

Production, Diagnostics, Service

Power Transformers



ZREW

A company of R&S



Production of oil-immersed power transformers

ZREW offers modern power transformers designed and constructed in compliance with all applicable standards: PN-EN, IEC or GOST. In its production of transformers, the Company uses materials and components ordered solely from the world's top manufacturers.

Our portfolio

The range of production includes power transformers for distribution networks, renewables (wind, solar, hydro), conventional heat and power plants and industrial applications including railways with rated power up to 120 MVA and voltage up to 145 kV.

Operating conditions

Standard version transformers are designed for continuous operation in temperate climates and are suitable for installation:

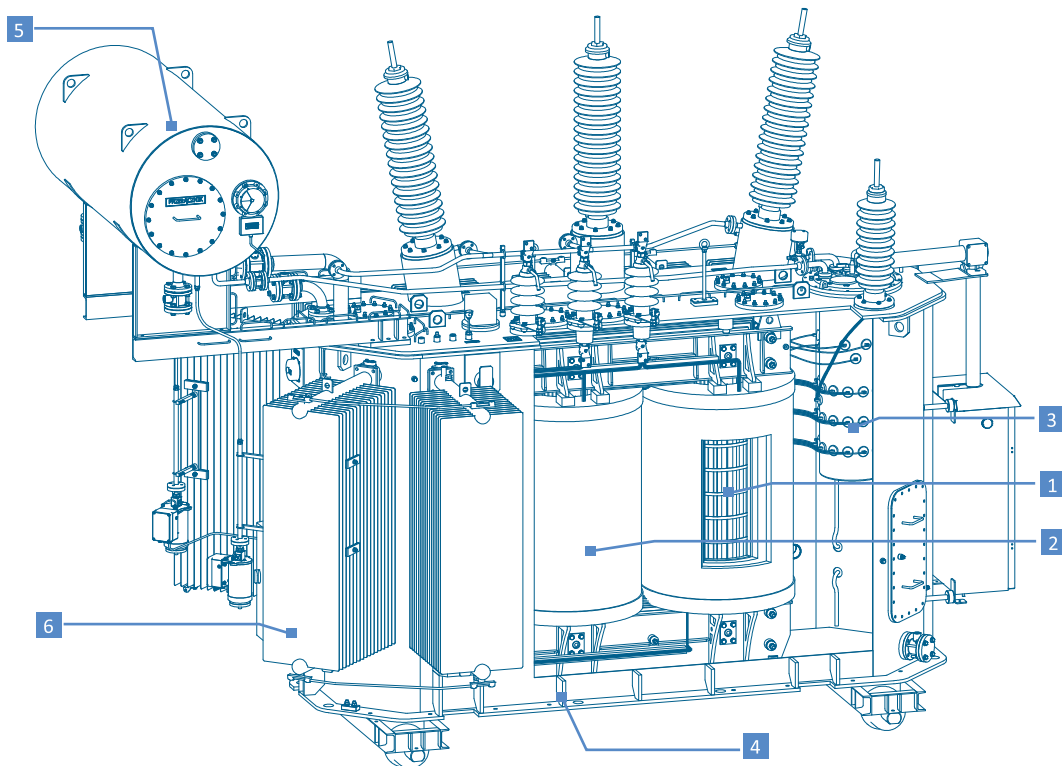
- outdoors or in properly ventilated indoor facilities in an atmosphere free of dust and chemically active or explosive gases;
- at the height not more than 1000 m above sea level;
- at an ambient temperature of -25°C to $+40^{\circ}\text{C}$ (from 248 K to 313 K).

We also manufacture transformers featuring special fittings designed to operate in an ambient temperature from -40°C (233 K).



Construction of transformer

Transformers are constructed as three- and single-phase core units with concentric windings.



1. Core
2. Windings
3. Tap changer
4. Tank
5. Conservator
6. Cooling system



Cores

For the production of cores we use high-quality, cold-rolled metal plates. The low loss of plates and the precise cutting and splicing using the STEP-LAP method ensure low no-load losses and low noise levels in our transformers.



Windings

Transformer windings are made of electrolytic copper in a paper based or synthetic insulation with increased thermal parameters (e.g. Nomex). Our insulation materials are sourced from the best manufacturers worldwide.



Tap changers

Transformers are equipped with tap changers from renowned manufacturers, enabling on-load and off-load voltage regulation.

These tap changers have a 3 x 400/230 V, 50 Hz motor drive which can be remotely or locally controlled electrically. Standard tap changers are equipped with tap number indicators.

Tanks

Tanks without additional fittings can withstand inside and outside pressure differences of $-950/+500$ hPa. The design of these tanks makes it possible to raise the transformer using hydraulic lifts, overhead cranes and hoists. Tank, cover and all transformer fittings are protected by means of modern multiple component paints which are weather and oil resistant.



Conservators

Transformers with on-load regulation have twin-chamber oil conservator (a separate chamber for the main transformer tank and a separate one for the tap changer). Each chamber is equipped with a magnetic oil level indicator. The oil in the conservator is protected with a silica-gel breather and optionally, a membrane or a polyurethane bag.



Cooling System

Standard transformers are equipped with galvanized radiators mounted on the tank which are removable. The radiators are equipped with plugs draining of oil. On request, we can equip our transformers with modern oil and air coolers (OF-AF) or oil and water coolers (OF-WF).



Standard Equipment

Our transformers are installed with:

- porcelain bushings on the HV and LV side,
- ball valves for filling, draining and filtering of oil,
- taps for drawing oil samples from the upper and lower section of the tank,
- earthing terminals on the tank,
- supports and lugs for lifting and pulling the transformer,
- a chassis with wheels set at gauge 1505/1505 (3010) mm for moving the transformer in two directions.

Inspection and measuring equipment:

- a gas flow relay (Buchholz) with contacts for signalling and turning off the transformer,
- a flow or pressure relay for the on-load tap changer,
- magnetic oil level indicators, with contacts to signal that the maximum or minimum oil levels have been exceeded,
- silica gel breathers (either operated or maintenance-free),
- contact thermometers to measure the temperature of the oil, with contacts for signalling that the set temperature has been exceeded,
- a resistance thermometer with an electronic indicator to be mounted in the control room,
- a pressure relief valve, with contacts to indicate its activation.

All control and measurement circuits are led to a cabinet located on the body of the transformer.

Standard transformers are filled with modern mineral transformer oils that are free of PCBs.

Production and special equipment

All transformers may be tailored to individual customer requirements.

- In order to reduce no-load losses and noise to a minimum, it is possible to produce cores using modern laser-cut transformer plates.
- Mineral transformer oil may be replaced by synthetic, ecologic, electro-insulating fluids such as MIDEL type fluids.
- To protect transformer oil from air ingress, we can equip our transformers with membranes or polyurethane bags in the conservator and maintenance-free breathers.
- It is also possible to use silicone bushings which are resistant to impact and heavy soiling or cable connectors supplied by PFISTERER or EUROMOLD.
- On request we can install a modern transformer monitoring system.
- Another option is the possibility of equipping the transformers with modern oil-air coolers and oil-water coolers.



Features of our transformers:

- modern, proven design,
- guaranteed trouble-free operation,
- low operating costs,
- high resistance to short circuits,
- the ability to withstand the highest dielectric stresses,
- low noise level,
- an optimum cooling system,
- a leak resistant sealing system,
- a surface protection system suitable for all environmental conditions.

International standards and requirements

All transformers are manufactured in accordance with the ISO 9001 Quality System and meet the requirements specified in Commission Regulation (EU) No 548/2014 of 21 May 2014 of minimum Peak Efficiency Index requirements for liquid immersed large power transformers.

At the end of the production process, transformers are subject to acceptance tests in accordance with IEC and PN-EN or GOST.

Advanced diagnostics of transformers

A significant part of our business involves transformer diagnostics and measurements. ZREW has modern measuring equipment, a fully equipped laboratory and experienced staff.

Acceptance tests of transformers manufactured by ZREW are performed in the new hall of the Testing Station. The Station is equipped with a reliable measuring system, has low level of acoustic background and the laboratory room is properly shielded with a mesh made of magnetic material (Faraday cage).





We carry out the following diagnostic operations either on site on the customer's premises or at a Testing Station:

Measuring and testing of transformers including, among other things:

- winding resistance measurements,
- ratio measurement and a check of connection groups,
- magnetising current measurement,
- measuring dispersion reactance,
- measurement of the dielectric loss factor ($\tan \delta$) and the capacity of transformer windings,
- measurement of the dielectric loss factor ($\tan \delta$) and bushing capacities,
- measurement of winding insulation resistance and dielectric absorption coefficients R_{60}/R_{15} ,
- measurement of zero sequence impedance,
- vibroacoustic transformer analysis,
- measurement of load losses and short-circuit voltages,
- measurement of losses and no-load current,
- induced voltage test,
- applied voltage test,
- impulse voltage test,
- partial discharge measurements by an electrical method,
- acoustic pressure measurements
- mechanical testing windings by the SFRA or FRA method,
- computer testing of OLTC change times,
- moisture testing of fixed insulation by the FDS, PDC and RVM methods,
- thermal-imaging measurements,
- testing of OLTC (measuring asynchronicity in the opening of contacts, measuring the continuity of the selectors cage),
- testing the power consumption of drives in OLTCs.

Testing insulating oils

Testing the physical and chemical parameters of insulating oil provides valuable information on the degree of moisture and aging of a transformer's insulation. The insulating oil's dielectric as well as physical and chemical properties are significantly affected by the operating conditions: temperature, oxygen from the atmosphere, the load applied and the construction materials.

To ensure reliable operation of equipment it is important to maintain the parameters of the oil at the appropriate level, which requires control testing of these parameters.

Tests of insulating oils involve the following:

- determining the furan derivatives in the oil,
- water content by the K. Fischer method,
- the voltage of a sudden flow of current through the insulator,
- dielectric loss factor ($\tan \delta$),
- resistivity,
- flash point,
- acid value,
- density at 20° C,
- kinematic viscosity,
- testing the surface tension of the oil,
- the content of impurities,
- testing the degree of polymerisation of new and used papers,
- determining the active sulphur content,
- testing the degree of aging of the insulation oil and determining its surface tension and polarity factor,
- chromatographic analysis of gases dissolved in the oil (DGA).

The great advantage of transformer diagnosis based on DGA is that it does not require shutting the unit down. This makes it possible to:

- detect latent defects in the active part,
- monitor the development of damage in time,
- take appropriate remedial measures early.

Measurements of electrical installations and devices:

- examining the effectiveness of fire protection,
- earthing resistance measurements,
- periodic testing of electrical devices.



Repairs, upgrades and service maintenance of transformers

Benefitting from the decades of our experience in the field of transformer repairs, ZREW performs repairs, upgrades and maintenance of all types of oil-immersed transformers with power rating of up to 150 MVA and HV up to 145 kV.

Since its establishment in Łódź, ZREW has repaired several thousand large and medium power transformers for the professional and industrial power industry.

Repairs and upgrades

- construction of new windings,
- changes to the electrical parameters of transformers,
- the replacement of final and equipotential insulation,
- repair or replacement of the core,
- repair or modernisation of fittings:
 - exchange of radiators for zinc units,
 - radiator valve replacement,
 - replacement of fans,
 - replacement of tap changers,
 - application of ball valves,
 - installation of safety valves,
 - replacement of bushings,
 - use of magnetic oil level indicators,
 - use of modern cooling system control cabinets,
 - division of oil conservator into a twin chamber one,
 - modernisation of oil-water and oil-air cooling systems,
- replacement of the electrical system,
- replacement of oil,
- replacement of seals,
- vacuum drying of transformers,
- final testing carried out in accordance with PN-EN 60076, IEC or GOST,
- inspection and maintenance of transformers at their place of operation:
 - replacement of OLTCs,
 - replacement of seals,
 - inspection of the active part,
 - inspection of fittings,
 - servicing of cooling systems
 - cleaning and painting of the exterior of transformers and their fittings,
 - oil treatment.

Maintenance and repair of OLTCs

- replacement of OLTCs at the transformer's place of operation,
- periodic review of controls and drives manufactured by MR, ABB, ELIN or Elta,
- adjustment of change times,
- computer measurement of change times,
- production of switch motor drives,
- repair of changers:
 - replacement of contacts,
 - replacement of springs,
 - sealing the chambers of power switches,
 - repair of the selectors cage,
- repairs of changer drives,
- installation of electronic tap position indicators.

Oil servicing

- treatment of transformer oils at their place of operation,
- replacement and refill of oil in transformers at their place of operation with the possibility of vacuum filling of transformers,
- removal and collection of used insulation oil,
- transport of insulating oil using our own tanker.

Transportation of transformers

- placing and setting of transformers at their place of operation or the reserve location,
- full range installation of new transformers from the reserve location and after repairs (up to 500 MVA),
- total or partial removal of transformer fittings intended for reserves, transportation or disposal of the transformers as scrap,
- loading and transportation of transformers on trailers.



R&S Group

ZREW is part of the Swiss-based R&S International Holding. R&S Group is a leading provider in selected niches for power products. With manufacturing facilities and offices in Europe, South America and the Middle East, and a wide partner network globally, R&S offers distribution and power transformers, switching devices as well as certain products for railway electrification and industrial electrical connectors.

Companies of R&S:

- Rauscher & Stoecklin: Distribution transformers, railway switches, high current connectors
- ZREW Transformatory: Power transformers
- Tesar: Cast resin transformers, distribution transformers, instrument transformers
- Kyte Powertech: Distribution transformers



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