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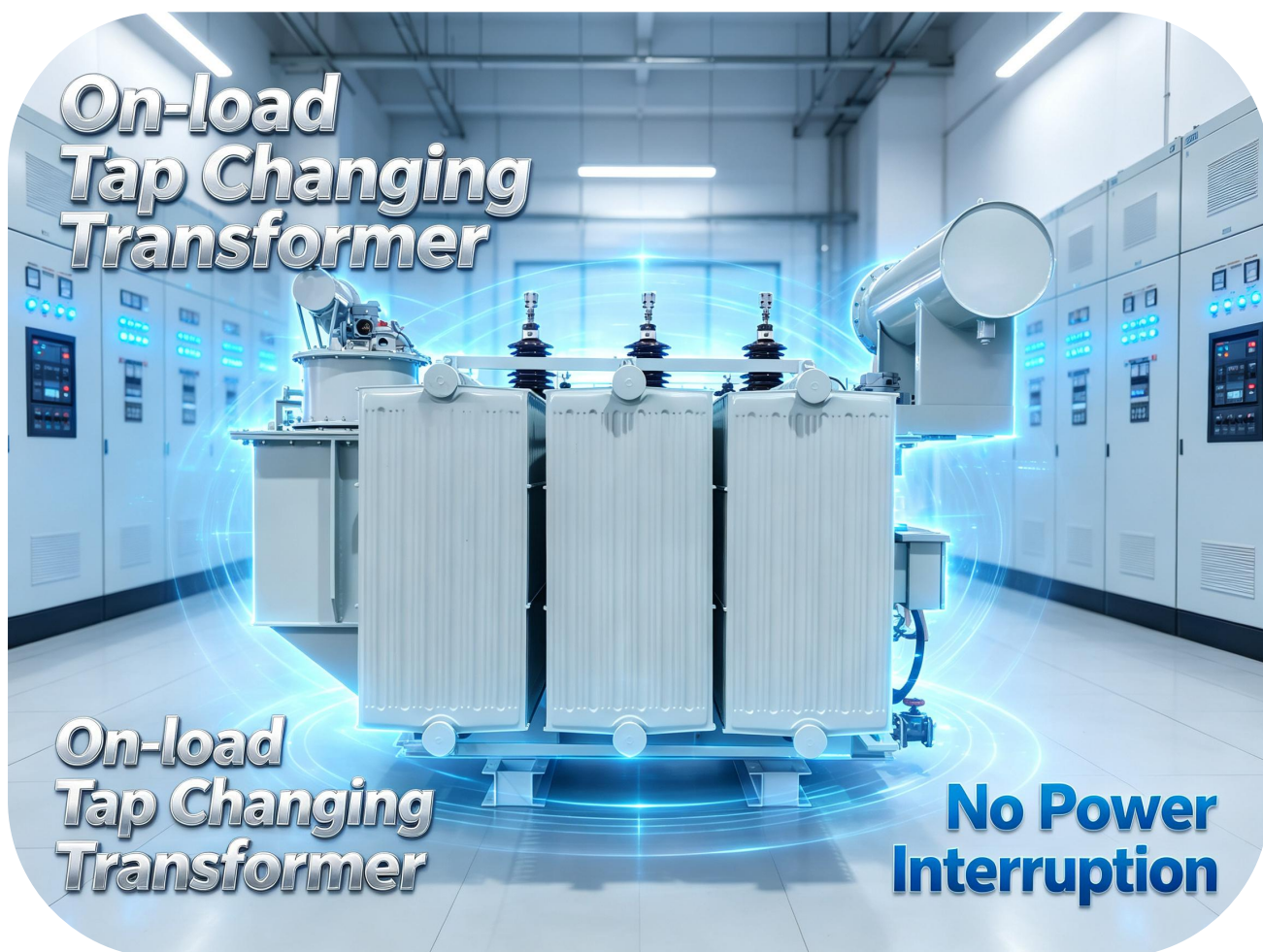
ELECTRICAL

SZ4000/35 ON-LOAD TAP-CHANGING OIL-IMMERSED POWER TRANSFORMER

35kV · 4000kVA · with SYJZZ Vacuum On-Load Tap Changer
Product Brochure

Zhejiang Tenrony Electric Co., Ltd.

Electric Power the Future



1. About Tenrony Electric

Zhejiang Tenrony Electric Co., Ltd. (Tenrony) was founded in 2003 in Lishui, Zhejiang. It is a national high-tech enterprise, a provincial "Specialized, Refined, Distinctive and Innovative" enterprise and a national green factory, with 23 years of deep experience in power transmission and distribution equipment. The company integrates transformer R&D, automated production, complete switchgear manufacturing and import/export trade.

Tenrony operates a 20,000 m² standardized intelligent production plant equipped with a fully automatic silicon-steel shearing line, vacuum drying and oil filling, CNC winding, and a full-performance high-voltage test station. Holding 39 core transformer patents, our products meet the bidding standards of State Grid and China Southern Power Grid, and serve urban/rural distribution networks, new-energy PV/wind booster stations, chemical and metallurgical plants, mines, industrial parks and 35kV regional substations. With full import/export qualifications, Tenrony has exported to numerous power projects in Southeast Asia, Central Asia and Africa.

All products are certified under the ISO9001 quality management system and type tests. Loss figures outperform the national Grade-2 energy-efficiency standard. The complete transformer carries a 3-year warranty, and the SYJZZ tap changer core components carry a 5-year warranty.

2. Product Overview

2.1 Model Designation

Model	Meaning
SZ4000/35	S: Three-phase oil-immersed; Z: On-load tap-changing; 4000: Rated capacity 4000kVA; 35: HV rated voltage 35kV
SYJZZ-40.5/200-11	S: Tap changer; Y: On-load; J: Central voltage regulation; Z: Vacuum arc extinction; Z: Integrated switching structure; 40.5kV: max. system voltage for 35kV class; 200A: rated current; 11: tap positions

2.2 Core Positioning

The SZ4000/35 is a 35kV-class two-winding oil-immersed vacuum on-load tap-changing main transformer, with the built-in Tenrony SYJZZ vacuum on-load tap changer. It performs continuous automatic voltage regulation under load without any power interruption, solving the bus voltage deviation (high/low) caused by day/night and seasonal load fluctuations, and keeping the low-voltage side stable within the national standard range. It is the primary voltage-stabilizing supply equipment for 35kV substations, new-energy booster stations and large industrial plants.

2.3 SYJZZ OLTC & Transformer — Integrated Core

- Sole voltage-regulating core: the SYJZZ vacuum OLTC is the only tap-changing executive core of this transformer. Mounted directly on the transformer tank cover, its contacts connect the multi-tap points of the HV winding. Without this switch, the transformer loses its on-load regulation capability.

- Dual oil-chamber isolation: the switch has its own sealed oil compartment, fully separated from the main-tank insulating oil. Arc-extinction impurities stay inside the switch oil only and never contaminate the main winding oil — greatly extending the transformer service life.
- Electrical interlocking control: with the matched VQC voltage & reactive power integrated controller, when the LV side voltage deviates from the set value, the controller commands the SYJZZ motor drive to complete a tap change within 3–6 seconds. Gas relay, refusal-to-operate and overcurrent faults can directly trip the transformer protection.
- Tailored structure: the 4000kVA HV winding is specially designed with $\pm 8 \times 1.25\%$ regulation taps; winding insulation and ampere-turn balance are optimized for SYJZZ switching duty, greatly improving surge and short-circuit withstand capability. Ordinary off-circuit tap-changing transformers cannot be retrofitted with this switch.

Design and test standards: GB/T6451-2015, GB1094 and GB10230.

3. Technical Parameters

Parameter	Standard Configuration	Optional Customization
Rated capacity	4000kVA	Non-standard capacity available
Voltage combination	HV: 35kV; Regulation $\pm 8 \times 1.25\%$; LV: 10.5kV	LV 6.3kV / 6.6kV / 0.4kV
Matched tap changer	SYJZZ-40.5/200-11 vacuum OLTC	Neutral-point type SYXZZ
Connection group	YNd11	Yyn0, Dyn11 on request
Rated frequency	50Hz	60Hz export version
Cooling method	ONAN oil-immersed self-cooling	ONAF with fans
No-load loss	3.15kW (better than national Grade-2)	Grade-1 low-loss upgrade
Load loss (75℃)	30.8kW	Low-resistance energy saving
No-load current	$\leq 0.45\%$	Ultra-low no-load current
Short-circuit impedance	7% $\pm 5\%$	6.5% / 7.5% on request
Total tap positions	17 (± 8 taps)	$\pm 4 \times 2.5\%$, 9-tap simplified scheme
OLTC rated current	200A	Adequate margin vs. 66A HV rated current of 4000kVA
Insulation level	HV: LI200 AC85kV; LV: LI75 AC35kV	Reinforced external insulation for polluted areas
Temperature rise limits	Top oil $\leq 55\text{K}$; winding $\leq 65\text{K}$	Reinforced cooling for hot climates
Noise level	$\leq 52\text{dB}$	Silent version $\leq 48\text{dB}$
Protection class	Outdoor IP23	Indoor IP44 sealed tank
Operating altitude	$\leq 1000\text{m}$	Reinforced insulation above 1000m

Rated current reference (this unit): HV 35kV side $\approx 66\text{A}$; LV 10.5kV side $\approx 220\text{A}$. The matched SYJZZ switch rated at 200A provides a generous safety margin for continuous full-load and short-time overload operation.

4. Core Technology & Manufacturing Advantages

4.1 Transformer Body Advantages

- Low-loss core system: high-permeability grain-oriented silicon steel, fully automatic 45° step-lap stacking with burr $\leq 0.01\text{mm}$; multi-stage vibration-damping core clamping — remarkably reduced no-load loss and noise, lower long-term energy cost.
- High-strength oxygen-free copper windings: HV and LV windings use high-purity oxygen-free copper wire in multi-layer cylindrical structure; internal/external insulation spacers fully chamfered to optimize field distribution; ampere-turn balanced design passes national short-circuit withstand tests; whole winding vacuum-impregnated for moisture resistance and low partial discharge.
- Fully sealed anti-leakage tank: heavy-duty steel plate one-piece welding with fully automatic kerosene leak detection; oil-resistant acrylic rubber gaskets stable from -30°C to $+40^{\circ}\text{C}$; corrugated/finned radiators with 15% higher heat-dissipation efficiency, suiting both southern heat and northern cold; anti-corrosion epoxy coating available for coastal projects.
- Full standard safety accessories: conservator, pressure relief valve, Buchholz gas relay, oil & winding temperature controller, oil level gauge, dehydrating breather, earthing device, OLTC motor-driven operating box — all standard; optional online oil filtration, partial discharge monitoring and intelligent remote acquisition modules.

4.2 SYJZZ Vacuum OLTC Exclusive Advantages (Core Highlights)

- Vacuum-bulb arc extinction, no oil carbonization: high-durability vacuum interrupters confine the switching arc completely inside the vacuum chamber — no carbon particles contaminate the insulating oil. Compared with traditional oil-arc switches, the oil change interval is extended 3 times, drastically cutting maintenance cost.
- Central regulation, balanced field: SYJZZ central-tap design gives uniform winding voltage distribution and extremely low partial discharge, ideal for 35kV medium/high voltage duty; the double-layer clamping moving contact withstands 4kA thermal and 10kA dynamic short-circuit current.
- Independent oil chamber, double protection: the switch cavity is fully isolated with its own gas relay protection; switching faults alarm independently without affecting main transformer operation; mechanical + electronic dual tap-position indication eliminates misalignment and lost steps.
- Fully automatic intelligent control: matched VQC regulator supports local automatic, local manual-motorized and remote control; end-position locking, operation timeout protection, daily operation-count limiting and fault auto-lock functions; manual mechanical regulation available without grid supply for emergency maintenance.
- Easy maintenance for outdoor long-term service: integrated reduction-gear energy-storage mechanism with stainless steel transmission parts; reserved oil filtering/sampling ports on the switch top allow inspection and oil change without lifting the core, minimizing outage time.

5. On-Load Tap-Changing Transformer vs Conventional Transformer

Dimension	This unit (with SYJZZ OLTC)	Conventional off-circuit transformer
Tap-changing operation	Under full rated load, no power interruption; one tap change in 3–6 seconds	Full station outage required; all loads disconnected; manual tap changing takes 30+ minutes
Core component	Built-in SYJZZ vacuum OLTC, independent oil chamber, motorized intelligent control box	Only simple exposed tap terminals; no arc-extinction/transition mechanism, no motor drive
Regulation accuracy & taps	$\pm 8 \times 1.25\%$, 17 fine steps, voltage stability $\pm 0.5\%$	Only $\pm 2 \times 2.5\%$, 5 coarse steps, poor voltage control
Application fit	Continuous-process chemical plants, PV/wind farms, urban hub substations, data centers — critical loads	Rural distribution, stable loads, sites allowing short outages
Maintenance cost	Periodic check of SYJZZ oil chamber and vacuum bulbs; long intervals for main body	No tap mechanism to maintain, but frequent regulation requires repeated outages — very high outage cost
Cost	25%–35% higher at same capacity (core cost: SYJZZ vacuum OLTC)	Lower cost, suitable only for low-requirement distribution
Grid value	Real-time voltage stabilization, reactive power optimization, lower line losses, better supply quality	Static coarse regulation only; cannot cope with day/night or seasonal swings — risks motor burnout (low voltage) or damage to precision equipment (high voltage)

6. What is an On-Load Tap Changer (OLTC)?

An on-load tap changer is a mechanism installed in power transformers that allows voltage regulation while the transformer remains energized and supplying load, without any interruption to power supply. Its primary role is to maintain a stable output voltage despite variations in input voltage or load conditions.

6.1 Key Functions of an OLTC

- Regulates secondary/output voltage
- Compensates voltage drop due to load variation
- Improves overall grid voltage stability
- Eliminates shutdowns during voltage correction
- Enables automatic voltage control via AVR

6.2 Major Components

Component	Function
Tap selector	Pre-selects the tap position; operates without load current
Diverter switch	Transfers load current between taps; prevents short-circuit during switching
Transition resistors / reactors	Limit circulating current; control arcing during tap change
Motor drive unit (MDU)	Motor, gearbox, limit switches; manual / automatic tap operation
OLTC oil compartment	Separate oil chamber; handles arcing stress & faster oil degradation

6.3 Working Principle (Simplified)

- 1. Tap selector pre-selects the next tap
- 2. Diverter switch transfers current via transition resistance
- 3. Arcing is confined inside the OLTC chamber
- 4. Voltage changes smoothly
- 5. No supply interruption

6.4 Types of OLTC

- Resistor type (most common) · Reactor type
- In-tank OLTC · External / compartment type OLTC

6.5 Typical OLTC Technical Data

- Voltage regulation range: $\pm 10\%$; Step voltage: 1.25% / 1.5% per tap; Number of taps: 17 / 19 / 33
- Operating levels: 11kV / 33kV / 132kV / 220kV; Control mode: manual / automatic (AVR)
- Protection & interlocks: OLTC oil surge relay (Buchholz type), motor overload protection, end-position limit switches, electrical & mechanical interlocks, tap position indicator

Why OLTC is critical: stable voltage = better equipment life, improved grid reliability, reduced losses, fewer consumer complaints. The OLTC may be a small part of the transformer, but it plays a huge role in power system stability.

7. Product Core Functions

- Uninterrupted automatic voltage stabilization (core function): during load peaks, valleys, seasonal changes or new-energy output fluctuations, the SYJZZ switch automatically changes winding turns without power interruption, stabilizing the LV bus voltage and ensuring stable operation of motors, precision instruments and energy-storage equipment.
- Grid power flow & reactive power optimization: the 35kV substation main transformer regulates bus voltage to optimize regional reactive distribution, reduce line voltage loss and overall grid losses, and raise transmission efficiency.
- All-scenario intelligent control: local automatic, remote background and local manual-motorized operation modes; the VQC controller can interlock with reactive compensation devices for integrated voltage/reactive regulation, ideal for unattended smart substations.
- Multi-layer safety interlocking: on main-transformer overload, oil over-temperature, gas relay action, tap position limits or switching faults, the OLTC is automatically locked to prevent dangerous regulation and avoid winding/switch arc damage.
- Wide duty-cycle adaptability: stable voltage regulation under strong new-energy output swings (PV/wind booster stations); also suited to 24-hour continuous production lines in metallurgy and chemical plants, eliminating production losses from outage-based regulation.

8. Standard Operating Environment

Item	Requirement
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Ambient temperature	Max. +40°C, min. -30°C (low-temperature special insulating oil available for cold regions)
Altitude	≤ 1000m (above 1000m: reinforced insulation and derated temperature rise)
Relative humidity	Monthly average ≤ 90%, no condensation (anti-corrosion tank for coastal salt-fog areas)
Installation site	Outdoor open-air substations, indoor distribution rooms; no explosion hazard, corrosive gas or heavy dust
Seismic intensity	≤ 8 degrees (vibration-damping base optional)

9. Typical Application Scenarios

- Power industry: 35kV urban regional substations, county-grid hub main transformers, rural grid upgrade projects.
- New energy: PV plant 35kV booster transformers, wind farm booster stations, energy-storage supporting main transformers.
- Industry: large chemical parks, metallurgy & steel, mining, paper-making & textile continuous production lines.
- Infrastructure: data centers, hospitals, airports, rail transit — class-1 important uninterrupted loads.
- Export: 35kV grid new construction and expansion power projects in Southeast Asia, Central Asia and Africa.

10. Package & After-Sales Service

- Complete supply list: SZ4000/35 on-load tap-changing transformer main unit ×1 + full SYJZZ vacuum OLTC mechanism + VQC intelligent voltage regulator + temperature controllers, full oil accessories, installation manual, factory type-test report and certificate of quality; optional 35kV HV switchgear, 10kV LV switchgear and prefabricated substation package supply.
- Warranty: 3-year free warranty on the complete transformer; 5-year warranty on SYJZZ OLTC core vacuum components; free on-site repair and parts replacement for non-human damage within warranty.
- Technical service: free pre-sales solution selection, voltage-drop calculation and capacity matching; full HV tests at factory; on-site installation guidance, core-lifting commissioning and OLTC tap-position calibration; lifetime cost-price spare parts and annual remote maintenance guidance.
- Customization: voltage, impedance, cooling method, anti-corrosion, silent version, Grade-1 energy efficiency, export 60Hz and other non-standard parameters; bilingual (Chinese/English) technical drawings and English factory documents for overseas bidding projects.

11. Ordering Information

- Parameters to confirm: rated capacity, HV/LV voltages, regulation range, cooling method, connection group, short-circuit impedance; whether fan cooling / silent / anti-corrosion is required.

- Environmental requirements: altitude, ambient temperature, pollution class, indoor or outdoor use.
- Supporting needs: whether VQC controller, online oil filtration, intelligent remote transmission, or complete HV/LV switchgear package is required.
- Export orders: confirm frequency 50/60Hz, insulation standard, language of documents, container size requirements.

12. Contact Us

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Specifications are subject to change without prior notice. All data in this brochure is for reference; the technical contract at the time of ordering shall prevail.