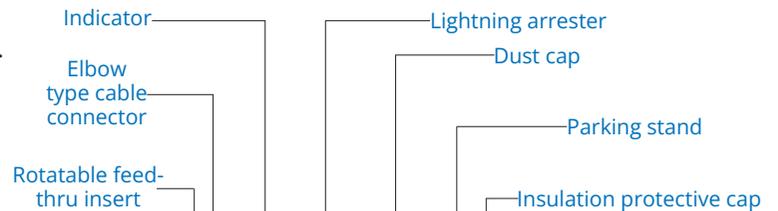
The design of the enclosure fully considers the requirements of waterproof, safety, and easy operation. The door is three-point interlocked, and the high-voltage interval can only be opened after the low-voltage interval is opened.



High voltage terminal

The high-voltage terminals of Eaton pad-mounted transformers are equipped with bushings produced by RTE (Cooper Cable Connector Factory), which are used to connect elbow type cable connectors with load breaking capacity. The bushings are connected to the elbow type cable connectors, sealing the live parts inside the insulation body, forming a fully insulated structure. The surface of the terminals is not charged (ground potential), reliably ensuring personal safety. Elbow type cable connectors can be plugged and unplugged with power when the transformer is fully loaded. Therefore, elbow type cable connectors can be used as load switches in emergency situations. On the outer shell of the enclosure, there are also some parking stands welded to fix the support type insulation bushing insert; When the elbow cable connector is unplugged with electricity, it can be immediately inserted into the bushing. According to the needs, elbow type fully insulated metal zinc oxide lightning arrester or wall mounted lightning arrester can also be installed on the transformer. The elbow type lightning arrester is fully shielded, fully enclosed, and pluggable. Its size and shape are similar to the elbow type cable connector, making it very convenient to install. Its installation method is to equip the high-voltage terminal of the pad-mounted transformer with Cooper's rotatable feedthru insert, with one end of the rotatable feedthru insert connected to the elbow type cable connector and the other end connected to the lightning

arrester. The wall mounted lightning arrester can be directly installed on the parking stand of the transformer, providing a socket and overvoltage protection for the live electric elbow type cable connector, and can also provide dust and moisture-proof protection for the uncharged elbow type cable connector.



Insulating oil

Eaton transformers use electrical grade mineral insulation oil or FR3 fluid. Test and degass highly refined fluids to ensure that the product has minimal chemical inertness of acid ions. Special additives can minimize oxygen absorption and inhibit oxidation to the greatest extent possible. To ensure high dielectric strength, the fluid is dried and retested for dielectric strength before being added to the complete transformer, filtered, heated, dried, and stored under vacuum.

Advantages of FR3 fluid.

- Improve transformer performance with smaller and more efficient transformers. Transformers using FR3 fluid have a capacity up to 20% higher than those using mineral oil.
- Improve fire safety (the flash point and ignition point of FR3 fluid are twice that of mineral oil).
- It can protect the insulation paper of the transformer, increase its usage time (compared to using mineral oil) by 5-8 times, and extend the service life of the transformer.

- Increase load capacity (up to 20% or more of FR3 natural ester high-temperature capacity).
- Improving environmental footprint, FR3 fluid is non-toxic and harmless to soil and water resources, and can achieve 100% biodegradation in as little as 10 days.



Switches and Protective Devices

Fuse

The Eaton pad mounted transformer is protected by connecting the fuses inside the Cooper backup protection fuse (ELSP) and the Bay-O-Net plug-in fuse in series. The protection principle is advanced, economical, reliable, and easy to operate. ELSP is an oil immersed, current limiting fuse installed inside the cabinet, which only operates when a fault occurs inside the transformer and is used to protect high-voltage lines. Bay-O-Net is an oil immersed, plug-in fuse that fuses when a short circuit fault, overload, or high oil temperature occurs on the secondary side. After the fuses (current type, dual sensitive type, dual factor type) inside the Bay-O-Net are blown, the Bay-O-Net can be pulled out and the internal fuses can be replaced without power outage in the substation.

Bay-O-Net fuse assembly

- Eaton Bay-O-Net fuse cartridge, protective pad-mounted transformer and distribution system, can be used in pad-mounted transformers and buried transformers filled with plant insulation oil and other transformer oils. The installation considers both the convenience of installing the insulated operating rod and the safety of the fully shielded structure.
- Eaton provides a Bay-O-Net fuse cartridge with a tongue valve (for side installation only), which automatically closes when the fuse cartridge is removed. In this way, when replacing the fuse, the probability of oil leakage from the transformer can be reduced, the safety of on-site line personnel can be improved, the environmental pollution caused by oil spills can be reduced, and the amount of oil spilling onto the connected elbow can be reduced.
- A fuse cartridge with a silver plating layer can overload the fuse with high current. Silver plated contacts with high current overload fuses can be used for larger capacity transformers.



Bay-O-Net fuse assembly



Bay-O-Net fuse

Bay-O-Net

- Bay-O-Net (BON) fuse can sense overload current from overload or secondary side faults. BON fuse is an integrated fuse tube design that simplifies the fuse installation steps and prevents incorrect installation. The integrated fuse tube has a silver plated terminal, greatly improving conductivity.

ELSP fuse

- ELSP current-limiting backup fuse can better cooperate with BON fuse to protect transformers.
- Our backup fuse has a maximum breaking level of 50 kA.
- The backup fuse is smaller, lighter, and thinner, making it easier to install small capacity and small-sized transformers, and also shockproof.



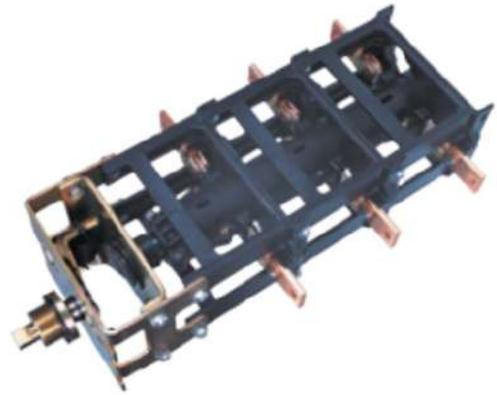
ELSP current-limiting backup fuse

Loadbreak switch

Oil immersed loadbreak switch is a three-phase linkage switch with a spring operating mechanism, which can complete load opening and closing operations. The loadbreak switch is divided into two positions and four positions, which are respectively used for terminal type distribution systems and ring network type distribution systems.

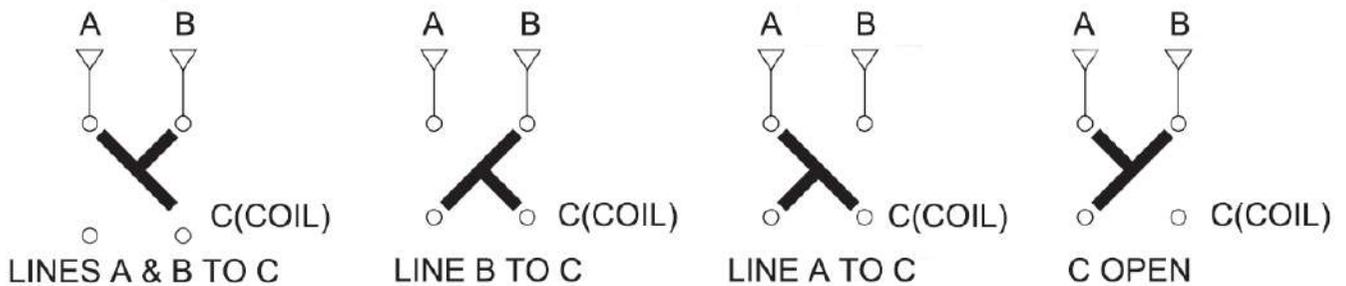


Four-position loadbreak switch

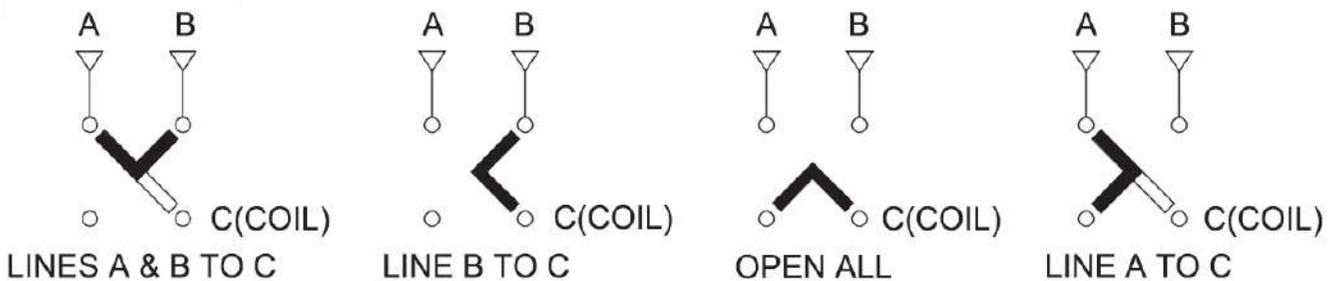


Two-position loadbreak switch

T blade type four position loadbreak switch connection method



V blade type four position loadbreak switch connection method



Core

The core of Eaton pad-mounted transformer is small in volume, rectangular in shape, and made of high-quality oriented magnetic core steel sheets. It is designed with characteristics such as low excitation current, low loss and low noise. The iron core adopts a three-phase three column or three-phase five column structure, and the zero sequence magnetic flux will flow through the two side columns without passing through the cabinet. The surface of the enclosure will not generate heat, while reducing iron loss.

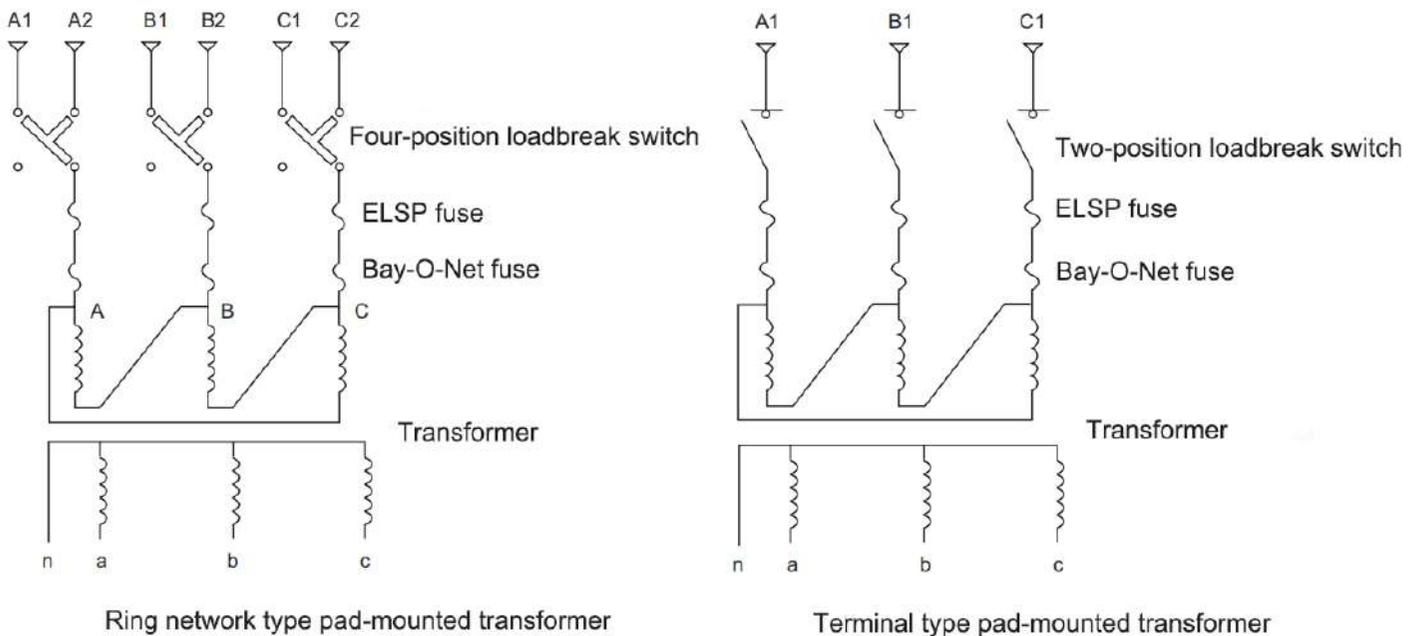
Vector group symbol

According to the characteristics of the distribution line load, pad-mounted transformer adopts Dyn1 and YNyn0 wiring, which has the characteristics of high output voltage quality, non drift neutral point, and good lightning protection performance. When the three-phase load on the low-voltage side of the pad-mounted transformer is unbalanced, due to the fact that zero sequence current and third harmonic current can flow in the closed circuit of the high-voltage winding, the total zero sequence magnetic potential and third harmonic magnetic potential on each iron core column are almost equal to zero, so the low-voltage neutral point potential does not drift and the voltage quality of each phase is high. Due to its ability to circulate in the closed circuit of high-voltage windings, the total magnetic potential of lightning current on each iron core column is almost zero, eliminating the overvoltage caused by forward and reverse converter, and correspondingly improving the lightning protection performance.

Paint layer

The enclosure undergoes eight strict pre-treatment processes before painting, followed by seven painting and baking processes before painting is considered complete. The surface paint of the enclosure has a long lifespan, long-lasting performance and can adapt to various harsh environments.

Electrical schematic diagram



Technical parameter

Rated Capacity (kVA)	H.V(V)	L.V(V)	Vector Group	Short Circuit Impedance (%)	Efficiency (%)
45	12470	208Y/120	Dyn1 YNyn0	2.70-5.75	98.92
75				2.70-5.75	99.03
112.5				3.10-5.75	99.11
150				3.10-5.75	99.16
225				3.10-5.75	99.23
300				3.10-5.75	99.27
500				4.35-5.75	99.35
750				5.75	99.40
1000				5.75	99.43
1500				5.75	99.48
2000				5.75	99.51
2500				5.75	99.53
3750				5.75	-

Testing

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

- 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; checks insulation of HV and LV 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 up-grade calculations.
- Routine Impulse Tests: 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 volts 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 assures a complete seal, with no weld or gasket leaks, to eliminate the possibility of moisture infiltration or fluid oxidation.

We are guided by our commitment to do business right, to operate sustainably and to help our customers manage power-today and well into the future. By capitalizing on the global growth trends of electrification and digitalization, we're accelerating the planet's transition to renewable energy, helping to solve the world's most urgent power management challenges, and doing what's best for our stakeholders and all of society.

Asia-Pacific is a key growth market for Eaton. The company first established a presence in the region during the 1970s and has been growing significantly since then. Today, we have 33 major manufacturing facilities across the region and about 18,000 employees working in a fast-growing network of sales and marketing offices, manufacturing sites, service centers and research facilities. Shanghai has been the Asia-Pacific headquarters office since 2004.

For more information about Eaton China, visit www.eaton.com.cn
Follow Eaton China WeChat account: **Eaton_China**

Eaton Corporation
Asia Pacific Headquarter
No.3, Lane 280, Linhong Road,
Changning District,
Shanghai 200335
Tel: 86-21-52000099
Fax: 86-21-52000200

Eaton Transformer (Jiangsu) Co., Ltd
No.68 Changjiang West Road ,Hai'an City,
Jiangsu Province, China 226600
Tel: 86-513-81813666
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