Dry-Type Transformer Characteristics

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01 Product Overview

A dry-type transformer is one whose core and windings are not immersed in insulating oil; electrical insulation is provided by air and/or solid insulation such as epoxy resin. The windings are commonly vacuum-cast in epoxy resin (cast-resin type, SCB series). These transformers are characterized by fire safety, environmental suitability, and low maintenance needs. They are widely used where stringent fire-protection requirements apply and are a mainstream choice for urban distribution networks.

02 Operating Principle

Like an oil-immersed transformer, it operates by electromagnetic induction ($U_1/U_2 \approx N_1/N_2$). The main difference is that air or solid insulation serves as the insulating and heat-transfer medium. Heat dissipates through the winding surfaces and ventilation ducts under air-natural (AN) cooling or air-forced (AF) cooling.

03 Main Structure and Components

Core. Stacked cold-rolled grain-oriented electrical-steel laminations for low losses and low noise, held in place by clamps and tie plates.

High-voltage winding. Copper foil or copper conductors vacuum-cast in epoxy resin and cured as an integrated assembly for moisture resistance and resistance to cracking.

Low-voltage winding. Copper-foil wound construction, with epoxy casting or encapsulation.

Temperature-control system. PT100 platinum resistance temperature sensors, an intelligent temperature controller, and overtemperature alarm/trip functions.

Cooling fans. Optional forced-air (AF) system to increase available output capacity.

Enclosure. IP20/IP23/IP44/IP54 protection options, with inspection windows and ventilation passages.

Cable entry and exit. Top entry/top exit, bottom entry/top exit, and other configurations to suit installation conditions.

04 Product Classification

Insulation type. Epoxy-resin cast type (mainstream), wound/open type, or encapsulated type.

Capacity and voltage. Distribution dry-type transformers: 30-2,500 kVA at 10/20/35 kV; larger ratings can be achieved at the 35 kV voltage class.

Cooling method. AN (Air Natural) or AF (Air Forced).

Core structure. Three-phase, three-limb or five-limb designs, etc.

05 Key Technical Specifications (Typical Values)

ITEM	TYPICAL SPECIFICATION
Rated capacity	30-2,500 kVA (10 kV class); larger capacities available at 35 kV class.
Rated voltage	LV: 0.4 kV; HV: 10 kV / 20 kV / 35 kV.
Rated frequency	50 Hz / 60 Hz
Vector group	Dyn11, Yyn0, Dd0, etc.
Insulation class	Class F (155 °C) / Class H (180 °C).
Temperature-rise limits	Average winding: ≤100 K (Class F); ≤125 K (Class H).
Short-circuit impedance	4%-6% (typical for distribution service).
Insulation levels	10 kV class: LI 75 kV, AC 35 kV; 35 kV class: LI 200 kV, AC 85 kV.
Partial discharge	≤10 pC (epoxy cast-resin type).
Loss performance	SCB10-SCB15 series; selected according to GB 20052 efficiency grades.
Noise level	Typically 55-65 dB(A), depending on rating and design.
Enclosure protection	IP20 / IP23 / IP44 / IP54.
Overload capability	AF cooling may increase output by approximately 40%; short-term overload up to 1.5 times rated load for 2 hours (temperature-dependent).

06 Product Features and Advantages

Fire and explosion safety. Flame-retardant, self-extinguishing epoxy resin; the oil-free design avoids oil-related fire and flashover hazards and is suitable for stringent fire-safety acceptance requirements.

Environmental suitability. No insulating oil, oil leakage, or oil-related contamination; recyclable materials.

Low maintenance. No oil sampling or filtration required; routine cleaning is generally sufficient.

Flexible installation. Compact and relatively lightweight; suitable for indoor rooms, basements, high-rise buildings, and rooftops.

Moisture and dust resistance. Integral epoxy casting performs well in humid, hot, and dusty environments.

Reliable operation. Low partial discharge, ample insulation margin, and long service life.

Considerations. Initial cost is generally higher than that of an oil-immersed transformer of the same rating. Natural cooling (AN) provides limited overload capability; fans are needed for sustained higher loading. Noise can be slightly higher than for oil-immersed designs, and heat dissipation depends on adequate ventilation.

07 Applications and Industries

High-rise buildings. Power distribution in commercial complexes, offices, and apartment buildings.

Rail transit. Power supplies for metro systems, high-speed railway stations, and tunnels.

Public facilities. Airports, hospitals, schools, and sports venues.

Data centers and clean facilities. Data centers, semiconductor plants, and other facilities requiring high cleanliness and fire safety.

Renewable energy. Photovoltaic and wind-turbine step-up service and packaged substations; outdoor units require suitable protective enclosures.

Load centers. Indoor power distribution installed close to electrical loads.

08 Selection Guidelines

Capacity and loading. Size according to the actual load plus an appropriate margin, and define whether operation is AN or AF.

Insulation class. Class F (100 K winding temperature rise) is commonly selected; Class H may be chosen for high-temperature environments.

Protective enclosure. IP20/IP23 for indoor service; IP44/IP54 for outdoor or harsh environments.

Temperature control and fans. Intelligent temperature control and fans are recommended as standard for larger-capacity units.

Overload requirements. Where short-duration overloading is expected, calculate the load on the basis of the AF rating.

Noise. Confirm noise specifications for noise-sensitive sites such as hospitals or residences.

09 Frequently Asked Questions and Standard Responses

Q1. Are dry-type transformers more expensive than oil-immersed ones?

Answer. For the same rating, dry-type units usually cost more upfront, but oil maintenance and fire-protection facilities are saved. Compare on a total life-cycle cost basis.

Q2. Can dry-type transformers be used outdoors?

Answer. Yes, with a higher protection enclosure (IP44/IP54 or above) and proper ventilation. For permanent outdoor service, oil-immersed units are generally recommended.

Q3. What is the overload capability of dry-type transformers?

Answer. Under natural cooling (AN) the overload capability is limited. With forced air cooling (AF) the output can rise by about 40%, with short-time overload up to 1.5× for 2 hours depending on temperature and loading profile.

Q4. Do dry-type transformers require maintenance?

Answer. They are largely maintenance-free. Periodic cleaning of dust and checking fans, temperature controllers and connections (e.g., annually) are recommended.

Q5. Is the epoxy-cast transformer moisture resistant?

Answer. Yes. The fully cast epoxy insulation offers excellent moisture resistance for humid environments. For locations with persistent condensation, an anti-condensation heater is recommended.

Q6. What is the noise level of your dry-type transformers?

Answer. Typically 55–65 dB(A), depending on rating and design. Low-noise designs are available for noise-sensitive projects.

Q7. Can dry-type transformers be used in renewable energy plants?

Answer. Yes. They are widely used for wind-turbine step-up and PV box-type substations. Outdoor types need high-protection enclosures.

Q8. What is the partial-discharge level?

Answer. For epoxy-cast dry-type transformers it is typically ≤10 pC, ensuring high insulation reliability.

Q9. Do you support 60 Hz?

Answer. Yes, both 50 Hz and 60 Hz are available; 60 Hz units are designed to IEEE/ANSI standards.

10 Related Standards and Certifications

IEC 60076-11 (dry-type power transformers); GB/T 10228; JB/T 3837; GB 20052-2020 (energy efficiency); and the GB 1094 series. Routine/type-test reports and third-party testing can be provided or arranged on customer request, subject to confirmation.