



CEEGB Transformer Co.,Ltd

ADDRESS

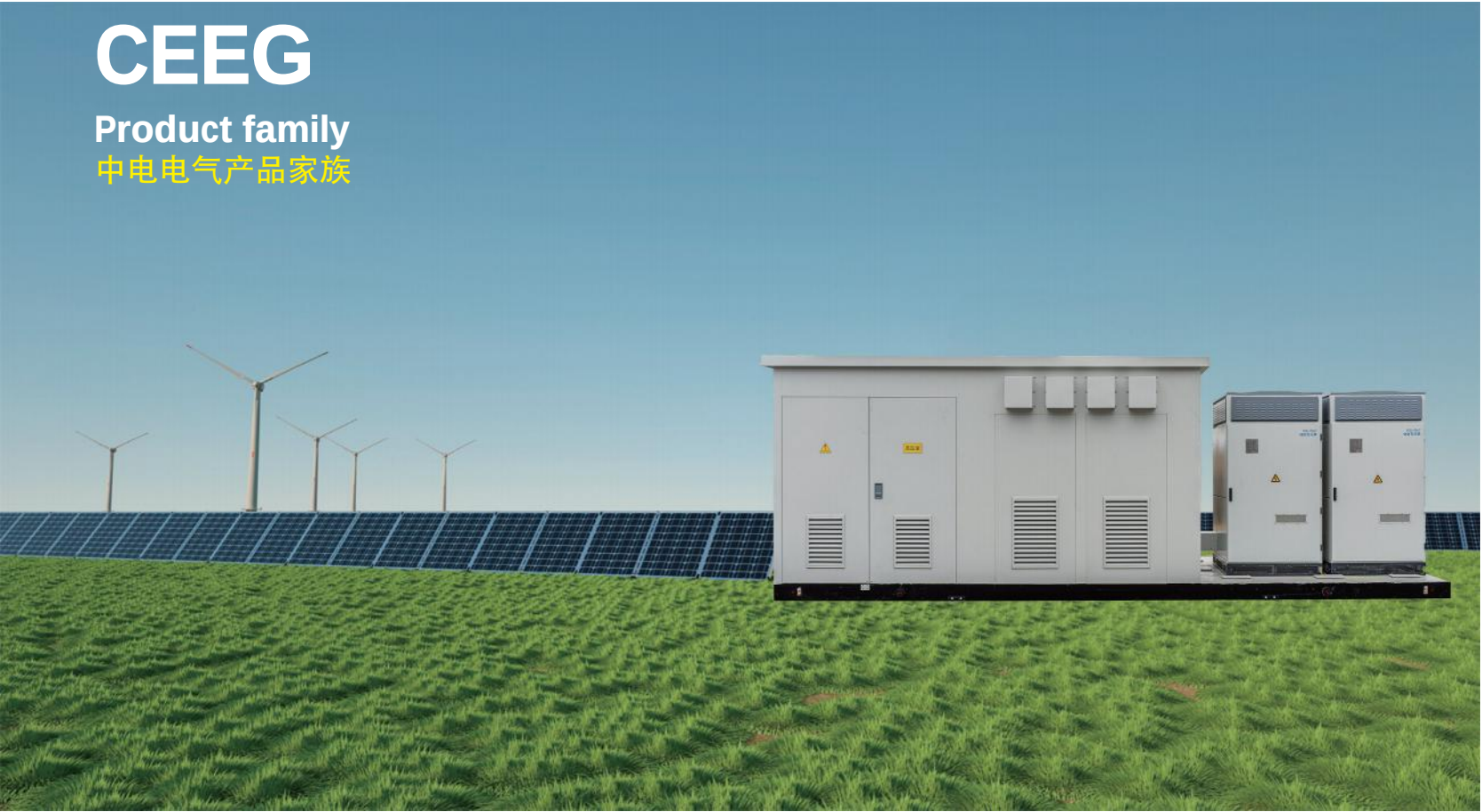
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+ COMPANY PROFILE

KEEPING DELIVERING PREMIUM POWER TO THE WORLD

Founded in 1990, CEEG Transformer Co., LTD (CEEG) has always adhered to the core value concept of "Vision, Innovation and Responsibility", taking "Delivering Premium Power to The World " as its responsibility, focusing on production and manufacturing for more than 30 years, forming electricity Power transformers, new energy and system solutions three pillar industries.

CEEG guided by the green concept of "Safety, Energy saving and Environmental protection", is committed to the research and development and production of transmission and distribution equipment, which is a collection of research and development, manufacturing and sales in one. CEEG has won the honorary title of national innovative enterprise, Top 500 Asian brands, China famous trademark, and national End-users' satisfaction products, and has the relatively larger dry type transformer production base in the world with American DuPont Nomex® paper as insulation material transformer manufacturer, the company registered capital of 300 million yuan, covers a total area of 82.4 acres, with an annual output of 40,000MVA transformer production capacity, sales and service outlets all over the country in major cities.

The company's main products are: 220kV and 110kV railway traction transformer, Scott railway traction transformers, 2x27.5kV railway auto transformers, 220kV and below oil-immersed type transformers, 35kV and below cast resin transformers, SG series open ventilated transformer and SCR semi-enclosed dry type transformers, energy storage specialized transformer, hydrogen-specific rectifier transformer, urban railway traction rectifier transformer apparatus, urban rail railway traction rectifier group, amorphous alloy dry type transformer, mining explosion-proof transformer and explosion-proof switch, high and low voltage switch cabinet, frequency conversion transformer, anti-harmonic transformer, marine transformer, urban rail transit intelligent pad-mounted, pad-mounted & European type substation, wind and photovoltaic substation,

reactor,etc. Sales cover railway, electricity, electronics, urban rail transit, hydropower, nuclear power, wind power, coal mining, communications, construction, petroleum, chemical, aerospace and other industries.

CEEG has an advanced three-dimensional integrated design cloud platform in the industry, which improves the design quality of products and meets with customer needs to the maximum extent with reliable power solutions. In recent years, the company has participated in the construction of many national key projects, such as the Beijing Olympic Games project, Nanjing South Railway Station, Shenyang National Games, Nanjing Youth Olympic Games, Shanghai WorldExpo project, manned spaceflight project, Beijing South Railway Station, Shanghai Yangtze River Tunnel and Bridge, Shenzhen Lingao Nuclear PowerProject, and its products are exported to Europe, Australia, Southeast Asia, the Middle East, Africa and other parts of the world.

Walking with giants and keeping pace with the world!

The company has established long-term strategic partnerships with world-class enterprises such as DuPont, ABB and Siemens. The pursuit of innovation, the fulfillment of responsibilities, by continuously upgrading products, quality, and services, we have developed into a large domestic supplier of power transmission and distribution equipment, the industrial foundation is strong. The series of products produced by the company have been exported to more than 80 countries and regions in the world, the strategic layout of brand internationalization and service globalization has been formed, and is transforming to " manufacturing globalization + terminal solution + service", and committed to making CEEG the world's top choice!

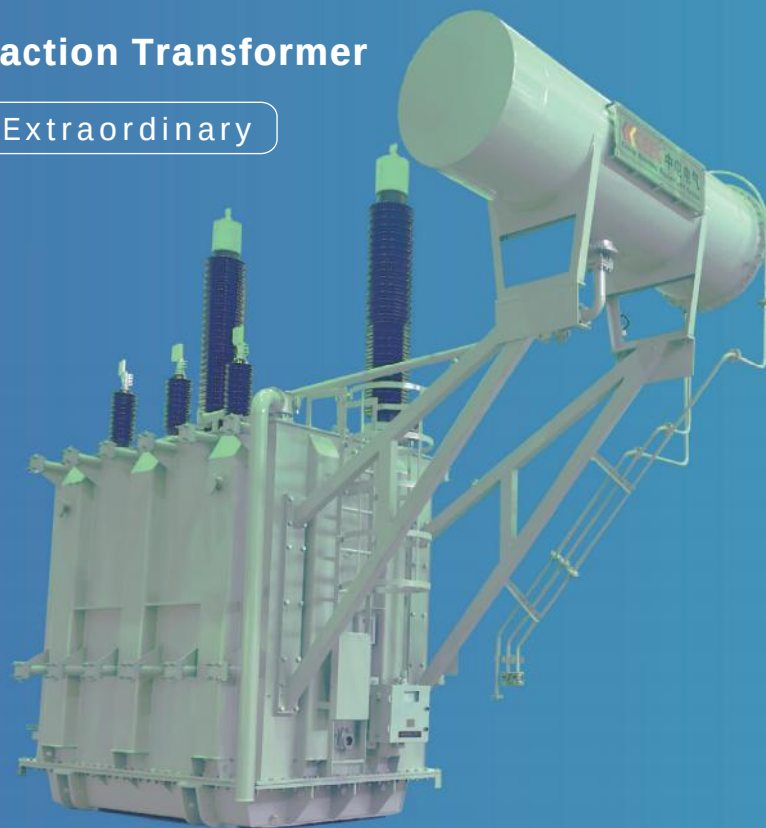
02



PRODUCT INTRODUCTION

220 (110) kV Railway Traction Transformer

Safe and Reliable Extraordinary



Product Introduction

1. Utilization of DuPont's Nomex insulation system, registered trademark: Anleide.
2. Advanced seven-level temperature control technology.
3. High overload capacity: Meets typical overload curves, capable of sustained 30% overload.
4. Low partial discharge: Routine Partial discharge is less than 40pC.
5. Short-circuit withstand capability: Meets the operational characteristics of frequent near-end short circuits in electrified railways.

Scope of Application

Suitable for electrified high-speed railway passenger dedicated lines as well as heavy-duty freight dedicated lines

Reference

Jing-Shi-Wu High-speed Railway, Jin-QinLine, Lan-Xin Line, Dun-Ge Line, Da-Qin Line, Guangzhou-Zhuhai Line, Chongqing-Fuling Line, and many other domestic electrified railway lines. Export destinations include Siba, En Bi, A.E. Distribution sh.p.k and more.

220kV, 110kV (66kV) Power Transformer

Precision Craftsmanship
Perfect Quality



Scope of Application

It is beneficial for meeting peak electricity demand during summer and is suitable for high-load distribution networks in high-temperature environments. It is also suitable for locations with impact loads and continuous overload requirements, such as the steel and metallurgical industry, railway transportation, power plants, hydro-electric stations, etc

Product performance

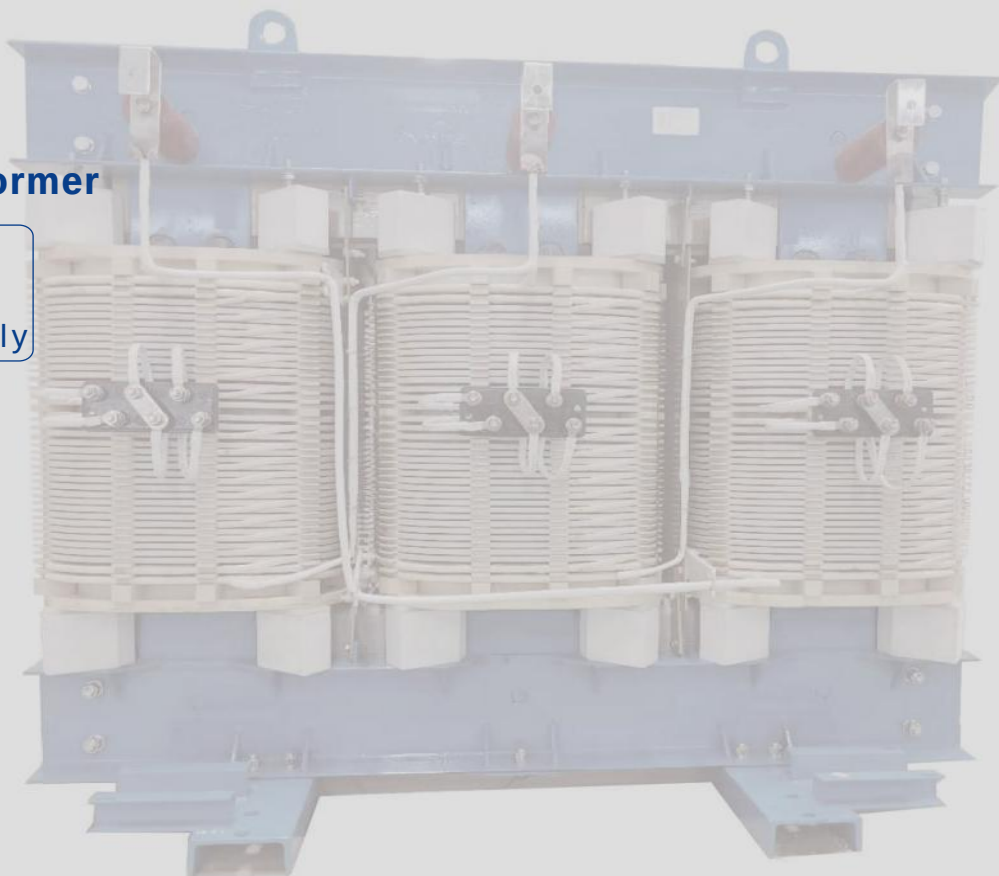
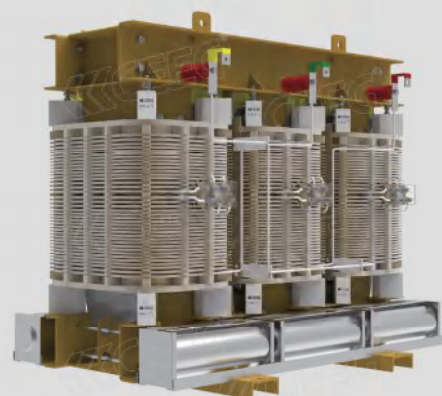
Beijing Zhongmei Electric Co., Ltd., Beijing Lufeng Times Technology Development Co., Ltd., Shenhua United Construction Co., Ltd., Chongqing Yuzhan Electric Co., Ltd., Hubei Power Survey and Design Institute Co., Ltd. (Yuanwanghe Storage Jiangdong 100MW PV Field Project), Xinjiang Production and Construction Corps, Huazi Technology Co., Ltd., Pinggao Group International Engineering Co., Ltd., Wuxi Metro, Yuanhe Power Station, etc.

Product Introduction

1. Adopting a fully enclosed manufacturing process with constant temperature, humidity, and dust control to ensure lean and controlled product quality.
2. Utilizing the original "Seven-level Temperature Control Technology" system in conjunction with finite element analysis of temperature distribution to fully leverage the performance advantages of various insulation materials.
3. Implementing unique noise-reduction methods in different components to ensure noise levels surpass national standards.
4. Employing one-time molding technology for sealing components and conducting multiple leakage tests, including fluorescent, positive pressure, and negative pressure methods, to ensure leakage-free products.
5. The core adopts Swiss advanced stacking manufacturing technology & production process, with low no-load loss.
6. Successfully passing the short-circuit test conducted by the National Transformer Testing Center, ensuring the safety and reliability of the product

SGBH19 series Open Ventilated Dry Type Transformer

High Efficiency Energy-saving
Superior Insulation
Green and Environmentally Friendly



Product Introduction

1. Complies with GB 20052-2020 energy efficiency standards, a new generation of Class 1 energy-efficient products.
2. Utilizes high-quality amorphous alloy strip, reducing no-load losses by 60% and achieving significant energy savings.
3. Adopts a self-developed three-phase three-column structure, allowing for easy assembly and occupying a small footprint.
4. Incorporates a unique iron core mounting technology, resulting in low mechanical stress and reduced noise.
5. Adopts DuPont Nomex® insulation system, ensuring high insulation heat resistance.
6. Excellent flame resistance, and strong overload capacity.
7. Equipped with intelligent transformer terminals and integrated with IoT cloud platform for smart operation and maintenance.

Implementation standards

1. GB 20052-2020 Limits and energy efficiency grades for power transformers
2. GB/T 1094.1-2013 Power transformers - Part 1: General
3. GB/T 1094.3-2017 Power transformers - Part 3: Insulation levels, Dielectric tests, and External clearances in air
4. GB/T 1094.5-2008 Power transformers - Part 5: Ability to withstand short-circuit
5. GB/T 1094.11-2022 Dry type transformers
6. GB/T 1094.12-2013 Power transformers - Part 12 Load Guide for dry power transformers
7. GB/T 22072-2018 Dry amorphous alloy iron core distribution transformer technical parameters and requirements
8. GB/T 1094.10-2003 Power transformers - Part 10: Determination of sound levels

SCBH series Amorphous Alloy Dry Type Transformer

CEEG Product Family

Three-phase Three-column
Energy-saving Pioneer



Product Introduction

1. Adopts high-quality amorphous alloy strip, reducing no-load losses by approximately 70%.
2. Use a self-developed three-phase three-column structure, occupying a small footprint.
3. Simulation analysis on the vibration model to reduce noise effectively. Unique core mounting technology and end sealing process to ensure low core stress and low noise.
4. Utilize a unique semi-enclosed structure with strong dustproof ability and high insulation performance.
5. High mechanical strength, strong waterproofing and short-circuit resistance capabilities.

Reference

China Telecom, China Mobile, China Unicom, People's Liberation Army of China (specific unit), Huawei Hubei Research Institute Data Center (IDC), Daqing Zhonglan Petrochemical Co., Ltd., Beijing Mining and Metallurgy Research Institute, etc.

Scope of Application

Suitable for places under distribution grid with low efficiency, the place with flammability & explosive character, or the area with high requirement for flame-resistance , such as cloud computing data centers, rural power grids, high-rise buildings, commercial centers, subway systems, airports, power plants, etc.

S(B)H-M series Oil-immersed Type Amorphous Alloy Distribution Transformer

Domestic Pioneer in Production Assembly Line

Product Introduction

1. Produced using a constant temperature, humidity, and dust-free fully enclosed manufacturing process.
2. Utilizes high-quality amorphous alloy strip, resulting in a reduction of approximately 60% in no-load losses compared to previous models.
3. Manufactured using the automated corrugated tank production line from Germany's Jörg, automatic forming a tank, and ensuring leakage-free tanks.
4. Adopts a fully vacuum oil-injection process online, resulting in high insulation performance and low partial discharge.
5. Utilizes fully automated testing equipment for product testing, with automatic comparative analysis of results.
6. Pioneered the SH15-M-6300/35 amorphous alloy transformer, successfully passing routine, special, type tests, short-circuit tests, in a single attempt.

Scope of Application

Suitable for the upgrading and reconstruction of agricultural grid and urban grid, as well as large-scale data computing centers.

Reference

Beijing Northern Energy Saving and Environmental Protection Co., Ltd., Tianjin Power Company, Shaanxi Power Company, Liaoning Power Company, Beijing Chaoyang Electric Power Engineering Company, Shenshuo Railway Branch, Nanjing China Post Air Express Logistics Distribution Center Phase II Apron Construction Project, etc.



S series Transformer

Low Noise Low partial Discharge
Customized Low Temperature Rise
Short-circuit Withstand Capability
Impulse Withstand Capability



Product Introduction

The Class-one S22/Class-two S20/Class-three S13 series oil-immersed type transformers combine the traditional structure of oil-immersed type transformers with modern domestic and international oil-immersed type transformer structures. They feature a new insulation structure for power transformer.

Scope of Application

They are widely used in urban power grids, rural power grids, high-end power supply fields, as well as in industries such as steel, coal, chemical, cement, paper, and metallurgy.

Reference

Shougang Shuicheng Iron and Steel (Group) Co., Ltd., AVIC The Third Research Institute of China Electronics Technology Group Corporation (CETC), Wuxi Metro Line 1-4, Chongqing Metro Line 2, Nanjing Metro, Guangzhou Metro

SRN series High-temperature Resistant Transformer

High-temperature Resistant Long Lifespan



Product Introduction

1. Strong overload capacity: With DuPont Nomex® paper as the core and a seven-level temperature control technology, it utilizes a hybrid insulation system effectively.
2. Wide applicability: Suitable for industries operating in high ambient temperatures or under long-term high loads, providing safe and reliable power supply.
3. Low maintenance cost: It exhibits excellent oxidation resistance, slow aging rate, more stable mechanical characteristic and electrical properties, resulting in a long lifespan.
4. Energy-saving and environmentally friendly: After the end of its service life, the materials can be recycled and reused, without causing pollution.
5. Safety and reliability: It possesses strong corrosion resistance and water-proof properties, ensuring safe and reliable long-term operation.

Scope of Application

High-end power supply sectors and customers in industries such as steel, coal, chemical, cement, paper, and metallurgy.

Reference

Guangzhou-Zhuhai Railway Co., Ltd., Beijing Shougang International Engineering Technology Co., Ltd., Guiyang Urban Rail Transit Co., Ltd., Heilongjiang Longmei Mining Group Co., Ltd., Guizhou Shuicheng Coal Mining Co., Ltd., Chongqing Energy Group, Lanzhou Railway Bureau, Liaoning Provincial Electric Power Co., Ltd., Shandong Luneng Materials Group Co., Ltd., Weiqiao Textile Co., Ltd., Shanxi Provincial Electric Power Company, Shaanxi Provincial Electric Power Company, Northwest Power Grid Co., Ltd., etc.

Mobile Transformer on vehicles

CEEG Intelligent Manufacturing Safe and Efficient

Product Introduction

The mobile transformer developed by CEEG is of vital importance to the overall performance of mobile substations. Although there is only a slight difference in wording between "mobile transformer" and "mobile transformer for vehicles," the design concepts differ significantly. Conventional mobile transformer as emergency power sources and typically only require short-term energized operation for a few days, their operating characteristics cannot be compared to those of substations. In contrast, the "mobile transformer on vehicles" for mobile substations, as a core equipment, must not only meet the transportation requirements of various road conditions but also fulfill the energized operation needs of the mobile substation for several months or even one to two years, essentially aligning with the operating characteristics of a substation.

Since it is a mobile substation, after the lease expires, it needs to be transported and leased to other projects multiple times. Therefore, the technical requirements for the "Mobile transformer on vehicles" are higher than those of tradition ones. This type of transformer can be integrated into a flatbed trailer or transported as a whole using conventional transport vehicles, without the need for complicated approval procedures for specialized vehicles, completely replacing conventional mobile transformers.

Reference

Jiangyin Second Yangtze River Crossing, Yuanhe Power Station Co., Ltd., Beijing Beikong Environmental Protection Co., Ltd., Pinggao Group International Engineering Co., Ltd., Suzhou Zhongcai Construction Co., Ltd., Wuxi Metro Group Co., Ltd., etc.



Oil-immersed Type Converter Transformer

High Temperature Resistance
High Overload Capacity
Low Noise High Reliability

Product Introduction

Power conversion refers to the collective term for rectification, inversion, and frequency conversion, among which rectification is widely used. Most industrial rectifier DC power supplies are generated by rectifier transformers and rectifiers connected to the AC power grid. The electrochemical industry is the most common application of rectifier transformers, used for the extraction of aluminum, magnesium, copper, and other metals through the electrolysis of metal compounds, as well as the production of chlorine-alkali through the electrolysis of salt, and the production of hydrogen and oxygen through the electrolysis of water. The explosive growth of the hydrogen energy industry is driven by factors such as depletion of fossil energy, environmental degradation, and frequent extreme climate events.

Hydrogen energy is a rich, green, and low-carbon secondary energy source, gradually becoming one of the important carriers in global energy transition. In the context of carbon peak and carbon neutrality goals, the combination of renewable energy sources such as photovoltaics, wind power, and hydropower with hydrogen production through rectifier equipment and water electrolysis technology can produce high-purity hydrogen and oxygen, leading to wider utilization in the global economy.

Product Performance

The oil-immersed rectifier transformers produced by CEEG have the characteristics of high temperature resistance, maintenance-free operation, high overload capacity, low noise, high reliability, lift-core free, leakage-free performance, and diverse product varieties. These features effectively improve electrolysis efficiency, reduce overall power consumption, and enhance operational reliability. The performance indicators meet or exceed the latest standards such as GB/T 18494.1-2014 and GB/T 18494.3-2012, demonstrating an advanced level among similar products in the domestic market.



Dry Type Converter Transformer

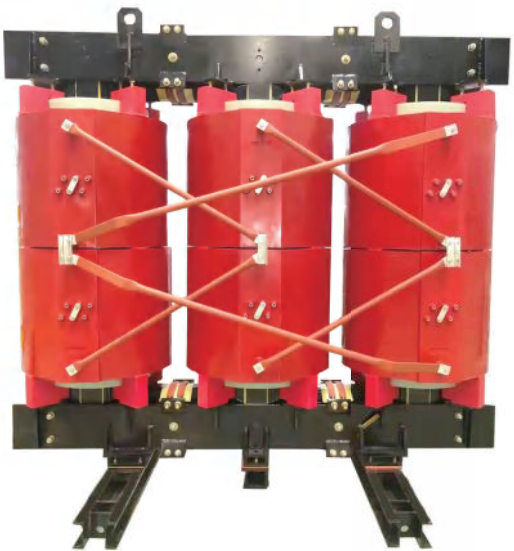
Professional Design Safe and Reliable

Product concept

Power conversion refers to the overall term for three working modes: rectification, inversion, and frequency conversion. Most of the rectifier and DC power supplies used in general industry, energy storage, photovoltaic, variable frequency speed regulation, subway railway traction, feed test, charging station and other places are generated by the rectifier equipment composed of transformer and rectifier in the AC power grid.

Product function

1. The power supply voltage on the AC grid side is stepped down (or stepped up) to meet the required AC valve side voltage for DC output.
2. Achieve electrical isolation between the DC side (AC valve side) and the AC grid side.
3. Convert the three-phase (or single-phase) AC power supply on the AC grid side into multi-phase AC power on the AC valve side to reduce the harmonic content on the AC grid side and improve the waveform of the DC voltage.



Product features

Core material: Optional choices include silicon steel or amorphous alloy strip.
Core structure: Optional choices include three-phase three-column or three-phase five-column.
Winding structure: Optional choices include axial split, radial split, or multiple windings on the valve side for multiple voltage outputs.
Insulation class: Optional choices include Class F or Class H.
Product process: Optional choices include epoxy resin casting process or vacuum pressure impregnation process.

SG series Dry Type Transformer

Safe Reliable Environmentally Friendly Energy Saving



Reference

National Olympic Sports Center Comprehensive Training Hall, Beijing Aerospace Times Laser Navigation Technology Co., Ltd., Chinese People's Armed Police Force, China University of Petroleum, Beijing Tiantan Hospital, and others.

Product Introduction

1. The product is rated as Class H insulation and Class C insulation materials, providing strong overload and short-circuit withstand capabilities and high safety performance.
2. High-quality high-permeability silicon steel is used with a multi-stage stepped process, resulting in low no-load losses.
3. Copper and silicon steel are recyclable, and the insulation materials are fully degradable, making it an environmentally friendly product.
4. DuPont ReliatraN® core technology is adopted, reducing the volume by 10% and saving materials by 10%.
5. Realizes full intelligent data collection and analysis, serving as an intelligent 'brain' for proactive operation and maintenance.

Scope of Application

1. Places with high population density such as shopping malls, residential areas, schools, hospitals, and entertainment venues that have strict safety requirements.
2. Locations with high energy consumption, high loads, susceptibility to overload, and uneven load distribution.
3. Harsh environments such as coal mines, nuclear power plants, and cement factories that have radiation hazards or high dust content.
4. Occasions that require high moisture resistance, resistance to salt spray, and corrosion protection.

Marine and Offshore Platform Transformer

Superior Insulation Seismic Resistance



Product Introduction

1. It adopts high-quality high-permeability silicon steel with multi-step process, resulting in low no-load losses.
2. The use of Nomex® paper insulation system for manufacturing marine transformers and offshore platform transformers is the first in China.
3. The transformer body adopts two kinds of process system: VPI (Vacuum Pressure Impregnation) process and epoxy vacuum casting process, both of which are applicable.
4. All fasteners and exposed conductive parts are treated with special processes to meet the requirements of waterproof, dustproof, and anti-corrosion.
5. The enclosure comes with a waterproof trough, with the highest protection level reaching IP44, ensuring safety and reliability.
6. It can adopt a combination of air cooling and water cooling, forming a hybrid air-water cooling structure, with strong overload capacity

Scope of Application

The scope of application for marine transformers includes bulk carriers, oil tankers, container ships, chemical tankers, LNG (liquefied natural gas) carriers, roll-on/roll-off (Ro-Ro) ships, passenger ferries, etc. They are also used in docks, offshore platforms, and other marine vessel-related products.

Reference

China Shipbuilding Industry Corporation (CSI) 712th Research Institute, Shanghai Zhenhua Heavy Industries Co., Ltd., Nantong COSCO Kawasaki Ship Engineering Co., Ltd., CNOOC (China National Offshore Oil Corporation) Shenzhen Branch, etc.

Cast Resin Transformer

Precision Manufacturing Perfect Quality

Product Introduction

1. High quality high permeability silicon steel with multi-stage stepping process leads to low no-load loss.
2. The surface adopting nano-paint & self-leveling process with low noise.
3. It has strong waterproof and short-circuit resistance, strong overload capacity, good electrical performance, safety and reliability.
4. Through the simulation analysis of electric field, temperature field and magnetic field, CEEG is the first company in China to pass KEMA's E2, C2 and F1 tests.
5. The product can adopt dual-mode structure scheme to meet the needs of different customer groups.
6. Special intelligent transformer solution and big data cloud diagnosis technology are adopted to be always online.



Product Category

10kV Series

1. Low loss, low partial discharge and low noise.
2. The product performance parameters are better than GB and IEC standards.
3. It is safe, flame-retardant, fireproof and pollution-free, and can be directly installed in the load center.
4. Maintenance free, convenient installation and low comprehensive operation cost.
5. Low temperature rise and high product reliability.
6. Stable structure and strong seismic capacity.
7. Moisture proof, corrosion-resistant, wide application range.

Scope of application: Strong adaptability to the product environment, especially suitable for the places where have seasonal load fluctuations or overloading cas.

35kV Series

1. Through the dynamic thermal stability simulation analysis, the winding structure is in reasonable arrangement and with strong short-circuit resistance.
2. Low loss, low noise and low partial discharge.
3. It can also operate under overload long time without air-cooling, with strong overload capacity.
4. Winding capacitance distribution is reasonable and impulse withstand ability is strong.
5. The product has the characteristics of flame retardant and self extinguishing, non-toxic and harmful gas generation, green and environmental protection.

Scope of application: densely populated and narrow urban substations, data centers, factories and mining enterprises.

Traction Rectifier Transformer

1. Low temperature rise, strong overload capacity and reliable operation under class VI load conditions.
2. The key technical parameters are well balanced, the load is evenly distributed, and the amount of non-characteristic harmonics is effectively reduced.
3. The coil adopts double split structure in axial with smoothly the output DC waveform.
4. High mechanical strength, good moisture resistance, partial discharge ≤ 10 pc.
5. Low noise , low electromagnetic radiation pollution.

Scope of application: Rail transit.

Reference

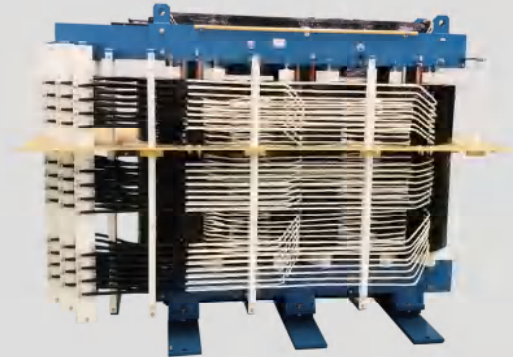
Olympic Center Gymnasium, Qingdao International Sailing Center, Beijing Urban sub center, Beijing Chang'an Street lighting project, Beijing Winter Olympics, China Iron and Steel Research Institute, Wuxi Metro, Nanjing Metro, Shanghai Disney Land, Shanghai Expo Exhibition Center, etc.

ZPSG Frequency Conversion Transformer

Protecting Motor Energy Saving Efficiency Enhancement

Product Introduction

1. The core adopts a core-positioning structure with multi-stage stepped process, ensuring no lateral or longitudinal displacement of the core under various operating conditions.
2. The winding adopts various structural types, providing strong short-circuit withstand capability.
3. It utilizes a dedicated air-cooling guiding system, achieving high heat dissipation efficiency and ensuring product safety and reliability.
4. The magnetic leakage distribution is reasonable, meeting the requirements of frequency converter.



5. Multiple technologies are employed to effectively suppress harmonic content, achieving harmonic-free performance and extending motor lifespan.
6. There are various structural types available to meet the requirements of different frequency conversion systems.
7. The product's maximum capacity can reach 9000kVA, enabling 72-pulse rectification.

Scope of Application

Suitable for use with high-voltage inverters, mainly in industries such as municipal water supply, power, metallurgy, petrochemicals, cement, coal, and others.

Reference

Siemens (Shanghai) Electrical Drive Systems Ltd., ABB Electrical Drive Systems Co., Ltd. (Beijing), Beijing Dynamic Source Technology Co., Ltd., Beijing Kangyi Sheng Frequency conversion Technology Co., Ltd., Jiangsu Lipu Electronic Technology Co., Ltd., Wuxi Fuji Electric Co., Ltd., Hefei Chunyan Electric Switch Co., Ltd., and others.

KBSG2-T Mining Explosion-proof Transformer KBSGZY2-T Mining Explosion-proof Mobile Substation

National Patent Safety High Compression Strength



Product Introduction

1. The unique full corrugated structure effectively improves the heat dissipation area, and has a national patent.
2. The cylindrical explosion-proof shell improves the strength of the shell, can withstand 1MPa pressure and has strong explosion-proof performance.
3. DuPont Nomex® Paper insulation system is adopted, which is more safe and reliable.
4. Adopting advanced design and processing technology, complete production and testing technology leading to more stable performance;
5. Low loss, low partial discharge, low noise and strong overload capacity.
6. Maintenance free, safe, flame-retardant, explosion-proof and fire-proof, pollution-free, and can be installed directly.

Scope of Application

It is widely used in power supply of underground devices in coal mines.

Reference

China Shenhua Group (including its subsidiaries), Datong Coal Mine Group Tongzhong Electric Co., Ltd., Shanxi Sanyuan Coal Industry group, Xinwen Mining Group, Shanxi China Resources Liansheng Energy Investment Co., Ltd., Inner Mongolia Beilian Power Energy Development Co., Ltd., etc.

KBZSGZY Mining Explosion-proof Converter Mobile Substation

Safe Reliable Environmentally Friendly

Product Introduction

1. The iron core adopts high-quality high magnetic conductivity silicon steel, full oblique joint and multi-stage stepping process, with low no-load loss.
2. The iron core adopts three-dimensional fastening structure. Under various working conditions, the iron core has no lateral and longitudinal displacement.
3. High and low voltage windings adopt a combined winding process, combined with VPI vacuum pressure impregnation and high-temperature curing, with high mechanical strength.
4. The shell adopts an oval structure, with low product height and short length, which is suitable for the space requirements of various mines.
5. The shell adopts the corrugated cylindrical structure of patented technology, with no ponding and dust on the top, good heat dissipation effect and strong explosion-proof performance.
6. It adopts the eight-point fastening method, which is firm and reliable and can go down the well vertically.
7. Nomex® paper insulation system is adopted, with thermal insulation up to Class C, recyclable, safe and environmental protection.
8. The integrated design scheme supplies power to the Flameproof Frequency Converter and communicates with the frequency converter to complete the functions of equipment operation status monitoring, fault breaking and centralized control.



Scope of Application

The product supplies power to the explosion-proof Frequency Converter and communicates with the frequency converter to complete the functions of equipment operation status monitoring, fault breaking and centralized control. It is widely used in coal mines to supply power to 1140V and 3300V explosion-proof Frequency conversion speed regulating devices with three-level technology.

Reference

China Coal Science and Industry Tiandi (Jiyuan) electrical transmission Co., Ltd. (central enterprise), Qingdao Tianxin frequency conversion Co., Ltd., Liaoning Rongxin Electric Co., Ltd., Shenhua Ningxia Coal Industry Group Co., Ltd., Jincheng Lanyan Coal Industry Co., Ltd., Shenhua Xinjiang Energy Co., Ltd., etc

CEEG Product Family



PBG/KBG High-voltage Vacuum Switch for Mine Explosion-proof Mobile Substation BBD Low-voltage Protection Box for Mine Explosion-proof Mobile Substation

Advanced Craftsmanship
Aesthetically Pleasing and Durable

Product Introduction

1. The core control system consists of an industrial programmable logic controller (PLC) and a human-machine interface (HMI). It provides stable performance, precise protection, and simple maintenance.
2. The HMI displays operational status, power parameters, and faults, with a fully Chinese-language LCD interface.
3. Current can be continuously set with a stepping value of 1A.
4. It supports live maintenance, ensuring safe and reliable operation and maintenance.
5. It features a small size, reasonable structure, and intuitive operation.
6. It offers comprehensive protection functions, including overload, short circuit, overvoltage, undervoltage, leakage, leakage lockout, phase loss, overtemperature, wind power and gas lockout, and emergency stop for the upstream power supply. It also protects against faults feedback from the low-voltage side of the mobile transformer.
7. The PLC intelligent protection system includes self-checking, fault diagnosis, inspection, and memory functions. It provides real-time detection, digital display of operational status, and fault indication for ease of

system use, maintenance, fault judgment, and handling.

8. It features a modular design and is equipped with standard RS232/485 communication interface for real-time monitoring and transmission of digital displays for operational status and fault indication. It can be integrated with the mine automation network to form a complete mine automation monitoring system.
9. All faults drive the high-voltage vacuum circuit breaker to disconnect through signal lines, reducing the breaking current.
10. The protection box has four circuits on two sides for output, meeting the connection requirements for multiple loads.

Scope of Application

Widely used for underground device power supply in coal mines.

Reference

China Shenhua Group (including subsidiary companies), Datong Coal Mine Group Tongzhong Electric Co., Ltd., Chongqing Energy Investment Group Co., Ltd., Xuzhou Mining Group Co., Ltd

Energy Storage Dedicated Open Ventilated Dry Type Transformer

Safer Transformer Safer Energy Storage

Product Introduction

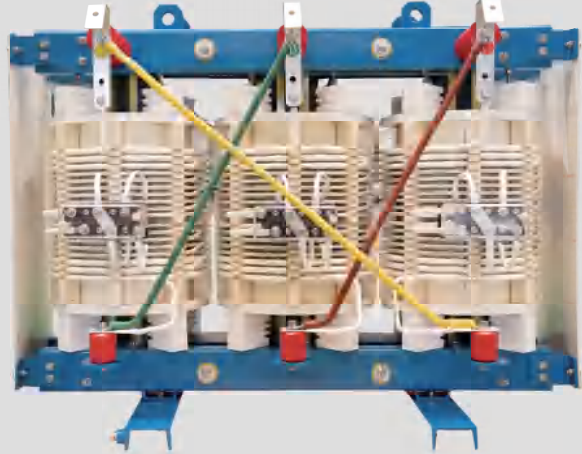
1. The winding adopts an open and ventilated structure, which provides excellent heat dissipation, strong overload capacity, and ensures transformer safety.
2. It utilizes DuPont Nomex® VPI (Vacuum Pressure Impregnation) insulation system, offering a compact structure and reasonable layout.
3. The transformer is capable of withstanding high temperatures up to 220°C and low temperatures down to -40°C, providing strong insulation performance to meet various energy storage environment requirements.
4. It possesses flame retardant and non-combustible characteristics, making it more suitable for user-side energy storage applications such as hospitals, smart parks, solar energy storage charging stations, data centers, ensuring worry-free energy storage.
5. Equipped with intelligent terminal for the transformer and utilizing an Internet of Things (IoT) cloud platform, it enables intelligent operation and maintenance.

Scope of Application

Suitable for user-side energy storage applications such as hospitals, smart parks, solar energy storage charging stations, data centers, and more.

Implementation standards

1. GB 20052-2020 Limits and energy efficiency grades for power transformers
2. GB/T 1094.1-2013 Power transformers - Part 1: General
3. GB/T 1094.3-2017 Power transformers - Part 3: Insulation levels, Dielectric tests, and external clearances in air.
4. GB/T 1094.5-2008 Power transformers - Part 5: Ability to withstand short-circuit
5. GB/T 1094.10-2022 Power transformers - Part 10: Determination of Sound levels
6. GB/T 1094.11-2022 Power transformers - Part 11: Dry-type transformers
7. GB/T 1094.12-2013 Power transformers - Part 12: Load Guide for Dry-type power transformers
8. GB/T 10228-2015 Technical parameters and requirements of dry type power transformer



Energy Storage Dedicated Epoxy Dry Type Transformer

Safer Transformer Safer Energy Storage



Product Introduction

1. The installation and usage environment is harsh, requiring high-level protection against dust, moisture, and vibration.
2. Strong overload capacity and excellent resistance to thermal shock.
3. Strong ability to withstand harmonics.
4. Low self-loss and high efficiency.
5. Different high and low voltage terminals' input and output methods, with a compact structure.
6. Various requirements for capacity, voltage, and impedance.

The energy storage system dedicated dry type transformer, developed and produced using advanced technology, - possesses highly reliable quality and offers excellent cost-effectiveness.

Implementation standards

1. GB 20052-2020 Limits and energy efficiency grades for power transformers
2. GB/T 1094.1-2013 Power transformers - Part 1: General
3. GB/T 1094.3-2017 Power transformers - Part 3: Insulation levels, Dielectric tests, and external clearances in air.
4. GB/T 1094.5-2008 Power transformers - Part 5: Ability to withstand short-circuit
5. GB/T 1094.10-2022 Power transformers - Part 10: Determinations of Sound levels
6. GB/T 1094.11-2022 Power transformers - Part 11: Dry-type transformers
7. GB/T 1094.12-2013 Power transformers - Part 12: Load Guide for Dry-type power transformers
8. GB/T 10228-2015 Technical parameters and requirements of dry type power transformer



CEEG Product Family

Energy Storage Dedicated Oil-Immersed Type Transformer

Safer Transformer Safer Energy Storage

Structural advantages

1. The core structure has been changed from the traditional long circular core to a quasi-elliptical core structure. It has been validated through sudden short-circuit tests conducted by the Shenyang Transformer Research Institute, enhancing the ability of the new energy transformer to withstand sudden short-circuits.
2. High-density laminated wood is used as the spacer material. By changing the outlet way the copper busbars, the width of the internal oil tank has been significantly reduced, resulting in a more compact overall structure. This also has a certain inhibitory effect on stray losses caused by leakage magnetic fields.
3. The internal body positioning and switch installation methods have been modified, replacing the high-voltage elevation outlets with a new structure without hand holes, reducing the risk of oil leakage.

Quality control advantages

1. From the perspective of product quality, following the testing methods specified in GB/T 7354, we have intensified the assessment by conducting partial discharge tests on each new energy transformer. The aim is to ensure that the partial discharge level at 1.2 times the rated voltage ($1.2U_r$) is $\leq 50\text{pC}$ and at 1.4 times the rated voltage ($1.4U_r$) is $\leq 100\text{pC}$ (U_r represents the rated voltage of the transformer).
2. For products of the same model and batch, a sample size of 10% (>1 unit) is selected for lightning impulse tests and temperature rise tests. This further ensures the electrical insulation and mechanical performance of the products.
3. Based on the magnitude and frequency of the harmonic current injected into the transformer as provided by the user, due consideration is given to the losses caused by harmonic currents. This is done to prevent excessive temperature rise in the top layer of the transformer oil and windings. Additionally, the increased capacitance demand caused by harmonic currents is taken into account, ensuring the lifespan of the transformer.
4. According to user requirements and considering the operational environment on-site, the transformers are subjected to anti-corrosion treatment in strict accordance with the requirements of ISO 12944.



Hydrogen-specific Rectifier Transformer

CEEG Product Family

Hydrogen Power in Action Electrifying Green Energy



Product Introduction

Power conversion is a general term for the three modes of operation: rectification, inversion, and frequency conversion, with rectification being the most widely used. Most industrial rectifier power supplies are generated by rectification equipment composed of rectifier transformers and rectifiers, which are connected to the AC power grid. The electrochemical industry is the most prominent user of rectifier transformers, such as for the production of aluminum, magnesium, copper, and other metals through the electrolysis of metal compounds; the production of chlorine and alkali through the electrolysis of salt; and the production of hydrogen and oxygen through the electrolysis of water. The depletion of fossil energy, worsening ecological environment, and increasing occurrence of extreme climate events have driven the explosive growth of the hydrogen energy industry.

Hydrogen energy is a rich, green, and low-carbon secondary energy source, gradually becoming one of the important carriers for global energy transition. Under the requirements of carbon peak and carbon neutrality, combining renewable energy sources such as photovoltaics, wind energy, or hydropower with hydrogen production through rectification equipment and electrolysis of water allows for the production of high-purity hydrogen and oxygen. This will lead to broader utilization in the global economy.

Performance characteristic

1. Safety and reliability: The transformer is filled with non-toxic, flame-retardant epoxy resin, which provides high mechanical strength, flame resistance, and no pollution.
2. Convenient installation: Dry type rectifier transformers are delivered as a complete unit, ready for operation upon placement, ensuring convenience and efficiency.
3. High overload capacity: The maximum overload capacity can reach 200%.
4. Low noise: The noise level is reduced by 3 to 5 dB compared to the national standard.
5. Cost-saving: Dry type rectifier transformers can be installed together with rectifiers and other electrical equipment, eliminating the need for separate design of power distribution rooms. This saves space and reduces initial investment.
6. Customization: Flexibly designed and quickly responsive according to specific customer requirements.
7. Authoritative certification: Certified by the National Electrical Products Quality Supervision and Inspection Center.

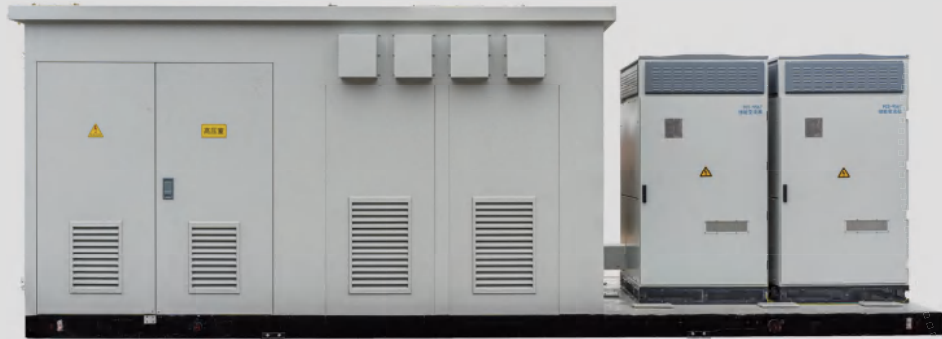
Energy Storage Step-up Substation integrated with Converter (Dry Type Transformer)

New Energy Flexible Electricity Green Power

Product Introduction

1. Turn-key Solution
 - a. Integrated photovoltaic inverter, transformer, and switchgear in one unit, factory-tested as a whole, saving installation and commissioning time on-site.
 - b. The enclosure adopts a container design, eliminating the need for special lifting equipment, making transportation and installation convenient.
2. Strong Environmental Adaptability
 - a. Strong corrosion resistance: The enclosure is containerized and made of high-weathering steel plate. High-weathering steel has stronger corrosion resistance than ordinary carbon steel.
 - b. Thermal insulation: Insulation boards are installed inside the enclosure, providing good fire resistance, insulation, and thermal insulation.
 - c. Ventilation and heat dissipation: The air inlet is specially designed to effectively prevent dust and sand.
3. High Reliability and Safety
 - a. Adoption of epoxy resin cast dry type transformer, which is a flame-retardant product, eliminating the risk of explosion and fire.
 - b. The dry type transformer has passed the C2E2 and F1 tests conducted by the National Transformer Quality Supervision and Inspection Center.
4. Low Investment, High Returns

Compared to the conventional 'inverter room + PV transformer cabinet' solution, the investment is reduced by 15% to 20%. The numbers of installation foundation are reduced from 2 to 1. Installation and commissioning time is reduced by 50%. Inverter and transformer are connected using copper busbars, eliminating the need for cables between the inverter room and PV transformer cabinet. Structural optimization saves two low-voltage switchgear cabinets between the inverter and transformer.
5. The product solution is flexible and diverse, completely tailored to meet the customer's actual needs, providing a satisfactory one-stop solution.



Energy Storage step up substation intergrated with Converter (Oil-immersed Type Transformer)

New Energy Flexible Electricity Green Power

Product Introduction

The energy storage boosting and conversion integrated machine has a high-voltage side voltage ranging from 6kV to 35kV, and the low-voltage side AC voltage of the transformer covers 0.315kV to 0.69kV. The transformer includes various models of oil-immersed, dry type, and Huabian (China) transformers. The energy efficiency grade meets the design requirements, and the maximum DC voltage on the direct current side can reach up to 1500VDC. The stand-alone capacity of the Energy Storage substation can reach up to 6.8MW.

The energy storage system can be connected to the grid as an independent system, playing a role in peak shaving, valley filling, and reactive power compensation. The energy storage system can also be combined with new energy generation to form a wind-solar energy storage system, smoothing the power output from renewable sources to the grid. Moreover, the energy storage system can be integrated

with wind power, solar power, and other renewable energy systems, forming a microgrid system at the load center, which improves energy utilization efficiency, enhances power quality, increases power supply reliability, and promotes green and environmental-friendly practices. By optimizing the configuration of batteries, inverters, bidirectional converters, wind and solar equipment, we can provide engineering consulting, design, system integration, and station-level monitoring for energy storage systems, wind-solar energy storage systems, and energy storage microgrid systems.



Referrnce

Qinghai Geermu 100MW200MW Project, State Power Investment Corporation's 20MW Photovoltaic Energy Storage Project, Ronghe Yuan Shandong Peninsula Yantai Haiyang 15MW Energy Storage Project, Guoxuan High-Tech Energy Storage Project, Shanghai Electric Jinchang Energy Storage Project, Ganghua Era User-Side Energy Storage Project, JD.com Energy Storage Project, Ningxia Muhe Energy Storage Project, and others.

ZGS series Prefabricated Substation

Modular Manufacturing



Product Introduction

1. The product has the advantages of compact structure, small volume, short construction cycle and easy installation and movement.
2. The shell adopts fully sealed design, with good protection effect.
3. The substation adopts unique guiding ventilation technology, with good heat dissipation effect and strong overload capacity.
4. Various power supply schemes of terminal or ring network can be adopted, with long service life and maintenance free.
5. Dry type, oil type, amorphous alloy and other types of transformers can be configured according to user requirements, and the schemes are flexible and diverse.
6. CT, PT, protection and communication devices can be installed at the high-voltage side, and multi-functional intelligent instruments for acquisition and protection can be installed at the low-voltage side, so as to realize the "three remotes" of high-voltage and low-voltage switches and transformers.
7. LED display screen can be installed on the surface of the shell to scroll all kinds of information, which is beautiful, environmentally friendly and economical.
8. It can realize fully intelligent data acquisition and analysis, realize active operation and maintenance, and provide energy management for various scenarios.

Scope of Application

It is widely used in various power transformation and distribution places such as industrial parks, residential quarters, commercial centers and high-rise buildings.

Reference

Beijing Gongke Feida Transportation Engineering Development Co., Ltd., Inner Mongolia Xilin Gol Baiyinhua Coal Power Co., Ltd., Jiangsu Huaxi Group Co., Ltd., Zibo Mining Group material supply Co., Ltd., Anqing Hengjiang industry (Group) Co., Ltd., Gezhouba Group Power Co., Ltd., Qinghai Upper Yellow River Hydro-power Development Co., Ltd., etc.

YB series Prefabricated Substation

Modular Manufacturing



Product Introduction

1. YB series prefabricated substation is a complete set of indoor and outdoor power transformation and distribution equipment composed of high-voltage switchgear, power transformer and low-voltage switchgear.
2. The product is a frame structure, which is welded with section steel or assembled from steel plate. The frame is covered with special paint layer, which has strong mechanical properties, weather resistance and corrosion resistance.
3. The top of the prefabricated substation is provided with a thermal insulation layer to prevent condensation caused by rapid temperature change. A thermal insulation layer can be added around the box.
4. YB series prefabricated substation is to install the secondary system (including telecontrol) of the substation into one or several movable, fully enclosed, moisture-proof and anti-corrosion boxes after installation and commissioning in the factory. After one-time installation in the factory, the box is transported to the site. Only the corresponding foundation and one-time connection are needed to transmit power.
5. It can realize fully intelligent data acquisition and analysis, realize active operation and maintenance, and provide energy management for various scenarios.
6. CT, PT, protection and communication devices can be installed at the high-voltage side, and multi-functional intelligent instruments for acquisition and protection can be installed at the low-voltage side, so as to realize the "three remotes" of high-voltage and low-voltage switches and transformers.

Scope of Application

In places without fire, explosion, chemical corrosion and violent vibration, the ground inclination shall not exceed 5°.

Reference

Beijing Olympic Doping Testing Center, Beijing Lvqi Kechuang Technology Co., Ltd., Qingdao International Sailing Center of the 29th Olympic Games of Qingdao East Olympic Development & Construction Group, 96201 Unit, 4822 plant of the Chinese people's Liberation Army, Wuhan Branch of China Petrochemical Corporation, State Grid Smart Grid Research Institute, Xinjiang Meihua Amino Acid Co., Ltd. and Sinopec (Hong Kong) Hainan Petroleum Co., Ltd., China Railway 14th Bureau Group Co., Ltd., etc.

Prefabricated Containerized Intelligent Substation

Precision Craftsmanship Perfect Quality

Product Introduction

The containerized enclosure features standardized design, factory-customized distribution, on-site modular construction, and the use of modular and combinable electrical equipment. It includes transformers, high-voltage switchgear and control equipment, internal wiring of low-voltage switchgear and control equipment, metering, compensation, surge arresters, and other auxiliary devices, configured within a common enclosure or a group of enclosures. There are multiple options for the enclosure, allowing for non-metallic or containerized selection based on specific needs. The equipment, following relevant standards, undergoes debugging and testing to form a complete substation.



Product Features

1. Factory production
2. Modular transportation
3. Convenient on-site installation
4. Small footprint
5. Short construction period
6. Low operation and maintenance costs
7. Fully enclosed, long service life, strong weather resistance

Reference

Zimbabwean Export Project

YBF series Wind Power Substation

Professional Design Safe and Reliable



Product Introduction

1. Good sealing performance, wind and sand proof, salt fog proof, rain and snow proof.
2. Advanced electric spray-coating technology, the shell is not easy to rust and fade.
3. The shell has strong adaptability to the environment, which can be selected according to different environments. It has the advantages of beautiful appearance and coordination between the shape & the windmill site.
4. Intelligent control, which can not only be controlled locally, but also be monitored remotely to realize the four remote functions.
5. Natural ventilation. The substation is equipped with sufficient natural ventilation and thermal insulation measures. When the ambient temperature is close to 40 ℃, forced ventilation will be started to ensure the normal operation of step-up transformer.

Scope of Application

Windmill power plant. YBF series windmill power substation is a special equipment for grid connected output after raising the 0.6-0.69kV voltage sent by windmill power generator to 10kV or 35kV.

Reference

Inner Mongolia Ximeng zheligentu wind farm phase I, Saihan project of Beijing International Power New Energy Co., Ltd., zheligentu project, Gansu Xinquan Wind Power Co., Ltd., Huaneng Tianzhen Wind Power Co., Ltd., Dafeng Wind Power Co., Ltd., National Electricity Yunnan New Energy Co., Ltd., Jiangxi SPIC New Energy Power Generation Co., Ltd, Datang Zhangzhou Wind Power Generation Co., Ltd., Huaneng Fuxin Wind Power Generation Co., Ltd., etc.

KYN28A series/ASZ1 series Armored Movable AC Metal-enclosed Switchgear

Reasonable Structure Safe and Reliable



Scope of Application

The seismic intensity does not exceed 8 degrees, there are no fires, no explosion hazards, and no severely polluted or intensely vibrating areas. It is mainly used for power plants, power transmission of medium and small generators, power distribution in industrial and mining enterprises, and power reception, transmission, and large high-voltage motor starting in the secondary substations of the power system, implementing control, protection, and monitoring.

Product Introduction

1. Equipped with ABB-produced VD4 vacuum circuit breaker or domestically produced VS1 vacuum circuit breaker.
2. Cabinet structure adopts fully assembled method.
3. Sufficient space in the cable compartment allows for the connection of multiple cables, making installation and maintenance convenient.
4. Cabinet can be reliably wall-mounted, reducing floor space occupation.
5. Excellent interchangeability of handcart.
6. Passed all type tests and full-load tests.
7. Equipped with interlocking functions to prevent pushing and pulling of circuit breaker handcart with load, prevent misoperation of circuit breaker, prevent closure of circuit breaker when grounding switch is closed, prevent accidental entry into live isolation compartment, and prevent accidental closure of grounding switch when energized.

Reference

China Construction International Engineering Co., Ltd., Mengniu Dairy (Chabei) Co., Ltd., Guizhou Shuicheng Mining Co., Ltd., Offshore Petroleum Engineering (Zhu-hai) Co., Ltd., China Coal Pingshuo Coal Industry Co., Ltd., China Railway 12th Bureau Group Electrification Engineering Co., Ltd., etc.

GGD, MNSZ, GCK, and GCS series are AC Low-voltage Switchgear Cabinets used for Power Distribution, lighting, metering, and other purposes

Modular Design with Good Scalability

Product Introduction

- 1. MNSZ low-voltage draw-out switchgear is a combination type low-voltage switchgear equipped with standard modular units. It is suitable for power distribution systems with an AC frequency of 50 (60) Hz and a rated operating voltage of 380V and below. It is used for the control of power generation, transmission, and electrical energy-consuming equipment.
- 2. GCK series draw-out switchgear is used in AC systems with a rated frequency of 50Hz and a voltage of 380V and below. It is used for power supply, feed, reactive power compensation, centralized control of electrical energy, and motors.
- 3. GCS low-voltage draw-out switchgear serves as a complete set of low-voltage distribution equipment for three-phase AC systems with a frequency of 50Hz, a rated operating voltage of 380V, and a rated current of 4000A and below. It is used for power distribution, centralized control of motors, reactor current limitation, and reactive power compensation.
- 4. GGD type AC low-voltage distribution cabinets are suitable for distribution systems with an AC frequency of 50Hz, a rated operating voltage of 380V, and a rated operating current of up to 6300A. They are used for the conversion, distribution, and control of electrical energy for power, lighting, and distribution equipment.

Scope of Application

Suitable for industries such as power plants, petrochemicals, metallurgy, textiles, high-rise buildings, and others, it is applied in large-scale power plants, petrochemicals, and similar places with high levels of automation and requirements for computer interfaces.

Reference

Beijing Guodian Electric Power Engineering Installation Co., Ltd., Beijing Guodian Tongfang Electric Power Construction Engineering Co., Ltd., Tongcheng State Grid Electric Equipment Co., Ltd., China Sea Network Technology Service Co., Ltd., Zhongzi Technology Traffic Engineering Co., Ltd., Xianju Jiuzhou Tong Pharmaceutical Co., Ltd.



03

SERVICE NETWORK



After more than 30 years of development, CEEG has successively obtained the ISO9001 Quality Management System Certification, ISO14001 Environmental Management System Certification, and OHSAS18001 Occupational Health and Safety System Certification, CNAS test authority. It has also passed the 3C, UL, and EU product characteristic tests, as well as multiple product certifications such as IEC, CE, and TUV.

CEEG Customer Service Hotline (025-52095855 15301592833) serves as an information communication and customer response platform. We are committed to providing feedback on customer opinions and suggestions within 24 hours. For urgent requirements such as customer maintenance and installation guidance, our sales service network covering the globe will provide immediate support and response.



编号 321182000201702210083



营业执照

(副本)

统一社会信用代码 9132118233888785XM (1/1)

名称	中电电气（江苏）变压器制造有限公司
类型	有限责任公司
住所	镇江市扬中市中电大道188号
法定代表人	陆瀚
注册资本	16000万元整
成立日期	2015年04月08日
营业期限	2015年04月08日至*****
经营范围	输配电及控制设备研发、制造、设计及其他相关技术服务；金属制品销售；自营和代理各类商品及技术的进出口业务（国家限定企业经营或禁止进出口的商品和技术除外）。（依法须经批准的项目，经相关部门批准后方可开展经营活动）



登记机关



2017年 02月 21日

BUSINESS LICENSE

(Copy)

NO.321182000201702210083

Unified Social Credit Code NO.9132118233888785XM (1/1)

Name of Enterprise: China Electric Equipment (Jiang Su) Transformer Manufacturing Co., Ltd.

Character of Economy: Limited Liability Company

Address: No.188 Zhongdian Road, Yangzhong, Zhenjiang, Jiangsu Province, China

Legal Representative: Lu Han

Registered Capital: RMB 160,000,000 Yuan

Date of Foundation: April 8, 2015

Business Term: From April 8, 2015 to present

Business Scope: Transmission and distribution and control equipment R&D manufacturing、 design and other related technical services; Sales of metal products; Independent management and agents of all types of goods and technology import and export business (Except for state limited business or prohibited imports and exports of goods and technology). (The project that shall be subject to approval according to law, they can carry out business activities after approved by the relevant project department)

Registration Authority: (Seal) Yangzhong City Administration for market supervision
February 21, 2017

This certificate is translated into English by China Electric Equipment (Jiang Su) Transformer Manufacturing Co., Ltd



Export Reference/Supply Reference till 2023

No.	Country/Area of Customer	Type	Products	Qty	Client	Delivery Date
1	Kirghizia	Oil	1600kVA/10kV	33	Electric company of Kirghizia	2003
2	Uganda	Oil	400kVA/11kV	12	Ministry of Foreign Affair of Uganda	2003
3	Nigeria	Oil	2500kVA/3.5kV	2	GOMBE water factory	2004
		Oil	4000kVA/3.5kV	1		
		Oil	100kVA/3.5kV	20		
		Oil	630kVA/3.5kV	8		
		Oil	3150kVA/33kV	4		
		Oil	6300kVA/33	3		
		Oil	13000kVA/132	2		
4	Russia	Oil	16000kVA/110kV	2	Beijing China Electric Switch Company	2004
		Oil	12500kVA/110kV	1		
		Oil	1250kVA/10kV	5		
		Oil	630kVA/10kV	9		
5	India	Oil	100kVA/11kV	21	India West Mengbon Sargadighi Burned-coal Power factory	2005
		Oil	315kVA/11kV	12		
		Oil	500kVA/33kV	14		
		Oil	800kVA/33kV	2		
		Oil	1250kVA/33kV	6		
		Oil	1600kVA/33kV	12		
		Oil	2000kVA/33kV	9		
		Oil	20000kVA/33kV	2		
6	UAE	Oil	50kVA/11kV	12	United Arab Emirates Cenmetn Corporation Cement Power Grinding station	2006
		Oil	160kVA/11kV	5		
		Oil	200kVA/11kV	5		
		Oil	630kVA/11kV	4		
		Oil	1600kVA/6.6kV	3		
		Oil	1000kVA/6.6kV	4		
		Oil	12500kVA/132kV	2		
7	KSA	Oil	2000kVA/13.8kV	7	Saudi Arabia NAJRAN cement Company Ltd	2006
		Oil	630kVA/13.8kV	11		

		Oil	1600kVA/13.8kV	2		
		Oil	1250kVA/13.8kV	3		
8	Guinea	Oil	630kVA/15kV	2	Guinea Double Tree project	2006
9	Surinam	Oil	200kVA/11kV	4	Surinam Embassy	2006
10	Yemem	Oil	200kVA/11kV	10	Yemen Republic Electric power Bureau	2006
		Oil	3000kVA/33kV	5		
11	UAE	Oil	2000kVA/6.6kV	2	China National Building Material Equipment Co., Ltd	2006
		Oil	2500kVA/6.6kV	3		
		Oil	1600kVA/6.6kV	2		
		Oil	30kVA/11kV	3		
		Oil	250kVA/11kV	1		
		Oil	25000kVA/132	2		
12	Grenada	Oil	630kVA/11kV	4	Hefei Transmission & Distribution Equipment Co.	2006
13	Vietnam	Oil	10000kVA/110kV	2	Vietnam Longan Water and electricity Plant	2006
		Oil	630kVA/10kV	3		
		Oil	100kVA/10kV	1		
		Oil	50kVA/10kV	1		
14	Vietnam	Oil	1000kVA/6kV	2	Vietnam Yuanhe Familiar Material Concrete Co	2006
		Oil	1250kVA/6kV	1		
		Oil	1600kVA/6kV	1		
15	Chile	Oil	3150kVA/23kV	1	Chile Powder Grinding Station	2006
		Oil	31500kVA/110kV	1		
16	Nigeria	Oil	1250kVA/33KV	1	Nigeria Northern Ishan Water Factory	2006
		Oil	1500kVA/33kV	1		
		Oil	2000kVA/33	1		
		Oil	7500kVA/33	1		
		Oil	300kVA/11kV	2		
		Oil	1000kVA/11kV	2		
17	Kenya	Oil	1600kVA/11kV	2	Shenzhen Rongcai Electron and Technology Development Company Ltd.	2006
		Oil	2500kVA/11kV	1		
		Oil	1250kVA/11kV	1		
		Oil	25000kVA/132	2		

18	Dominica	Oil	1250kVA/11kV	4	Former Dominica Palaestra	2006
19	Tanzania	Oil	800kVA/11kV	2	China Trading Company	2006
20	Ethiopia	Oil	1600kVA/6kV	1	Hefei Cement Research Institute	2007
		Oil	630kVA/6kV	1		
21	Nepal	Oil	630kVA/11kV	2	China TIESIJIU Civil Engineering Co	2007
22	Costa Rica	Oil	5000kVA/34.5kV	1	SAI MEI S.A	2007
23	Japan	Oil	1630kVA/6kV	5	TOSHIBA Co. Ltd	2007
24	Bangladesh	Oil	1000kVA/11kV	3	China National Heavy Machinery CO.	2007
25	Angola	Oil	630kVA/15kV	5	China National Electronics CO	2007
26	Angola	Dry	630kVA/15kV dry type	5	Beijing Shougang Construction Group CO.	2007
27	Angola	Dry	630kVA/15kV dry type	2	Beijing Fushunxiang Jianzu CO.	2007
28	KSA	Oil	2500kVA/34.5kV	2	Shanghai Pony Technology Co.	2007
		Oil	3150kVA/34.5kV	2		
		Oil	1250kVA/34.5kV	2		
		Oil	800kVA/34.5kV	2		
29	KSA	Oil	2500kVA/13.8kV	4	Hefei Cement Research Institute	2007
		Oil	800kVA/13.8kV	1		
		Oil	1600kVA/13.8kV	2		
		Oil	1250kVA/13.8kV	1		
		Dry	100kVA/13.8kV dry	12		
		Dry	200kVA/13.8kV dry type	12		
30	Bangladesh	Oil	1250kVA/6.3kV	3	China Trading Co.	2007
31	Indonesia	Dry	1250kVA//10.5kV dry	3	Shandong machinery Equipment Group Co.	2007
32	Uruguay	Dry	1000kVA/10kV dry type	2	Tianjin Cement Industry Institute	2007
		Dry	400kVA/10kV dry type	1		
		Dry	1600kVA/10kV dry type	2		
33	Sudan	Oil	20000kVA/33kV	2	Hefei Cement Research Institute	2007

34	Ireland	Oil	1600kVA/11	1	Melton Power Services	2007
35	Russia	Oil	2000kVA/6.6kV	1	China National Building Material Equipment Corporation	2007
		Dry	160kVA/6.6kV dry type	1		
		Dry	30kVA/6.6kV dry type	1		
		Dry	30kVA/6.6kV dry type	1		
36	Russia	Dry	1600kVA/10kV dry	9	WISDRI Engineering Co.	2007
		Dry	1000kVA/10kV dry	1		
		Dry	2000kVA/10kV dry	12		
		Dry	1250kVA/10kV dry	2		
37	South Africa	Dry	1000kVA/11kV dry	1	Beijing General Research Institute	2007
		Dry	2000kVA/11kV dry	5		
		Dry	2500kVA/11kV dry	2		
38	North Korea	Oil	1500kVA/11kV	2	Elcore electrical Contractors	2007
39	Australia	Dry	1250kVA/6.6kV, dry	4	Rutherford Power Pty Ltd	2007
		Oil	12500kVA/33kV	1		
40	Ghana	Oil	500kVA/11kV	2	Western Omega Electric Ltd.	2007
41	South Africa	Dry	1250kVA/6.6kV dry	4	Afrikaans Generator Co	2007
42	Ukraine	Dry	1000kVA/10kV dry	3	Energobud-Komplicit	2008
		Dry	630kVA/6kV dry	2		
		Dry	630kVA/10kV, dry	1		
		Dry	1250kVA/10kV dry	1		
43	UAE	Dry	1500kVA/11kV dry	2	KFB Group	2008
44	North Korea	Oil	1600kVA/3.3kV	1	China trading co.	2008
		Oil	100kVA/3.3kV	1		
45	Australia	Oil	12500kVA/33kV	2	Rutherford Power Pty Ltd	2008
		Oil	3000kVA/25kV	1		
46	Russia	Dry	250kVA/6kV dry type	3	China trading Company	2008
		Dry	400kVA/6kV dry	2		
		Dry	1000kVA/6kV dry	2		
		Dry	1500kVA/6kV dry	1		
		Dry	2000kVA/6kV dry	1		
47	Vietnam	Oil	12500kVA/2kV	2	China Trading Company	2008

48	Algeria	Oil	500kVA/5.5kV	3	Shengli Petro Engineering Com.	2008
		Oil	800kVA/5.5kV,	5		
		Oil	3150kVA/33kV	3		
49	Russia	Oil	3500kVA/10kV	11	Danieli Officine Meccaniche S.P.A	2008
		Oil	2500kVA/11kV	9		
50	Mozambique	Dry	160kVA/11kV dry type	2	Maputo Trading Company (Maputo International Airport)	2008
		Dry	200kVA/11kV dry type	3		
		Dry	400kVA/11kV dry	4		
51	India	Dry	1600kVA/11kV dry	2	SEPCO III Electric Power construction Corporation	2009
		Dry	630kVA/11.5 dry type	10		
		Dry	800kVA/11.5kV dry	4		
		Dry	1600kVA/11.5kV dry	2		
		Dry	2000kVA/11.5kV dry	4		
52	Pakistan	Dry	2500kVA/11.5kV, dry	4		
		Dry	1600kVA/11kV dry	2		
53	Algeria	Oil	60000kVA/132kV	8	Kunye Co., Ltd	2009
		Oil	10000kVA/33kV	2		
54	South Africa	Oil	13000kVA/66	2	Groupment Sonatrach Project	2009
		Dry	1000kVA/11kV dry type	1		
		Dry	2000kVA/11kV dry	6		
		Dry	1600kVA/11kV dry	2		
55	Afghanistan	Oil	2500kVA/11	2	MITTAL Deoxidize Project	2009
56	Egypt	Dry	630kVA/15kV dry type	2		
		Oil	800kVA/11kV	4		
57	Angola	Oil	630kVA/11kV	6		
58	Laos	Dry	1000kVA/22kV dry	2	Capital Palestra Project	2009
		Dry	800kVA/22kV dry	2		
59	Bangladesh	Oil	10000kVA/15.75kV	1	Capital International Cabaret Project	2009
		Oil	75000kVA/132kV	4		
		Oil	2500kVA/6.6kV	2		
60	Burma	Oil	4000kVA/33kV	3	West Bengal Burn Station	2009
61	Iraq	Oil	45000kVA/33kV	2		
62	Cambodia	Oil	25000kVA/115kV	1	Burma Auto Factory	2009
63	Bangladesh	Oil	23000kVA/33kV	2		
					As-Sulaymaniyah Project	2009
					Ratanakiri Water Power Plant	2009
					Adex Corporation Ltd	2009

64	Russia	Oil	100 kVA/10kV	1	Tianjin Cement Industry Design & Research Institute	2010
65	Albania	Oil	121kVA/37.5kV/6.3 kV, 12/15MVA	1	NDREKAJ Sh.p.k	2010
		Oil	242kVA/10.5kV, 60MVA	1		
66	Peru	Oil	2.3/66kV, 12/15MVA	1	Electrica Yanapampa SAC	2010
67	Hong Kong		800kVA 11/0.4kV Silicone	1	Gason Electrical Contracting Ltd	2010
70	Singapore	Dry	SCR-250/1/0.415	3	Rutherford Power Asia Pte Ltd	2010
		Oil	0.415/6.6kV, 750kVA	1		
		Oil	0.415/6.6kV, 1000kVA	1		
		Oil	0.415/6.6kV, 1500kVA	1		
		Dry	500kVA, 11-10/0.44kV Cast Resin Transformer	1		
		Parts	BWDK-S3207A Dry Type Transformer Temperature Controller	6		
		Dry	SC-500KVA 6.6(11)0.415 KV	1		
71	Hong kong	Dry	ZSCRB10-556kVA 11kV Dry Type Rectifier Transformer	2	First-Tech Engineering Limited	2010
72	Iran	Substation	20/0.4kV, 315kVA RMU type pad-mounted transformer	1	ASIA BEHIN BARQ CO.	2010
73	New Zealand	Oil	6.3/33kV, 2700kVA	1	Talla Burn Generation Limited	2010
74	Saudi Arabia	Oil	ZTS-1600kVA/13.5kV/2×720V	1	Nanjing Shengze Technology Co., Ltd	2010
		Oil	ZTS-800kVA/13.5kV/2×720V	1		
		Oil	ZTS-1000kVA/13.5kV/2×720V	1		
		Oil	0V	1		
		Oil	ZTS-630kVA/13.5kV/2×720V	1		

75	Russia	Dry	SCB10-1000kVA/6kV	2	China National Machinery IMP. & EXP. Co. , Ltd	2010
76	Kazakhstan	Parts	Transformer Spare Parts		Tianjin Shiming Machinery & Electrical Spare Parts Co., Ltd	2010
77	Algeria	Oil	13MVA/66kV	1	SINOPEC International Petroleum Service Corporation	2010
		Parts	4TS Monitor	1		
78	Jordan	Dry	SCB	9	SEPCOIII Electrical Power Construction Corporation	2010
79	Indonesia	Switchgear	High Voltage On-load Switcher HXGN-12	1	China National Machinery IMP. & EXP. Co. , Ltd	2010
80	North Korea	Oil	SZ9-1000kVA/3.3kV/0.38kV	1	Dandong Ji Li Trading Co., Ltd.	2010
81	Nepal	Dry	SCB10-500KVA/11kV	1	China Jiangxi Corporation for International Economic and Technical Corporation	2010
82	Philippine	Dry	SCB10-800kVA/10kV	2	Dalian East New Energy Development	2010
		Dry	SCB10-1250kVA/10.5kV/0.4KV	3		
		Dry	SCB10-1000kVA/10.5kV/0.4KV	1		
		Dry	SCB10-800kVA/10.5kV/0.4KV	1		
83	Uganda	Dry	SGZ(B)-1250kVA	2	Yan Jian Group	2010
		Switchgear	Low Voltage Switch Box	22		
84	India	Dry	SCB9-1600kVA-6kV/0.4kV	1	Anhui Masteel K.Wah New Building Materials Co., Ltd	2010
85	Uganda	Oil	SRN11-1000kVA	3	Peak International Trading Co., Ltd	2010
		Oil	SRN11-500kVA	5		
86	Peru	Dry	SCB9-500kVA	1	Yan Jian Group	2010
87	Congo	Switchgear	Low Voltage Incoming Cabinet AA1	1	Weihai International Economic & Technical Cooperative CO., Ltd	2010
		Switchgear	Capacitor Box	1		
		Switchgear	Low Voltage Outgoing	2		

		Switchgear	Cabinet AA3/AA4	2		
		Dry	SCB10/20kV/500kVA	1		
		Parts	Seal Bus Duct	1		
88	Bahamas	Dry	SC(B)9-400kVA/11kV/0.20 8kV	2	Shandong Hi-speed Qi Lu Group CO., Ltd	2010
		Dry	SC(B)9-800kVA/11kV/0.20 8kV	2		
89	Peru	Oil	2.3/66KV, 12/15MVA step-up	1		2011
90	India	Oil	S11-800/6.6	4	Tianjin Cement Industry Design & Research Institute	2011
		Oil	S11-1000/6.6	3		
		Oil	S11-1600/6.6	8		
		Oil	S11-2000/6.6	2		
		Oil	S11-1600/6.9	1		
		Oil	ZTS11-1000/6.6	1		
		Oil	ZTS11-1600/6.6	1		
		Dry	SC10-20/415	7		
		Dry	SC10-30/415	6		
		Dry	SC10-50/415	1		
		Dry	SC10-100/6.6KV	1		
		Dry	SC10-200/415	1		
91	Indonesia	Dry	SCB10-315/6.3	2	Qingdao Jieneng Power Engineering Co., Ltd	2011
		Dry	SCB10-800/6.3	2		
		Dry	SCB10-1000/6.3	6		
		Dry	SCB10-1250/6.3	8		
		Substation	YB-800KVA/20/0.4	1		
92	Congo	Switchgear	LV Incoming Cabinet	1	Weihai International Economic and Technical Cooperative Co., Ltd	2011
		Switchgear	LV Outgoing Cabinet	2		
		Parts	Capacitor	1		
93	Malaysia	Oil	S11-630/6.6	4	Tianjin Cement Industry Design & Research Institute	2011
		Oil	S11-1600/6.6	3		
		Oil	S11-1250/6.6	8		
		Oil	S11-2000/6.6	2		
		Oil	S11-1000/6.6	1		

		Oil	S11-800/6.6	1		
		Switchgear	Load Break Switch	1		
94	Albania	Oil	242/13.8KV, 150MVA	1	China Electric Equipment Group Hong Kong Co., Ltd	2011
95	Korea	Dry	SC10-5000/10 10±2X2.5%/3.3 Dyn11 UK=7%	5	LS Group	2011
		Dry	SCB10-2000/10 10±2X2.5%/0.4 Dyn11 UK=6%	20		
		Dry	SCB10-1600/10 10±2X2.5%/0.4 Dyn11 UK=6%	4		
		Dry	SCB10-1600/10 10±2X2.5%/0.4 Dyn11 UK=4%	4		
		Dry	SCB10-1250/10 10±2X2.5%/0.4 Dyn11 UK=6%	3		
		Dry	SCB10-1000/10 10±2X2.5%/0.4 Dyn11 UK=6%	1		
		Dry	SCB10-630/10 10±2X2.5%/0.4KV Dyn11 UK=6%	2		
		Dry	SCB10-800/10 10±2X2.5%/0.44KV Dyn11 UK=6%	1		
		Dry	SC10-3000/10.5 10.5±2X2.5%/3.3KV Dyn11 UK=6%	1		
		Dry	SCB10-2500/10 10.5±2X2.5%/0.4KV Dyn11 UK=6%	1		
		Dry	SCB10-1000/10.5 10.5±2X2.5%/0.4KV Dyn11 UK=6%	1		

		Dry	SCB10-800/10.5 10.5±2X2.5%/0.4KV Dyn11 UK=6%	2		
		Dry	SCB10-2000/10 10±2X2.5%/0.4 Dyn11 UK=6%	2		
96	Russia	Parts	Circuit Breaker	2	Zhejiang CHINT Group	2011
97	Thailand	Oil	0.44/0.11kv, 10kva	2	China Electric Equipment Group Hong Kong Co., Ltd	2011
		Oil	0.44/0.24kv, 15kva	8		
		Oil	0.44/0.24kv, 80kva	2		
		Oil	0.44/0.24kv, 100kva	4		
98	Russia	Dry	SCB10-2000KVA6.3/0.4KV	9	Tianlangxing Power Plant Equipment Co., Ltd	2011
		Dry	SCB10-1600KVA 6.3/0.4KV	8		
		Dry	SCB10-1250KVA 6.3/0.4KV	2		
		Dry	SCB10-1000KVA 6.3/0.4KV	4		
		Dry	SCB10-800KVA 6.3/0.4KV	2		
		Dry	SCB10-630KVA 6.3/0.4KV	2		
		Dry	DKSC-200KVA6.3/0.4	2		
99	Albania	Oil	121/6.3KV, 12/15MVA	1	China Electric Equipment Group Hong Kong Co., Ltd	2011
100	Thailand	Oil	0.44/0.11kv, 10kva	2	China Electric Equipment Group Hong Kong Co., Ltd	2011
		Oil	0.44/0.24kv, 15kva	8		
		Oil	0.44/0.24kv, 80kva	2		
		Oil	0.44/0.24kv, 100kva	4		
101	Malaysia	Oil	S11-630/6.6	1	Tianjin Cement Industry	2011

		Oil	S11-1600/6.6	2	Design & Research Institute	
		Oil	S11-1250/6.6	4		
		Oil	S11-2000/6.6	2		
		Oil	S11-1000/6.6	1		
		Oil	S11-800/6.6	1		
102	Australia	Oil	S11-2000KVA-11/0.42KV	2	China Electric Equipment	2011
		Oil	S11-1500KVA-11/0.42KV	2	Group Hong Kong Co., Ltd	
		Oil	S11-1000KVA-11/0.42KV	1		
		Oil	S11-1000KVA-11/0.725KV	3		
103	Hong Kong	Dry	1500KVA 11/0.38KV	2	China Electric Equipment Group Hong Kong Co., Ltd	2011
104	Peru	Parts	2.3KV bushings	3	China Electric Equipment Group Hong Kong Co., Ltd	2011
105	Taiwan	Parts	Amorphous Alloy Iron Core	44	China Electric Equipment Group Hong Kong Co., Ltd	2011
106	Laos	Oil	S-4000KVA-11/0.69KV	1	China Electric Equipment Group Hong Kong Co., Ltd	2011
107	Australia	Oil	SFZ-25000KVA-66/11KV	1	China Electric Equipment Group Hong Kong Co., Ltd	2011
108	Venezuela	Substation	Substation 30KVA	6	China CAMC Engineering Co., Ltd	2011
		Substation	Substation 50KVA	21		
		Substation	Substation 160KVA	1		
		Substation	Substation 250KVA	1		
		Substation	Substation 315KVA	4		
		Substation	Substation 400KVA	5		
		Substation	Substation 500KVA	7		
		Substation	Substation 630KVA	2		
		Switchgear	Outdoor High Voltage Vacuum Circuit Breaker ZW()-15(D)/630-25	3		
		Parts	Lightning Arrester YH5WS-17/50	3		
		Oil	S11-M-800/13.8	2		
		Oil	S11-M-1250/13.8	1		
		Parts	Copper Busbar TMY-80×10	90		

		Parts	Copper Busbar TMY-63×10	30		
109	Hong Kong	Oil	S-2000KVA-11/0.38KV	6	China Electric Equipment Group Hong Kong Co., Ltd	2011
110	Hong Kong	Oil	600KVA 11/0.412KV Silicone	1	China Electric Equipment Group Hong Kong Co., Ltd	2011
111	Hong Kong	Oil	550KVA 380/420V	1	China Electric Equipment Group Hong Kong Co., Ltd	2011
112	Hong Kong	Oil	SFZ-25000KVA-66/11KV	1	China Electric Equipment Group Hong Kong Co., Ltd	2011
113	Nigeria	Oil	S11-1250/11	1	Beijing HANSOM Trading Co., Ltd	2011
		Oil	S11-2500/33	1		
114	Italy	Oil	S9-2500/10	9	Danieli&C.Officine Meccaniche S.p.A	2011
		Oil	S9-3500/10	11		
115	Algeria	Oil	S10-800/5.5	1	GROUPEMENT SONATRACH-SINOPEC	2011
		Oil	S10-900/5.5	1		
		Oil	S10-10000/30	2		
		Oil	S10-13000/66	2		
		Oil	S10-400/30	1		
		Oil	S10-50/30	1		
116	Venezuela	Dry	SCB-160KVA	2	China CAMC Engineering Co., Ltd	2012
		Dry	SCB-250KVA	1		
		Dry	SCB-1600KVA	1		
		Dry	SCB-1250KVA	1		
		Dry	SCB-1250KVA	1		
		Substation	Substation 400KVA	1		
		Substation	Substation 800KVA	1		
117	Columbia	Dry	1000KVA 13.8/0.48KV, Dyn5	2	China Electric Equipment Group (HK) Ltd	2012
		Dry	2000KVA 13.8/0.48KV, Dyn5	2		
		Dry	2500KVA 13.8/0.48KV, Dyn5	4		

		Dry	2500KVA13.8/0.69KV, Dyn5	2		
		Oil	100000/12500KVA 34.5/13.8KV, Dyn 5	2		
118	Russia	Substation	Complete transformer substation 35/6 kV	2	China Electric Equipment Group (HK) Ltd	2012
119	Tanzania	Dry	SCB10-3150/10/0.45	1	The ABB Group	2012
120	Australia	Dry	SG10-2000-25 13.2/0.6kv	1	Rio Tinto Group	2012
		Dry	SG10-5000-25/4.16KV	5		
		Dry	SG10-3000-25/4.16KV	13		
		Dry	SG10-3000-25/0.6KV	20		
		Dry	SG10-3000-13.2/0.6KV	4		
		Dry	SG10-5000-25/13.2KV	2		
		Dry	SG10-2000-25/0.6kv	7		
121	Equatorial Guinea	Oil	S11-M-400/20/0.4	1	CCCC First Harbor Engineering Company Ltd	2012
		Oil	S11-M-1250/20/0.4	2		
		Oil	S11-M-800/20/0.4	2		
122	Indonesia	Oil	S11-1600kva/10kv	1	SINOMA International Engineering Co., Ltd	2012
123	Hongkong	Dry	CSD-2000/0.69	2	The ABB Group	2012
		Dry	CSD-225/0.48	2	The ABB Group	
		Dry	CSD-125/0.48	1	The ABB Group	
124	Canada	Dry	SGB10-3000/25	6	The ABB Group	2012
125	Hongkong	Dry	CSD-2000/0.69	2	The ABB Group	2013
		Dry	CSD-1200/0.69	2	The ABB Group	
		Dry	CSD-500/0.69	2	The ABB Group	
		Dry	CSD-450/0.44	2	The ABB Group	
		Dry	CSD-150/0.44	1	The ABB Group	
		Dry	CSD-80/0.69	2	The ABB Group	
		Dry	CSD-30/0.44	4	The ABB Group	
126	Hongkong	Dry	CLSD-100/0.44	16	The ABB Group	2013
		Dry	CLSD-75/0.44	8	The ABB Group	
		Dry	CLSD-270/0.44	8	The ABB Group	
127	Azerbaijan	Oil	S11-M-1250/10	3	China non-ferrous Construction	2013
		Oil	S11-M-1600/10	1		

		Oil	ZS11-900/10	1		
		Oil	ZSS11-M-1800/10	2		
		Oil	ZSS11-M-6200/10	1		
		Dry	SCB11-1250/10	4		
		Dry	SCB11-1600/10	2		
		Dry	ZSCB10-1800/10	1		
128	Yemen	Oil	33/0.4KV,400kVA	5	Yemen Utilities	2013
129	Indonesia	Oil	S11-M-630/10/0.4 Dyn11±2x2.5%4.5%	2	Tianjin Cement Industry Design & Research Institute	2013
		Oil	S11-M-1250/10/0.4 Dyn11±2x2.5%4.5%	2		
		Oil	S11-M-1600/10/0.4 Dyn11±2x2.5%4.5%	2		
		Switchgear	FN3-10/400 On-load Switch	6		
130	Russia	Substation	Complete transformer Substation 4000kva/35/6	2	Russia Petroleum	2013
131	Iran	Oil	S11-1600/6KV	2	Sinoma	2013
132	Congo	Oil	S11-M-1250/10	1	Sinoma-Heidelberg Congo	2013
133	Indonesia	Oil	S11-M-1000/10	2	Sinoma	2013
		Oil	S11-M-1250/10	2		
		Switchgear	On- load switch	2		
134	Indonesia	Substation	YB-2500/6.6/0.4 Substation	1	Heidelberg	2013
135	Malaysia	Dry	SCB10-1250/6.6/0.433	6	Sinoma	2013
136	Hongkong	Dry	CSD-2000/0.69/0.44	4	ABB	2013
		Dry	CSD-1500/0.69/0.44	4		
		Dry	CSD-500/0.69/0.44	4		
		Dry	CSD-450/0.69/0.44	4		
		Dry	CSD-150/0.44/0.23	4		
		Dry	CSD-112.5/0.44/0.23	2		
		Dry	CSD-100/0.44/0.23	4		

		Dry	CSD-30/0.44/0.23	8		
137	Venezuela	Dry	ZSS-6200/13.8/0.75/0.75	1	China Nonferrous Metals Processing Technology	2013
		Dry	ZSS-1800/13.8/0.66/0.66	1		
		Dry	ZSCB10-1800/13.8/2x0.66	1		
		Dry	ZSCB10-900/13.8/0.66	1		
		Dry	SCB10-1600/13.8/0.48	1		
138	Azerbaijan	Oil	SZ9-16000/110	1	DEL.AL ALUMINIUM LLS	2013
139	Burkina Faso	Oil	S11-M-1600/10	2	Sinoma-Heidelberg	2013
		Oil	S11-M-630/10	1		
		Oil	SFZ11-8000/33	1		
140	Ghana	Oil	S11-M-2000/10	1	Tianjin Cement Industry Design & Research Institute-Heidelberg	2013
141	Russia	Substation	YB-2x6300KVA/35/6	1	Russia Petroleum	2013
142	Nigeria	Oil	ZTS-700/11	2	Nanjing Shengze Science and Technology	2013
		Oil	ZTS-1300/11	5		
		Oil	ZTS-2500/11	2		
143	Zambia	Oil	ZTS-700/11	2		
		Oil	ZTS-1300/11	2		
144	Cameroun	Oil	ZTS-2500/11	2		
		Oil	ZTS-700/11	1		
145	Saudi Arabia	Oil	ZTS-1300/11	3	Nanjing Shengze Science and Technology	2013
		Oil	ZTS-2500/11	1		
146	Russia	Dry	SCB-1000,Dyn11,6.0±2x2.5/0.4	2	Tian Lang Xing Power Station Equipment CO,LTD	2014
		Dry	SCB-200,Dyn11,6.0±2x2.5/0.4	5		
		Dry	SCB-2500,Dyn11,6.0±2x2.5/0.4	2		
		Dry	SCB-800,Dyn11,6.0±2x2.5/0.4	3		
		Dry	SCB-630,Dyn11,6.0±2x2.5/0.4	4		
147	Hong Kong	Oil	11kV/0.38kV,2.5MVA Transformer+6/-2x2.5%	2	CHEVALIER(ENVIROMENT)LIMITED	2014
		Oil	11kV/0.38kV,2MVA Transformer+6/-2x2.5%	2		

		Oil	11kV/0.38kV, 1.5MVA Transformer+6/-2x2.5%	6		
		Oil	11kV/0.38kV, 1.5MVA Transformer+6/-2x2.5%	2		
148	Burkina Faso	Oil	S11-8000KVA/33/10KVA	1	Heidelberg	2014
149	Canada	Dry	SG10-3000-25/13.2/0.6kV	1	KMP	2014
150	Sweden	Oil	Transformer 500KVA 0.4/0.48KV	1	ABB	2014
		Dry	CSD-1000KVA/0.69/0.44KV	2		
		Dry	CSD-400KVA/0.69/0.44KV	2		
		Dry	CSD-2000KVA/0.69/0.482K V	2		
		Dry	CSD-225KVA/0.69/0.44KV	2		
		Dry	CSD-125KVA/0.69/0.44KV	1		
		Dry	CSD-99KVA/0.69/0.44KV	2		
		Dry	CSD-22.5KVA/0.69/0.44KV	1		
		Dry	CSD-10KVA/0.69/0.44KV	1		
151	Sweden	Dry	CSD=2500KVA/0.44/0.22KV	4	ABB	2014
		Dry	CSD-160KVA/0.44/0.22KV	2		
		Dry	CSD-100KVA/0.44/0.22KV	2		
		Dry	CSD-120KVA/0.44/0.22KV	1		
		Dry	CSD-80KVA/0.44/0.22KV	1		
152	Albania	Oil	220/115/37.6KV, 120MVA Autotransformer	1	EnBi Power Sh.p.k	2014
153	Ghana	Dry	SCB10-11/0.44KV-1000KV A	1	Jiang Xi International CO.,LTD	2014
		Dry	SCB-11/0.44KV-800KVA	1		
154	Peru	Dry	KBSGZY2-T-50KVA/4.16/0 .46KV	1	Genera,LLC.	2014
155	Philippine	Oil	S11-2000KVA/4.16KV	1	Libo International Mechanical & Electrical Engineering Co.,LTD	2014
156	Philippine	Oil	S11-1000KVA/4.16KV	1	Libo International Mechanical & Electrical Engineering Co.,LTD	2014

157	Philippine	Oil	S11-3500KVA/33KV	1	LAFARGE	2014
		Oil	S11-M-400/10	1		
158	Philippine	Oil	ZTS-850KVA/2.3	1	LAFARGE	2014
159	Philippine	Oil	S11-M--750KVA	1	LAFARGE	2014
160	Philippine	Oil	S11-1000/10	1	SINOMA	2014
161	Indonesia	Oil	S11-2000/11KV	1	Heidelberg	2014
		Oil	S11-1600/11KV	1		
		Oil	S11-1250KV/11KV	1		
		Oil	S11-1000KVA/11KV	1		
162	Kazakhstan	Oil	S11-2000/11KV	1	SINOMA	2014
		Oil	S11-1600/11KV	2		
		Oil	S11-1250/11KV	3		
		Oil	S11-1000/11KV	1		
		Oil	S11-800/11KV	2		
163	Malaysia	Oil	S11-1250KVA/6.6KV	1	SINOMA	2014
164	Malaysia	Oil	ZSS-1000KVA/6.6KV	1	SINOMA	2014
165	Kazakhstan	Oil	S11-2500/6	1	Kazakhmys Aktogay LLC-Branch office of Kazakhmys Projects B.V.	2014
166	Congo	Oil	ZTS-1300	2	Nanjing Shengze Science and Technology Co.Ltd.,.	2014
		Oil	ZTS-600	2		
167	Mozambique	Oil	ZTS-1500	1	Nanjing Shengze Science and Technology Co.Ltd.,.	2014
166	Malaysia	Oil	ZSS-1000/6.6	1	SINOMA	2014
167	Hong Kong	Dry	CSD-50/0.69/0.69	4	ABB (Hong Kong) Limited	2015
169	Saudi Arabia	Oil	S11-1600KVA/13.8KV/0.46 KV	1	Nanjing Shengze Science and Technology Co.Ltd.,.	2015
		Oil	ZTS-1300KVA/13.5KV/2*7 20V	1		
170	Saudi Arabia	Oil	ZTS-1600/11/2×2.2Dy11d0 ±3×2.5%6%	1	Nanjing Shengze Science and Technology Co.Ltd.,.	2015
		Oil	ZTS-2500/11/2×2.2Dy11d0 ±3×2.5%6%	2		
171	Saudi Arabia	Oil	ZTS-1600KVA/13.8KV/2*7 20V	1	Beijing Datuo technology development Co.Ltd.,.	2015
172	Hong Kong	Dry	CSD-1000KVA	2	Shanghai ABB engineering Co.Ltd.,.	2015
		Dry	CSD-80KVA	2		

		Dry	CSD-250KVA	2		
		Dry	CSD-100KVA	1		
173	Malaysia	Oil	S11-2000kVA/6.6kV	3	SINOMA	2015
		Oil	S11-1500kVA/6.6kV	9		
		Oil	S11-1000kVA/6.6kV	1		
		Oil	S11-800kVA/6.6kV	1		
		Oil	S11-630kVA/6.6kV	1		
174	UAE	Oil	S11-M-1250/10	1	Sinoma energy conservation Co., LTD	2015
175	Taiwan	Dry	SCH15-30/10 (245kg)	8	MAXWELL Electric Co.,Ltd	2015
		Dry	SCH15-30/10 (215kg)	8		
		Dry	SCH15-30/10 (644kg)	10		
176	Malaysia	Oil	S11-M-1000/10	1	LAFARGE ILIGAN, INC.	2015
177	Taiwan	Dry	SC(R)BH15-2000/10	1	Frank & Associates Plastic Co.,Tld	2015
178	Hong Kong	Dry	CSD-800	2	ABB (Hong Kong) Limited-N697	2015
		Dry	CSD-400	4		
		Dry	CSD-300	1		
179	Norway	Oil	SZ11-10500/70	1	SCANCEM INTERNATIONAL DA	2015
180	Albania	Oil	115/37/10.5KV, 31.5MVA	1	NDREKAJ Sh.p.k	2016
181	Hong Kong	Oil	CS(W/F)D-4000/6.6/0.45	2	ABB (Hong Kong) Limited	2016
182	Nicaragua	Oil	S11-1600	1	Schneider Electric (China) Co.,Ltd.	2016
		Oil	S11-630	1		
183	Indonesia	Oil	S11-M-2000/10	1	/	2016
184	Malaysia	Oil	S11-M-2000/10	1	/	2016
185	Albania	Oil	110/37.5/10.5KV, 15MVA	1	EnBi Power Sh.p.k.	2016
		Oil	110/20.8KV, 40/50MVA	1		
186	Togo	Parts	BWY802	1	SCANCEM	2016
		Parts	BWY804	1		2016
		Parts	AVR	1		2016
187	Philippine	Dry	SCB10-1000/4.16/0.44	1	Holcim Philippines, Inc	2016
		Dry	SCB10-2000/4.16/0.44	1		
188	Irap	Oil	S11-1000/6	1	/	2016
189	Saudi Arabia	Dry	SGBH15-800/13.8/0.4	4	/	2016
190	Malaysia	Dry	SCB10-1000/11/0.433	4	EWT Transformer Sdn Bhd	2016

191	Philippine	Dry	SCB10-1250/11/0.48	2	/	2016
		Dry	SCB10-2500/11/0.48	2	/	
192	Burma	Dry	SCB10-2000/10/0.4	4	/	2016
		Dry	SCB10-1600/10/0.4	1		
		Dry	SCB10-1250/10/0.4	1		
		Dry	ZSCB10-1400/10/0.6	1		
		Dry	SCB10-1000/10/0.4	1		
193	Vietnam	Oil	S11-1250/22	1	/	2016
194	Philippine	Dry	ZSCB10-1800/4.16/0.72*2	1	New Sporot Enterprises (H.K) Company Limited	2016
195	Philippine	Dry	ZSCB10-650/4.16/0.72	2	/	2016
196	Russia	Oil	S11-M-1500/6.3	1	/	2016
		Oil	S11-M-2000/6.3	1	/	2016
197	Philippine	Dry	SCB10-1600/11/0.48	2	/	2017
		Dry	SCB10-2500/11/0.48	2	/	2017
198	America	Dry	SGB10-1000/13.8/0.48	1	Australasian Power Equipment Pty Ltd	2017
199	Burma	Dry	SCB10-630/10/0.4	1	/	2017
		Dry	SCB10-800/10/0.4	1		2017
200	Namibia	Oil	SZ11-8000/66	1	/	2017
		Oil	SZ11-16000/66	1		2017
201	Hong kong	Dry	CSD-50/6.6/0.45	2	ABB (Hong Kong) Limited	2017
202	Tanzania	Oil	S11-2500kVA/3.3kV	1	/	2017
203	Namibia	Oil	SZ11-10000/66	1	/	2017
204	Namibia	Oil	S11-M-630/10	1	(WHALE ROCK CEMENT (PROPRIETARY) LTD.	2017
		Oil	S11-M-1250/10	1		2017
205	Albania	Oil	220/115/37.6KV, 120MVA	1	EnBi Power Sh.p.k.	2017
206	Lucky	Oil	S11-800/6	1	PT LUCKY AL-SHUMOOKH HOLDING LIMITED	2017
207	Kyrgyzstan	Substation	YB-1250	1		2017
208	Hong Kong	Dry	SCB10-1500/11/0.38	2	SE Electric (HK) Limited	2017
209	Hong Kong	Dry	CSD-50	1	CSUN-SOLAR INTERNATIONAL	2017
		Dry	CSD-30	1		2017

		Dry	CSD-25	2	LIMITED-N596	2017
		Dry	CSD-10	1		2017
210	UAE	Oil	S11-M-1600/6.3	1	/	2017
211	Brunei	Oil	SZ11-5500/11	1	BUTRA HEIDELBERGCEMENT SDN BHD	2017
212	Hong kong	Dry	CSD-50	1	CSUN-SOLAR INTERNATIONAL LIMITED-N706	2017
		Dry	CSD-30	1		2017
		Dry	CSD-25	2		2017
		Dry	CSD-10	1		2017
213	Lucky	Oil	S11-2000/6.6	1	/	2017
214	Namibia	Oil	S11-2000/33/0.55	3	Swakop Uranium (Pty) Ltd	2017
		Oil	S11-2000/33/6.6	2		2017
		Oil	S11-5000/33/6.6	1		2017
215	Pakistan	Dry	ZGS11-Z.G-11/0.48-1250	10	Adhikot District Khushab Pakistan 12M Grid connected photovoltaic power generation project	2017
216	Pakistan	Switchgear	Low voltage cabinet	1	Adhikot District Khushab Pakistan 13M Grid connected photovoltaic power generation project	2017
217	Philippine	Dry	SCB10-1500/3.3	1	Holcim Philippines, Inc.	2017
218	Cameroon	Dry	DKSC-125/6	1	CIMENCAM Cameroon	2017
219	Uganda	Dry	DKSC-250/11	1	Uganda grinding station project	2017
220	Cote d'Ivoire	Oil	SZ11-5000/33	2	Total drop transformer for Cote d'Ivoire grinding station	2017
221	Cote d'Ivoire	Oil	S11-1000/10	2	Total drop transformer for Cote d'Ivoire grinding station	2017
		Oil	S11-1600/10	1	Total drop transformer for Cote d'Ivoire grinding station	2017
222	Philippine	Dry	SC10-250kva/4.16/0.44kv	1	Holcim Philippines, Inc.	2017
		Dry	SC10-50/0.44/0.22	6		2017

		Dry	DC10-50/0.44/0.22	5		2017
223	Namibia	Oil	SZ11-16000/66	1	/	2018
224	Papua New Guinea	Oil	S11-1000/11	1	APEQ	2018
		Oil	S11-500/11	1		
225	Namibia	Oil	S11-1000/10	1	/	2018
		Oil	S11-1250/10	1		
		Oil	S11-1600/10	1		
226	Iraq	Oil	S11-100/33/0.415	10	/	2018
227	Australia	Oil	S11-1500/11	1	APEQ	2018
228	Namibia	Oil	S11-2000/33	2	SWAKOP	2018
229	Vietnam	Oil	S11-M-1000/6.3	1	VCM WHG PROJRECT	2018
230	Vietnam	Oil	S11-M-800/6.3	2	SG WHG PROJRECT	2018
231	Indonesia	Oil	S11-500/6.3	1	Sinoma,Tianjin Cement Industry Design and Research Institute Co.,Ltd.	2018
232	Nigeria	Oil	ZTS-600	3	Nanjing Shengze Science and Technology Co.Ltd.,.	2018
		Oil	ZTS-700	1		
		Oil	ZTS-1300	1		
		Oil	ZTS-2500	1		
233	Papua New Guinea	Switchgear	8DJH -RRLL 12KV	2	OK TEDI MINING (APEQ)	2018
234		Switchgear	8DJH -RRLL 24KV	2		
235		Switchgear	8DJH -RRLL 24KV+DC	2		
236	Bangladesh	Oil	SZ11-9500KVA/33KV	1	CNBM	2018
237	Bangladesh	Oil	S11-M-1000/6.3	1	China Heavy Machinery Co., Ltd	2018
238	Philippines	Substation	YB-1500/13.8	1	/	2018
239	Burkina Faso	Oil	S11-M-1600-10/0.4KV	1	CIMBURKINA S.A	2018
240	Mexico	Dry	SCB10-500-13.2/0.4	2	Ruian New Energy	2018
		Switchgear	GGD	2		
241	Papua New Guinea	Parts	HV isolators	13	OK TEDI MINING (APEQ)	2018
242	Philippines	Dry	SCB10-250/0.44/0.22	1	Holcim Philippines, Inc.	2018
		Dry	SC10-50/0.44/0.22	2		
		Dry	DC10-50/0.44/0.22	1		

243	Zambia	Oil	ZTS-1300/11	1	Nanjing Shengze Science and Technology Co.Ltd,.	2019
244	Pakistan	Oil	S11-630/6	1	Sinoma,Tianjin Cement Industry Design and Research Institute Co.,Ltd.	2019
		Oil	S11-800/6	1		
		Oil	S11-1250/6	1		
		Oil	S11-1600/6	4		
245	Bangladesh	Oil	S11-M-800/11/0.4KV	1	China Heavy Machinery Co., Ltd	2019
		Oil	S11-M-1250/11/0.4KV	1		
		Oil	S11-M-1600/11/0.4KV	1		
		Oil	S11-M-1600/11/0.4KV	2		
		Oil	S11-M-2000/11/0.4KV	1		
246	Albania	Oil	20.8/0.4KV, 250KVA	2	EnBi Power Sh.p.k.	2019
		Oil	110/20.8KV, 40/50MVA	2		
247	Swiss	Dry	SC-80KVA-0.315/0.4	1	MATTDAMON	2019
248	Canada	Dry	SG-24.94/13.2/0.6KV 1MVA	2	Rio Tinto Alcan	2019
249	Chile	Dry	SCB10-500KVA-4.16/0.4 (Outdoor Type)	1	Albemarle Corporation	2019
250	Saudi Arabia	Oil	S11-1250kVA-13.8/0.5kV	1	CNBM KIVAY International Engineering Co., Ltd	2019
251	Hong Kong	Dry	SCB10-1500/11/0.38	2	ATAL	2019
252	Libya	Oil	S11-M-2000/6.6	1	Sinoma,Tianjin Cement Industry Design and Research Institute Co.,Ltd.	2019
253	Tajikistan	Oil	SFZ11-16000/110	2	Yanbian Group Co., Ltd.	2019
		Oil	S13-M-100/10.5	1		
		Oil	S13-M-50/35	1		
		Oil	S13-M-100/6	1		
254	Mozambique	Dry	SGB10-2000/22/0.433 Substation	1	APEQ	2019
255	Indonesia	Oil	ZTS-1200	1	Nanjing Shengze Science and Technology	2019
		Oil	ZTS-600	1		
		Oil	ZTS-800	2		
		Oil	ZTS-900	1		

		Oil	ZTS-2000	1		
256	Philippines	Oil	SFZ-12000/69	1	CRH	2019
257	Philippines	Oil	S11-300/3.3/0.22	1	CRH	2019
258	Trinidad & Tobago	Dry	SCB10-1500/3.3/0.48	2	CEMEX	2019
259	Mexico	Switchgear	Electrical Power Outlets	47	CEMEX	2019
260	Canada	Dry	SGB-3000/25-13.2/0.6	1	Rio Tinto Alcan Inc	2019
261	Dubai	Oil	S11-M-1600/11/0.4KV	2	China Heavy Machinery Co., Ltd	2019
262	Bangladesh	Oil	S11-1250	1	China Heavy Machinery Co., Ltd	2019
263	UAE	Oil	SFZ11-25000/33	1	Sinoma Energy Conservation Limited	2019
		Oil	S11-M-2000/6.6	2		
264	Papua New Guinea	Switchgear	8DJH -DC+RLL 12KV -013	1	OK TEDI MINING (APEQ)	2019
265	Brunei	Parts	SZ11-5500/11 Transformer Fans	2	BUTRA HEIDELBERGCEMENT SDN BHD	2019
266	Togo	Oil	4MVA 20KV/10.5KV	1	CIMTOGO S.A.	2019
267	Malaysia	Dry	SCB10-3150-33/0.415	2	Intco Malaysia Sdn.Bhd	2019
268	India	Dry	ZPSG-488/6.6	2	ABB India Limited	2019
269	India	Dry	ZPSGL-888/11	2	ABB India Limited	2019
270	India	Dry	ZPSG-563/11	3	ABB India Limited	2019
271	India	Dry	ZPSGL-625/6.6	1	ABB India Limited	2019
272	Papua New Guinea	Switchgear	8DJH -DC+RLL 12KV -014	1	OK TEDI MINING (APEQ)	2019
273	Philippines	Dry	SCB10-2000/13.8	1	CH Asia World of Electric Inc	2019
274	Brunei	Oil	S11-1000-6/0.4KV	2	BUTRA HEIDELBERGCEMENT SDN BHD	2019
		Oil	S11-500-6/0.4KV	1		
275	Pakistan	Dry	SCB11-2500/11/0.42KV	2	China BOQI	2019
276	Bolivia	Dry	SCB11-2000/6KV	2	CMEC	2019
		Dry	SCB11-10000/24.9/6	1		
		Dry	SCB11-2500/6	3		

277	England Ireland Finland Turkey Columbia Greece	Dry	SGB10-335/6.6/0.4KV (Batch Basis)	16	Rainbow-Cargotec Industries Co.,Ltd	2019
278	Philippines	Oil	S11-1000KVA, 4160/440V	1	REPUBLIC CEMENT MINDANAO, INC	2019
279	Tanzania	Parts	SPARES FOR LV TRANSFORMERS PL4	4	Tanzania Portland Cement Public Limited Company	2019
280	Hong Kong	Dry	SCB10-1500/11/0.38	1	ATAL	2020
281	Uzbekistan	Oil	S11-1250KVA/6±2×2.5%/0. 4kV,DYn11	1	CNBM KIVAY International Engineering Co., Ltd	2020
282	Liberia	Oil	S11-1600/6.3/0.4KV	1	CNBM KIVAY International Engineering Co., Ltd	2020
283	Brunei	Service	6KV 500KVA&1000KVA Transformer Service	1	BUTRA HEIDELBERGCEMENT SDN BHD	2020
284	Philippines	Oil	S11-400KVA/6.6KV	2	CEMEX	2020
		Dry	SC10-150/0.44	1		
		Oil	S11-500KVA/6.3KV	1		
285	Brunei	Service	SZ11-5500/11 Transformer Refurbishment	1	BUTRA HEIDELBERGCEMENT SDN BHD	2020
286	Papua New Guinea	Parts	RMU Remote Control Upgrade Kits	4	OK TEDI MINING (APEQ)	2020
287	Philippines	Dry	SCB10-1500-PH	2	CH Asia World of Electric Inc	2020
288	Singapore	Dry	CSD-100,CSD-200	4	ABB PTE. LTD.	2020
289	Hong Kong	Dry	CS(WF)D-1500/0.69/0.44	4	Sunergy (Hong Kong) Trading Co.,Limited	2020
290	Tajikistan	Oil	KS11-400,10kV/0.4kV,10±5 %,Dyn11	2	Closed Joint Stock Company"TALCO GOLD"	2020
		Oil	KS11-500,10kV/0.4kV,10±5 %,Dyn11	1		

		Oil	KS11-250,10kV/0.4kV,10±5%,Dyn11	1		
		Oil	KS11-160,10kV/1kV,10±5%,Dyn11	2		
		Oil	KS11-315,10kV/0.4kV,10±5%,Dyn11	4		
		Oil	Lighting Transformer 5kVA 380V/220V	4		
		Dry	SG1-5/1.0F 5kVA 380/220V	4		
		Oil	S11-630KVA(10/0.4KV)	7		
		Oil	S11-160KVA(10/0.4KV)	3		
		Dry	SCB11-500,10kV/0.4kV,10±2x2.5%,D.n11	1		
		Dry	SCB11-2000,10kV/0.4kV,10±2x2.5%,Dyn11	2		
		Dry	SCB11-1250,10kV/0.69kV,10±2x2.5%,Dyn11	1		
		Dry	SCB11-1250,10kV/0.4kV,10±2x2.5%,Dyn11	1		
		Oil	S11M-125/10,10/0.4kV,10±2x2.5%,Dyn11	1		
		Oil	S11M-315/10,10/0.4kV,10±2x2.5%,Dyn11	1		
		Dry	SC11-315,10kV/0.4kV,10±2x2.5%,Dyn11	1		
		Dry	SC11-400,10kV/0.4kV,10±2x2.5%,Dyn11	1		
291	Philippines	Oil	S11-630KVA/6.6kV	1	CEMEX	2020
292	Philippines	Dry	SZGB10-550KVA/13.8KV (K=20)	1	CEMEX	2020
293	Indonesia	Oil	SFZ11-40000/22	2	SOMA CFSP 2 x 31MW (RUHN POWER)	2020
		Oil	SF11-9000/10.5	2		
		Dry	SCB13-800/10/0.4	1		
		Dry	SCB10-800/6.3/0.4	1		
		Dry	SCB10-1000/6.3/0.4	5		
294	Philippines	Oil	S11-2000KVA/6.6kV	1	CEMEX	2020

295	New Zealand	Switchgear	8DJH-PT+LL+LLL & LLL+LL+PT (12KV RMUs)	1	OCEANA GOLD	2020
296	Honduras	Oil	SFZ11-31500/138 31.5MVA 138±8X1.25%/6.6kV	1	EMCO 1*25MW (NOVA)	2020
		Dry	SCB11-1250/6.6	3		
297	New Zealand	Switchgear	8DJH-PT+LL+LLL (Grey Street RMU)	1	OCEANA GOLD(APEQ)	2020
298	Philippines	Oil	S11-1000KVA, 4160V	2	REPUBLIC CEMENT MINDANAO, INC	2020
		Oil	S11-2000KVA, 4160V	1		

299	New Zealand	Critical Spares	Zero Sequence Current Transformer 50/1 2.5VA	1	OCEANA GOLD (APEQ)	2020
			Phase Current Transformer 800/1 0.5/5P20 10/10VA	3		
			Phase Current Transformer 200/1 0.5/5P20 10/10VA	3		
			Voltage Transformer 11kV/110V	1		
			Three Position Switch Motor Actuator for Remote Switching	1		
			Shunt Trip Coil	1		
			Undervoltage Release Coil	2		
230	Congo	Oil	S11-7000/10/3.3	1	CNMC International Trading Co.,Ltd	2020
231	Namibia	Oil	SFZ11-16000/33KV	1	SWAKOP Uranium(Pty)Ltd	2020
		Dry	SCB11-2000/6.6KV	1		
232	Middle East	Oil	SFZ11-125000/230	3	JP	2020
233	Laos	Dry	SCZB-1250/11/0.4	3	China Heavy Machinery	2020

			SCZB-1250/22/0.4	1	Co., Ltd	
			SCB-400/22/0.4	1		
			SCZB-400/22/0.4	2		
234	UAE	Spares	Silicone Gel	1	Sinoma Energy Conservation Limited	2020
235	Japan	Dry	SCB10-650/6.6/0.38	1	NEXTES (NR Electric Power Electronics Co.,Ltd)	2020
			SC10-20/0.38/0.2	1		
			DC10-20/0.38/0.2-0.1	1		
236	Philippines	Spares	Transformer Spare Parts	20	Phil Gold Processing & Refining Corp	2020
237	Philippines	Oil	S11-500/0.525	1	REPUBLIC CEMENT MINDANAO, INC	2020
238	Vietnam	Oil	ZTS-1600/6	1	CAPITAL INVESTMENT COMMERCE AND SERVICES JOINT STOCK COMPANY	2021
239	Philippines	Oil	S11-2000	1	REPUBLIC CEMENT ILIGAN, INC	2021
240	UAE	Spares	HV bushing	1	Sinoma Energy Conservation Limited	2021
			LV bushing	1		
			OLTC	1		
			Gaskets for 2000KVA Txf	1		
			Gaskets for 2500KVA Txf	1		
241	Republic of Mali	Oil	S11-50KVA-33KV	1	Selingue (SAC)	2021
		Dry	SCB10-250KVA-33KV	1		
		Switchgear	Outdoor Vacuum Circuit Breaker ZW32-40.5/630A	1		
242	Germany	Dry	SG(L)B-2000/6/0.69	1	CEMEX	2021
		Dry	SG(L)B-1600/6/0.69*2	1		

243	Middle Africa	Dry	SCB11-2500kVA/15kV	2	CEEC (NR Electric Power Electronics Co.,Ltd)	2021
244	Middle East	Oil	SFZ11-20/22MVA-33KV	4	JP	2021
245	Uzbekistan	Dry Mine Type	KBSG ZY2-T-1000/6/1.2/0.693	2	ENERGOMAX LLX	2021
246	Philippines	Dry	SCB10-2000/34.5	2	CH Asia World of Electric Inc	2021
247	Republic of Mali	Dry	SCB11-250/15	1	Markala (SAC)	2021
			SCB11-250/15	1	Bougouni(SAC)	
248	Papua New Guinea	Switchgear	Remote Control Panel	1	OK TEDI MINING (APEQ)	2021
249	Cameroon	Oil	ZTS11-700	1	DANGOTE CEMENT CAMEROON S.A	2021
			S11-2500	1		
250	Federal Republic of Nigeria	Dry	SCB10-1600/11/0.415	4	ZUNGERU Hydro (CNEEC)	2021
			SCB10-800/11/0.415	2		
			SC10-250/11/0.415	2		
			SC10-315/11/0.415	4		
			SCB10-100/11/0.415	2		
251	Thailand	Dry	SCB11-2000/10.5/0.4	4	Bangkok Waste to Energy Project (New Sky)	2021
			SCB11-1250/10.5/0.4	2		
			SCB11-1250/24/0.4	2		
			Reactor	2		
252	Thailand	Dry	SCB11-2000/10.5/0.4	4	Bangkok Andrew Waste to Energy Project (New Sky)	2021
			SCB11-1000/10.5/0.4	2		

			SCB11-1250/24/0.4	1		
253	Canada	Dry	SGB10-1000/24.94-13.2/0.6	2	Anderson Creek Sub X (Rio Tinto Alcan Inc)	2021
254	Singapore	Oil	S11-12000/22	2	ABB PTE. LTD.	2021
		Dry	CSD-700/11/0.4	2		
		Dry	CSD-700/0.435	2		
		Dry	CSD-700/11/0.525	2		
		Dry	SG-200/11/0.4	2		
255	Republic of Guinea	Kiosk	ZGS-1500/0.4/10	5	Kindia Tunnel (China Railway 18th Bureau Group Co.,Ltd)	2021
		Kiosk	ZGS-1250/10/0.4	5		
		Kiosk	ZGS-160/10/0.4	13		
		Switchgear	XGW-12/CCC	13		
256	Tajikistan	Dry	ZSGB10-800/10	1	Parut gold mine (China Nonferrous Metal Mining (Group) Co., Ltd.)	2021
257	Myanmar	Dry	SCB10-1600/10	1	Mount Dagong (China Nonferrous Metal Mining (Group) Co., Ltd.)	2021
258	Vietnam	Oil	S11-1000/10	2	Hefei Rongju Iron (WISDRI-MCC)	2021
		Oil	S11-1600/10	2		
259	Vietnam	Dry	SCB10-800/11	1	VINASPARE COMPANY Limited	2021
260	Uzbekistan	Oil	S11-M-1600/10	1	QCC4 Clinker Line Project (Sino-Cemtech)	2021
		Oil	S11-M-2000/10	1		
		Oil	S11-M-2500/10	2		
261	Saudi Arab	Dry	SGB10-2000/13.8	1	AJCC	2021

					(Jiangsu Pengsheng Photovoltaic Technology Co., Ltd)	
262	Malaysia	Dry	SCB10-100/11	1	Seagate (Nanjing) Power Electronics Technology Co., Ltd	2021
			SCB10-300/33	1		
263	Kenya	Oil	S11-250/11/0.415	1	Berth 1-3, Port Lamu, Kenya COMPLANT (ZCTS Shenzhen Co.,Ltd)	2021
		Oil	SZ11-10000/33/11	1		
264	Zimbabwe	Ehouse	Ehouse	1	SINOMA	2021
265	Barbados	Oil	S11-1000/11	1	CEMEX	2021
266	Ethiopia	Oil	S11-200/15	1	Green River Banks (Jiangsu Nantong Sanjian Construction Group Co., Ltd.)	2021
267	Honduras	Dry	SCB11-1250/13.8	1	Caracol Knits S.A (NOVA)	2021
		Dry	SCB11-2500/13.8	1		
268	Outer Mongolia	Dry	ZSCB10-660	1	NGK (NR Electric Power Electronics Co.,Ltd)	2021
269	Iraq	Spare	Spare Parts	1	Schneider Electric (China) Co.,Ltd.	2021
270	Pakistan	Dry	SCB10-1250	1	F2021E003-WHR PROJECT FOR LUCKY CEMENT LTD. PEZU PLANT LINE (Sinoma Energy Conservation Limited)	2021
271	Iraq	Spare	Spare Parts	1	Nanjing Zhongji Import and export Co. LTD	2021
272	Philippines	Dry	SCB-2500/13.8	1	CH Asia World of Electric Inc	2021
273	Myanmar	Dry	ZSSCB10-630	1	Myanmar International Terminals Thilawa Limited	2021

274	Poland	Dry	ZSCB10-1100	2	Nanjing Shengze Technology Co., LTD	2021
			ZSCB10-2250	1		2021
275	Philippines	Dry	SCB10-1500/34.5	2	CH Asia World of Electric Inc	2021
276	Outer Mongolia	Dry	SCB11-500KVA	1	3MWh Lead carbon Energy Storage (Shuangdeng Group)	2021
277	Saudi Arab	Spare	Current Transformer	5	Sinoma Energy Conservation Limited	2021
278	Dominican Republic	Oil	SF11-40000/138	1	CEMEX	2021
279	Australia	Dry	SGB10-1333KVA/22KV Outdoor Type	1	MT Atlas MMU (APEQ)	2021
280	Bangladesh	Oil	S11-1250/6.3	1	HEIDELBERGCEMENT BANGLADESH LTD	2021
281	Ethiopian	Dry	SGB10-2000/15	2	Ethiopian Bank (Beijing New union International Engineering Technology Co., LTD)	2021
282	Pakistan	Oil	SZ11-25000/132	2	Hefei Cement Research&Design Institute Corporation Ltd	2021
			S13-1000/6.3	3		
			S13-1600/6.3	5		
			S13-2000/6.3	1		
			S13-M-1000/6.3	3		
			S13-M-1000/6.3	1		
			S13-M-1250/6.3	2		
			S13-M-1600/6.3	1		
			S13-M-2000/6.3	2		
			S13-M-2500/6.3	3		

			S13-1000/6.3	1		
			S13-2000/6.3	1		
283	Philippines	Dry	SCB10-2000/34.5	1	CH Asia World of Electric Inc	2021
284	Philippines	Dry	SCB10-2000/13.8	1	CH Asia World of Electric Inc	2021
285	Philippines	Spares	Breather Capsules	5	Phil Gold Processing & Refining Corp	2021
286	Pakistan	Oil	S13-1000	1	Tianjin Cement Industry Research&Design Institute Corporation Ltd	2021
287	Togo	Oil	S11-M-2000	1	SCANTOGO	2021
288	Singapore	Dry	CSD-12	1	NC-256 CDL Cable Laying Vessel(ABB PTE. LTD)	2021
			CSD-250	2		
			CSD-50	1		
			CSD-700	2		
			CSD-1750	1		
			CSD-630	1		
289	Cyprus	Dry	CSCBFD-4500	2	CPP CYPRUS FSRU PROJECT (ABB (Hongkong) Limited)	2021
			CSD-50	2		
			CSCBFD-25/6.6/0.46	2		
290	Philippines	Spares	OTI; Multi-Function Meter; WTI	4	Phil Gold Processing & Refining Corp	2021
291	Australia	Dry	SGB10-1333KVA/11KV Outdoor Type	1	MT Mindarie MMU (APEQ)	2022
292	Namibia	Dry	SCB11-2000/6.6	1	SWAKOP URANIUM (PTY) LTD	2022
293	Japan	Dry	SCB10-300	1	KitaKink 200kW (NR Electric Power	2022

					Electronics Co.,Ltd)	
294	Japan	Dry	SCB10-540	1	Anritsu (NR Electric Power Electronics Co.,Ltd)	2022
			SC-70	1		
295	Gabon	Oil	63/30KV 15MVA	1	COMILOG (Eramet)	2022
		Oil	2MVA 30/5.5KV	1	COMILOG (Hatch)	
		Oil	2MVA 30/0.4KV	9		
		Dry	200KVA 0.4KV	6		
		Dry	50KVA 0.4KV	5		
296	Iraq	Oil	DKS- 2000/33/0.4	1	Mass Iraq Company For Cement Industry	2022
297	Guatemala	Oil	S11-1500 13.8KV	1	CEMEX	2022
		Oil	S11-1500 13.8KV	1		
298	Philippines	Dry	SCB10-1500 13.8/0.4kV	1	CH Asia World of Electric Inc	2022
299	Canada	Dry	CSD-400	2	McRAE Marine Electrical & Electronics LTD.	2022
			CSD-160	2		
			CSD-45	4		
			CSD-45	1		
			CDGD-10	2		
300	Pakistan	Dry	ZSG10-1250/6.3	2	HUBEI AMERSON AUTOMATION SYSEM ENGINEERING CO.,LTD	2022
			ZPSG-700/6	1		
			ZPSG-550/6	1		
301	Ethiopia	Oil	S11-630/15	1	HUAWEI DATA CENTER (Beijing Deere United	2022

					Engineering Technology Co., LTD)	
302	Naura	Dry	SCB13-2750/11	2	Solar Power Development Project (HNAC)	2022
			SCB13-2500/11	1		
			SCB13-2000/11	2		
			SCB13-630/11	2		
303	Nigeria	Oil	ZSS-M-2000/11	1	HEFEI ChunYan	2022
			ZSS-M-2700/11	1		
			S13-M-1000/11	1		
			S13-M-1250/11	1		
			S13-M-1600/11	2		
			S13-M-2000/11	3		
			ZTS-M-550/11	1		
			ZTS-M-700/11	2		
304	India	Oil	SFZ11-25000/132	2	LANJIGARH 130MW (RUHN POWER)	2022
305	Australia	Dry	SGB10-750-11KV	2	Mindarie Mineral Sand Plant (APEQ)	2022
		Dry	SGB10-1500-11KV	3		
		SWG	Siemens 8DJH RMU 12KV+DC+RCP	4		
306	Gabon	Dry	SGB10-1250 5.5KV	1	COMILOG (Hatch)	2022
		Dry	SG10-30	1		
		Dry	DG10-30	1		
		SWG	NGR 300A 10S	1		

307	America	Oil	SSF11-2500 4.16/0.48/0.6kV	1	CEMEX	2022
308	Ethiopia	Dry	SCB13-1250	2	YHF	2022
		Dry	SCB13-1000	2		
309	Trinidad and Tobago	Dry	SCB10-1500 3.3	1	CEMEX	2022
310	Australia	Dry	SGB10-600/22	1	MT Atlas Pump Skid (APEQ)	2022
311	Mexico	Dry	ZSCB-1500 6+/-2*2.5%/0.44kV	1	CEMEX	2022
312	Papua New Guinea	Spares	Buchholz Relay	1	APEQ	2022
			Pressure Relief Valve	1		
313	Japan	Dry	SCB10-750	1	Ando-Hazama 600kW (NR Electric Power Electronics Co.,Ltd)	2022
		Dry	SCB10-110	1		
314	Malaysia	Oil	S13-630 6.6+/-2*2.5%/0.433kV	1	SINOMA Tianjin Control and Engineering Co.,Ltd	2022
315	Dominican Republic	Oil	S11-1000/4.16/0.5	2	HEFEI ChunYan	2022
			S11-1600/4.16/0.5	1		
			S11-2500/4.16/0.5	4		
			ZSS-1000/4.16/2×0.72	1		
			ZSS-1250/4.16/2×0.72	1		
			ZSS-510/4.16/2×0.72	1		
316	Philippines	Dry	SCB10-2000/34.5/0.23	1	ZHZQ ARCHITECT	2022
317	Philippines	Dry	SCB10-3000/34.5/0.38	1	ZHZQ ARCHITECT	2022
318	Philippines	Dry	SCB10-2000/13.8/0.46	1	CH Asia World of Electric Inc	2022

319	Tanzania	Oil	S11-4000/33/0.415	1	(Tanzania Ceramics factory) GUANGZHOU Sunda	2022
320	Senegal	Oil	S11-2500/11/0.4	1	(Senegal Ceramics factory) GUANGZHOU Sunda	2022
321	Philippines	Oil	S11-2000	1	(INFINITYSQUARE) CH Asia World of Electric Inc	2022
322	Gabon	Oil	S11-1250/5.5	2	COMPAGNIE MINIERE DE L'OGOUE (COMILOG)	2022
323	Japan	Dry	ZSC10-70	1	Omron Yachiyo 400KW (NR Electric Power Electronics Co.,Ltd)	2022
		Dry	ZSCB10-540	1		
324	Mexico	Oil	S11-1000/4.16	1	CEMEX	2022
325	Philippines	Oil	ZTS-2500	1	(REPUBLIC CEMENT BUILDING MATERIALS INC.) CRH	2022
326	Thailand	Dry	SCB11-200	2	China Energy Engineering Group Jiangsu Power Design Institute Co.,Ltd	2022
327	Saudi Arab	Oil	S11-2000	1	(SPCC2000kVA) Nanjing Zhongji Import&Export Co.,Ltd	2022
328	Japan	Dry	SCB10-285	1	Fuji 285KW BESS (NR Electric Power Electronics Co.,Ltd)	2022
			SCB10-60	1		
329	Bangladesh	Oil	S11-1600	1	China National Heavy Machinery Corporation	2022
			SZ11-15000/33/11	1		
330	America	Oil	S11-1400/4.16	2	CEMEX	2022
331	Malaysia	Oil	S11-2000	2	Sinoma Energy Conservation Limited	2022

332	Namibia	Dry	SCB11-3150	2	SWAKOP URANIUM(PTY) LTD	2022
333	Philippines	Spare	Spare Parts	1	Phil Gold Processing & Refining Corp	2022
334	Pakistan	Oil	SZ11-35000/132	1	LUCKY CEMENT LIMITED	2022
335	Philippines	Oil	S11-1500	1	REPUBLIC CEMENT BUILDING MATERIALS INC.	2022
336	Dominican Republic	Oil	SF-25000/34000/42000-138	4	Siba Energy Corporation	2022
			SF-39000/52000/65000-138	1		
337	Laos	Oil	S11-M-1000/22/0.4	1	SINO-KCL	2022
		Oil	S11-M-3150/22/10	1		
		Dry	SCB14-3150/10/0.4	1		
		POS	YBW-12/0.4-2000	3		
338	Zambia	Oil	S11-4000/33/0.4	1	GUANGZHOU Sunda	2022
339	America	Oil	S11-1000/4.16	1	CEMEX	2022
340	Philippines	Oil	S11-1500	1	REPUBLIC CEMENT BUILDING MATERIALS INC.	2022
341	Philippines	Oil	S11-8000	1	Phil Gold Processing & Refining Corp	2022
342	Philippines	Spares	Spare Parts	1	Phil Gold Processing & Refining Corp	2022
343	South Africa	Oil	ZTS-1300	1	Sephaku (Shanghai Ehkyu International Trading Co., Ltd.)	2022
344	Poland	Dry	ZPSGL-500/6/4 × 1.85Yd6-9%/Q/(16418)	4	ABB Sp. z o.o.	2022
345	India	Dry	ZPSG-7296/11/0.73 × 27Yd8-11%/G/(16420)	1	ABB india Limited	2022

346	Germany	Dry	CS(W/F)D-2100/0.69/0.45Dy11±5%6%/Q/(20160)	1	Wärtsilä Deutschland GmbH	2022
			CSCBFD-3200/0.71/0.46Dy11±2.5%6%/T/(20227)	2		
			CSCBFD-3200/0.71/0.46Dy11±2.5%6%/T/(20227)	2		
347	India	Dry	ZPSGT-625/6.6/0.73×18Yd8-10%/T/(16422)	1	ABB india Limited	2022
348	India	Dry	ZPSGL-938/6.6/0.73×18Yd8-10%/Q/(16432)	2	ABB india Limited	2022
349	Thailand	Oil	115/10KV 25/31.5MVA	1	HCE(Pinggao)	2023
		Oil	115/10KV 40/50MVA	2		
350	Republic of Chad	Dry	SC(B)11-3450kVA/15kV	3	CEEC (NR Electric Power Electronics Co.,Ltd)	2023
351	Philippines	Dry	SC10-150KVA	1	CEMEX	2023
352	Philippines	Oil	S11-2000/13.8/0.44KV	1	CEMEX	2023
353	America	Oil	S11-1150KVA/4.16KV	1	CEMEX	2023
354	Honduras	Spares	138KV Bushings	1	IE (NOVA)	2023
355	Myanmar	Dry	SCB10-1600	1	SINOMA	2023
356	Malaysia	Spares	Bushing	1	SINOMA	2023
357	India	Dry	ZPSGL-563/6.6/0.73×18Yd8-10%/Q/(16435)	8	ABB india Limited	2023
			ZPSGT-938/6.6/0.73×18Yd8-10%/T/(16466)	3		
358	Hongkong	Dry	CSD-100/0.415/0.415Dyn11±2×2.5%3.5%/Q/(20144)	2	ABB (Hong Kong) Limited	2023
			CSD-35/0.415/0.415Dyn11±2×2.5%3.5%/Q/(20143)	2		
359	Switzerland	Dry	CS(W/F)D-1650/0.66/0.45Dy11/6%/Q/(20256)	2	Winterthur Gas & Diesel	2023

360	Finland	Dry	CSCBFD-2400/0.71/0.467 Dy11±2.5%6%/Q/(20259)	11	Wärtsilä Deutschland GmbH	2023
361	Saudi Arab	Dry	SCB10-2000/11/0.38	1	Shenglong Electric	2023
362	Venezuela	Dry	SCB11-2000/13.8/0.4	7	Shenzhen Renfuyingrui Import&Export Co., Ltd	2023
363	Nigeria	Oil	S13-M-1600/11/0.4	1	HEFEI ChunYan	2023
			S11-800/10 10±2*2.5%/0.48KV	1		
			S13-M-2000/11/0.4	1		
364	Malaysia	Dry	SCB10-300/11/0.433	1	Xijie(Nanjing) Power electronics technology	2023
365	Pakistan	Dry	SCB10-1250/6.3/0.4		Hefei Cement Research&Design Institute Corporation Ltd	2023



QUALITY MANAGEMENT SYSTEM CERTIFICATE

Certificate No. 00120Q311194R0M/1100

We hereby certify that

China Electric Equipment (Jiangsu) Transformer Manufacture Co., Ltd.
(This main certificate contains 1 attachment and 5 sub-certificates)

Unified Social Credit Code: 9132118233888785XM

No.188 Ganglong Road, Yangzhong Economic Development Zone, Zhenjiang City, Jiangsu Province, China
(Subsidiary's information refers to the attachment and sub-certificate)

by reason of its

Quality Management System

has been awarded this certificate for compliance with the standard

GB/T 19001-2016 / ISO 9001:2015

The Quality Management System Applies in the following area:

- 1, The Design, Manufacturing, Sales and After Service of 35kV Grade and Below Voltage Dry Type Transformer, Rectifier Frequency Transformer and Marine Transformer, Rectifier Transformer and Transformer Supporting Accessories
- 2, The Design, Manufacturing, Sales and After Service of 220kV Grade and Below Voltage Oil-immersed Power Transformer, Railway Traction Transformer, Auto-transformer, Amorphous Alloy Oil-immersed Transformer and Transformer Supporting Accessories; The Design, Manufacturing, Sales and After Service of 35kV Grade and Below Voltage Wind Power Generation Modular Transformers, PV Power Transformer and Transformer Supporting Accessories; The Design, Manufacturing, Sales and After Service of 35kV Grade and Below Substation, Complete Switch Equipment
- 3, The Design, Manufacturing, Sales and After Service of 35kV Grade and Below Voltage Amorphous Alloy Oil-immersed Power Transformer, Amorphous Alloy Core dry Type Power Transformer, Amorphous Alloy Core
(Subsidiary's information refers to the attachment and sub-certificate)

Certified since: December 29, 2020 Valid from: January 6, 2022 Valid until: December 28, 2023

After a surveillance cycle, the certificate is valid only when used together with an Acceptance Notice of Surveillance Audit issued by CQC.
Please access www.cqc.com.cn for checking validity of the certificate.

This certificate and its relevant information can query in the website of Certification and Accreditation Administration of the People's Republic of China (www.cnca.gov.cn).



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管理体系
MANAGEMENT SYSTEM
CNAS C001-M

谢肇煦
Signed by: Xie ZhaoXu



CHINA QUALITY CERTIFICATION CENTRE

Section 9, No.188, Nansihuan(the South Fourth Ring Road) Xilu(West Road), Beijing 100070,China

<http://www.cqc.com.cn>

A 0039175

2021年版

Business License

No.: 320121000202004200426

Uniform Social Credit Code
913201150802804862

Name: CEEG Nanjing Transmission & Distribution Equipment Co., Ltd.

Character of Economy: Company with limited liability

Address: No. 6 Shuige Road, Jiangning, Nanjing

Legal representative: Wang Chengbing

Registered Capital: RMB 30,000,000 Yuan

Date of Foundation: November 31, 2013

Term of Business: From November 31, 2013 to ****

Business scope: Research & development, manufacturing, sale, design and related technical service of power transmission and distribution equipment, self-operate and agent import and export business of various kinds of commodities and technologies. (with exception of state limited and banned import and export goods or technologies) (Any project that needs to be approved by law can only be carried out after getting approval by relevant authorities.)

Registration Authority:

Market Supervision Administration of Jiangning, Nanjing

April 4, 2020



编号 320121000202004200426

统一社会信用代码

913201150802804862 (1/1)

营业执照

(副本)



扫描二维码登录“国家企业信用信息公示系统”了解更多登记、备案、许可、监管信息。

名称 中电电气输配电设备南京有限公司

注册资本 3000万元整

类型 有限责任公司(自然人投资或控股)

成立日期 2013年10月31日

法定代表人 王成兵

营业期限 2013年10月31日至*****

经营范围 输配电设备的研发、生产、销售、设计及其他相关技术服务；自营和代理各类商品及技术的进出口业务（国家限定公司经营或禁止进出口的商品和技术除外）。（依法须经批准的项目，经相关部门批准后方可开展经营活动）

住所 南京市江宁经济技术开发区水阁路6号

登记机关



2020 年 04 月 20 日



ENVIRONMENTAL MANAGEMENT SYSTEM CERTIFICATE

Certificate No. 00120E34741R0M/1100

We hereby certify that

China Electric Equipment (Jiangsu) Transformer Manufacture Co., Ltd.

(This main certificate contains 1 attachment and 5 sub-certificates)

No.188 Ganglong Road, Yangzhong Economic Development Zone, Zhenjiang City, Jiangsu Province, China
(Subsidiary's information refers to the attachment and sub-certificate)

by reason of its

Environmental Management System

has been awarded this certificate for compliance with the standard

GB/T 24001-2016 / ISO 14001:2015

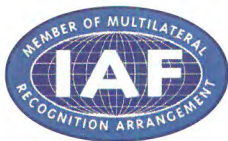
The Environmental Management System Applies in the following area:

- 1, The Design, Manufacturing, Sales and After Service of 35kV Grade and Below Voltage Dry Type Transformer, Rectifier Frequency Transformer and Marine Transformer, Rectifier Transformer and Transformer Supporting Accessories and Related Management Activities
- 2, The Design, Manufacturing, Sales and After Service of 220kV Grade and Below Voltage Oil-immersed Power Transformer, Railway Traction Transformer, Auto-transformer, Amorphous Alloy Oil-immersed Transformer and Transformer Supporting Accessories; The Design, Manufacturing, Sales and After Service of 35kV Grade and Below Voltage Wind Power Generation Modular Transformers, PV Power Transformer and Transformer Supporting Accessories; The Design, Manufacturing, Sales and After Service of 35kV Grade and Below Substation, Complete Switch Equipment and Related Management Activities
- 3, The Design, Manufacturing, Sales and After Service of 35kV Grade and Below Voltage Amorphous Alloy Oil-immersed Power Transformer, Amorphous Alloy Core dry Type Power Transformer, Amorphous Alloy Core and Related Management Activities
(Subsidiary's information refers to the attachment and sub-certificate)

Certified since: December 28, 2020 Valid from: January 5, 2022 Valid until: December 27, 2023

After a surveillance cycle, the certificate is valid only when used together with an Acceptance Notice of Surveillance Audit issued by CQC.
Please access www.cqc.com.cn for checking validity of the certificate.

This certificate and its relevant information can query in the website of Certification and Accreditation Administration of the People's Republic of China (www.cnca.gov.cn).



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管理体系
MANAGEMENT SYSTEM
CNAS C001-M

谢肇煦
Signed by: Xie ZhaoXu



CHINA QUALITY CERTIFICATION CENTRE

Section 9, No.188, Nansihuan(the South Fourth Ring Road) Xilu(West Road), Beijing 100070,China

<http://www.cqc.com.cn>

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2021年版



OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEM CERTIFICATE

Certificate No. 00120S33609R0M/1100

We hereby certify that

China Electric Equipment (Jiangsu) Transformer Manufacture Co., Ltd.
(This main certificate contains 1 attachment and 5 sub-certificates)

No.188 Ganglong Road, Yangzhong Economic Development Zone, Zhenjiang City, Jiangsu Province, China
(Subsidiary's information refers to the attachment and sub-certificate)

has been awarded this certificate for compliance with the standard
GB/T 45001-2020 / ISO45001:2018

The Occupational Health and Safety Management applies in the following area:

- 1, The Design, Manufacturing, Sales and After Service of 35kV Grade and Below Voltage Dry Type Transformer, Rectifier Frequency Transformer and Marine Transformer, Rectifier Transformer and Transformer Supporting Accessories and Related Management Activities
- 2, The Design, Manufacturing, Sales and After Service of 220kV Grade and Below Voltage Oil-immersed Power Transformer, Railway Traction Transformer, Auto-transformer, Amorphous Alloy Oil-immersed Transformer and Transformer Supporting Accessories; The Design, Manufacturing, Sales and After Service of 35kV Grade and Below Voltage Wind Power Generation Modular Transformers, PV Power Transformer and Transformer Supporting Accessories; The Design, Manufacturing, Sales and After Service of 35kV Grade and Below Substation, Complete Switch Equipment and Related Management Activities
- 3, The Design, Manufacturing, Sales and After Service of 35kV Grade and Below Voltage Amorphous Alloy Oil-immersed Power Transformer, Amorphous Alloy Core dry Type Power Transformer, Amorphous Alloy Core and Related Management Activities
(Subsidiary's information refers to the attachment and sub-certificate)

Certified since: December 28, 2020 Valid from: January 6, 2022 Valid until: December 27, 2023

After a surveillance cycle, the certificate is valid only when used together with an Acceptance Notice of Surveillance Audit issued by CQC.

Please access www.cqc.com.cn for checking validity of the certificate.

This certificate and its relevant information can query in the website of Certification and Accreditation Administration of the People's Republic of China (www.cnca.gov.cn).



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CNAS C001-M

谢肇煦
Signed by: Xie ZhaoXu



CHINA QUALITY CERTIFICATION CENTRE

Section 9, No.188, Nansihuan(the South Fourth Ring Road) Xilu(West Road), Beijing 100070, China

<http://www.cqc.com.cn>

A 0039413

2021年版

Vendor Information

1) Company Information Required:

Name: CEEG Nanjing Transmission & Distribution Equipment Co.,Ltd
Registration NO: 913201150802804862(1/1)

2) Payment Details required:

2.1

- ※ Bank Name: Bank of China, Jiangsu Branch
- ※ Bank Address: 148 Zhongshan Nanlu, Nanjing, China
- ※ Account Name: CEEG Nanjing Transmission & Distribution Equipment Co.,Ltd
- ※ Swift Code: BKCHCNBJ940
- ※ Bank Account Number: 480664572368
- ※ Currency: USD

3) Accounts Receivable contact Name: Hang Xu (Lisa)

4) Phone No. for Remittance: 86-25-84207888

5) Email and/or Fax No. for Accounts Receivable: xh@ceeg.cn

6) Company information provided by: Jin Qian (Hardy)

中电电气输配电设备南京有限公司
CEEG Nanjing Transmission&Distribution Equipment Co., Ltd.



C E R T I F I C A T E

ATTESTATION CERTIFICATE OF ELECTROMAGNETIC COMPATIBILITY AND LOW VOLTAGE DIRECTIVES

Technical file of the company mentioned below has been observed and audit has been completed successfully.

2014/30/EU Electromagnetic Compatibility Directive and

2014/35/EU Low Voltage Directives have been taken as references for these processes

Company Name : China Electric Equipment (Jiangsu) Transformer Manufacture Co., Ltd.

Company Address : No. 188 Ganglong Road, Yangzhong, Zhenjiang, Jiangsu, China

Related Directives and Annex : 2014/35/EU Low Voltage Directive
2014/30/EU Electromagnetic Compatibility Directive

Related Standards : EN 60076-1:2011, IEC 60076-1:2011

Product Name : Oil Immersed Transformer

Report No and Date : TCF-ZD220413LE

Product Brand/Model/Type : S,S-M,SL,SL-M,S(F)Z,S(F)Z-M,S(F)SZ,S(FP)SZ-M,OS(PF)SZ,
OS(PF)SZ-M,QYS,ZTSF,ZHSF,YS,ZPSF(Capacity 240000kva and below,
voltage grade 220kV and below)

Certificate Number : M.2022.206.C72761

Initial Assessment Date : 13.04.2022

Registration Date : 14.04.2022

Reissue Date/No : -

Expiry Date : 13.04.2027


UDEM International Certification
Auditing Training Centre Industry
and Trade Inc. Co.

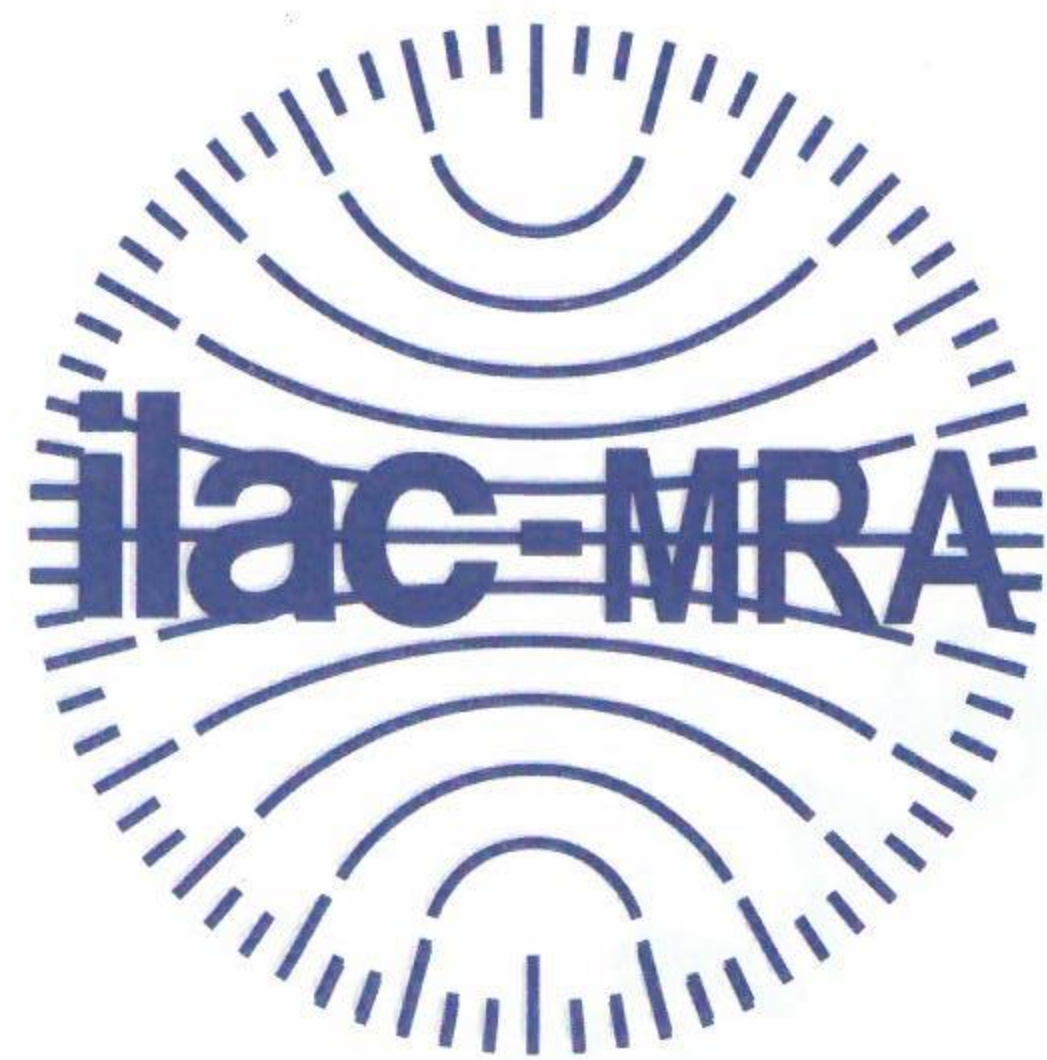
The validity of the certificate can be checked through www.udem.com.tr. The CE mark shown on the right can only be used under the responsibility of the manufacturer with the completion of EC Declaration of Conformity for all the relevant Directives. This certificate remains the property of UDEM International Certification Auditing Training Centre Industry and Trade Inc. Co. to whom it must be returned upon request. The above named firm must keep a copy of this certificate for 15 years from the registration of certificate. This certificate only covers the product(s) stated above and UDEM must be noticed in case of any changes on the product(s)

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China National Accreditation Service for Conformity Assessment
LABORATORY ACCREDITATION CERTIFICATE
(Registration No. CNAS L18260)

**Testing Center of China Electric Equipment (Jiangsu)
Transformer Manufacture Co., Ltd.**

(Legal Entity: China Electric Equipment (Jiangsu) Transformer Manufacture Co., Ltd.)

Building 8, No.188, Ganglong Road, Economic Development Zone,
Yangzhong, Zhenjiang, Jiangsu, China

is accredited in accordance with ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories(CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence to undertake the service described in the schedule attached to this certificate.

The scope of accreditation is detailed in the attached schedule bearing the same registration number as above. The schedule forms an integral part of this certificate.

Effective Date: 2023-05-16

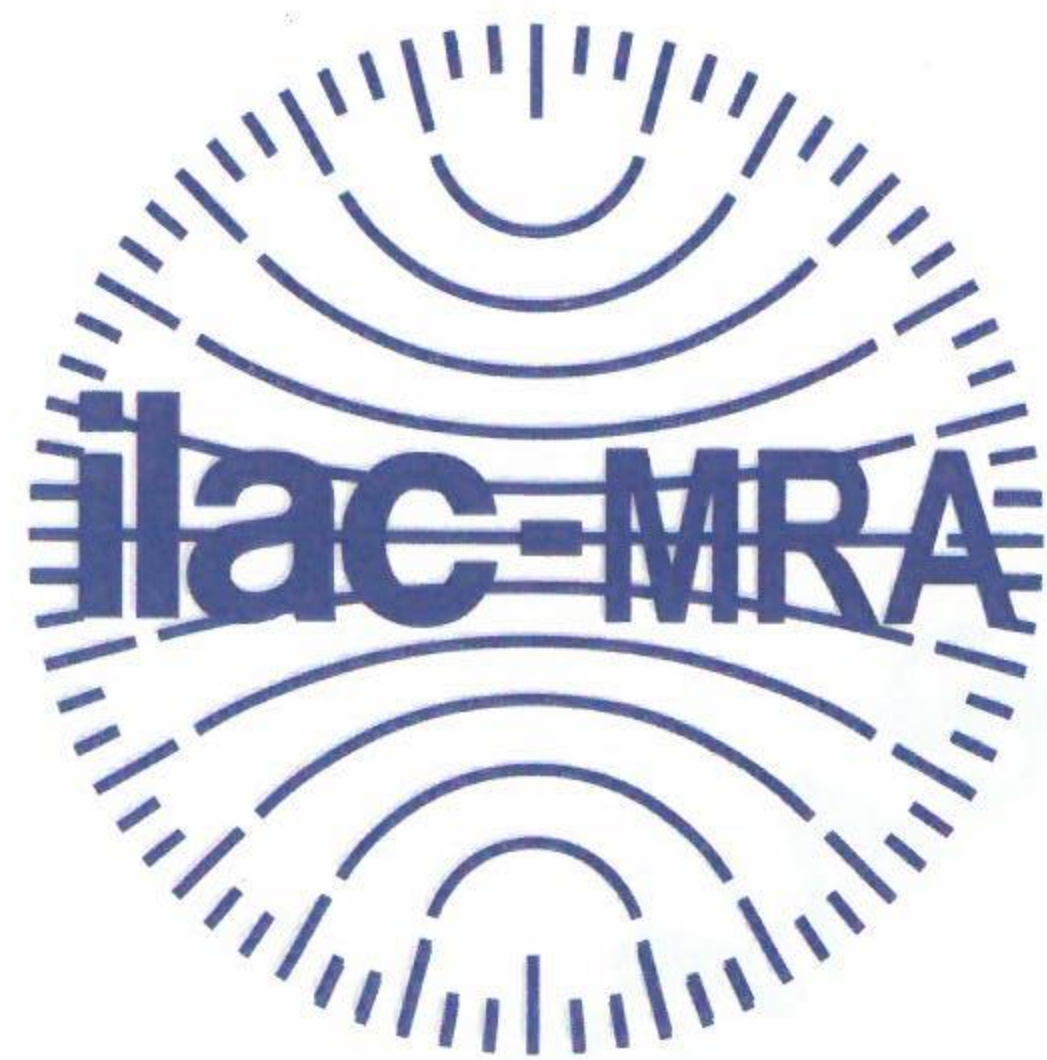
Expiry Date: 2029-05-15

Signed on behalf of China National Accreditation Service for Conformity Assessment

徐朝华

China National Accreditation Service for Conformity Assessment (CNAS) is authorized by Certification and Accreditation Administration of the People's Republic of China (CNCA) to operate the national accreditation schemes for conformity assessment. CNAS is a signatory of the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement (ILAC MRA) and the Asia Pacific Accreditation Cooperation Mutual Recognition Arrangement (APAC MRA).

The validity of the certificate can be checked on CNAS website at <http://www.cnas.org.cn/english/findanaccreditedbody/index.shtml>.



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中国认可
国际互认
检测
TESTING
CNAS L1020



实验室名称: 国家电器产品质量监督检验中心

Lab Name: China National Center for Quality Supervision
and Test of Electrical Apparatus Products

No 20M0561-S

型式试验报告 Type Test Report

委托单位: China Electric Equipment (Jiangsu) Transformer
Manufacturing Co., Ltd

Client:

产品名称: Power transformer

Name of Product:

产品型号: SZ11-63000/110

Product Type:

检验类别: Commission test

Test Category:

本实验室对出具的检验(试验)结果负责, 未经实验室书面同意,
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The laboratory is responsible for the inspection (Test) results. The report shall
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China National Center for Quality Supervision and Test of Electrical Apparatus Products
Test Report

№: 20M0561-S

Total 68 Page 01

Client	China Electric Equipment (Jiangsu) Transformer Manufacturing Co., Ltd	Test category	Commission test
Manufacturer	China Electric Equipment (Jiangsu) Transformer Manufacturing Co., Ltd	Date of sample receiving	Mar. 21, 2020
Name of sample	Power transformer	Type of sample	SZ11-63000/110
Address of manufacturer	No.188 Zhongdian Road, Yangzhong, Zhenjiang City, Jiangsu Province, China	Original number or date of production	ZD202003856
Date of test	From Apr. 09, 2020 to Apr. 22, 2020	Number of sample	1 set
Test items	Routine test Type test (including calculation of the winding hot-spot temperature-rise) Measurement of bushing capacitances and dielectric dissipation factor ($\tan\delta$) Measurement of zero-sequence impedances on three-phase transformers Measurement of the harmonics of the no-load current Measurement of frequency response Measurement of no-load excitation characteristics Long-duration no-load test Measurement of short-circuit impedance on LV Short-circuit withstand test	Test standards	GB/T 1094.1—2013 GB/T 1094.2—2013 GB/T 1094.3—2017 GB/T 1094.5—2008 GB/T 1094.10—2003 GB/T 6451—2015 GB/T 7595—2017 JB/T 10088—2016 IEC 60076-1:2011 IEC 60076-2:2011 IEC 60076-3:2013+AMD1:2018 IEC 60076-5:2006 IEC 60076-10:2016 Commission requirements
Test conclusion	The test results of routine test, type test (including calculation of the winding hot-spot temperature-rise), measurement of bushing capacitances and dielectric dissipation factor ($\tan\delta$), measurement of zero-sequence impedances on three-phase transformers, measurement of the harmonics of the no-load current, measurement of frequency response, measurement of no-load excitation characteristics, long-duration no-load test, measurement of short-circuit impedance on LV and short-circuit withstand test of power transformer (type: SZ11-63000/110) are in accordance with test standards and commission requirements. The sample has passed the above tests.		
Remarks	/ Signing and issuing date: 2020-4-29 Note: the conclusion is valid only for the inspected and tested sample. (1)		

Compiled by: 袁小勇 Proofread by: 刘子兴 Checked by: 邹彦珍 Approved by: 李明智

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1. Sample parameters

Rated power: 63000kVA
Rated voltage: 110/10.5kV
Rated current: 330.7/3464.2A
Rated frequency: 50Hz
Number of phases: 3
Tapping ranges: (110±8×1.25%)/10.5kV
Connection symbol: YNd11
Cooling method: ONAN
Class of insulation and heat-resistant: /

Insulation level: HV	Um/LI/LIC/AC	126/480/530/200kV
HVN	Um/LI/AC	72.5/325/140kV
LV	Um/LI/LIC/AC	12/75/85/35kV

2. Test standards

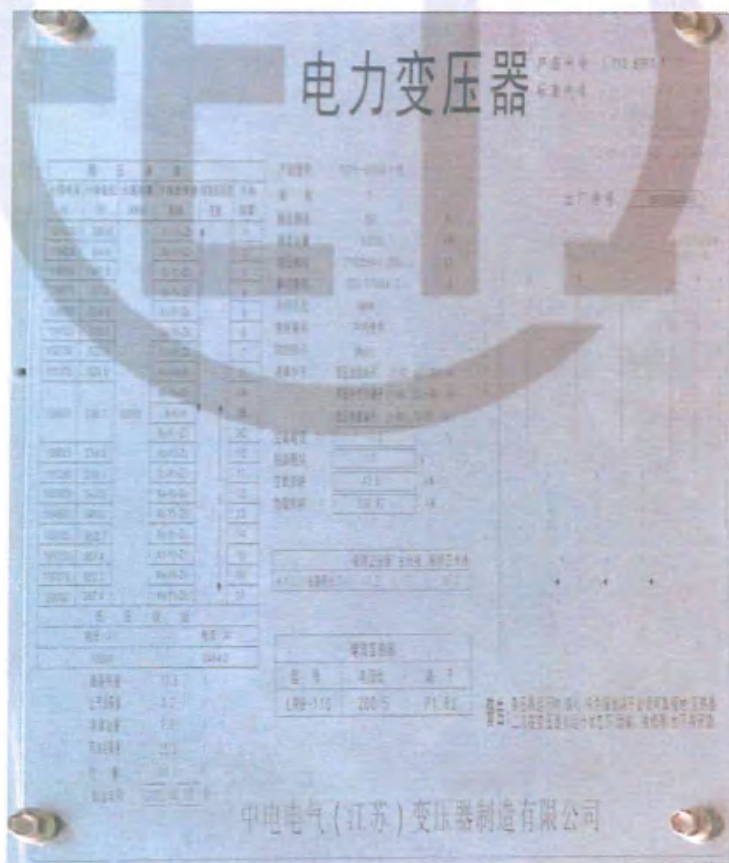
GB/T 1094.1—2013 *Power transformers—Part 1: General*
GB/T 1094.2—2013 *Power transformers—Part 2: Temperature rise for liquid-immersed transformers*
GB/T 1094.3—2017 *Power transformers—Part 3: Insulation levels, dielectric tests and external clearances in air*
GB/T 1094.5—2008 *Power transformers—Part 5: Ability to withstand short circuit*
GB/T 1094.10—2003 *Power transformers—Part 10: Determination of sound levels*
GB/T 6451—2015 *Technical parameters and requirements of oil-immersed power transformer*
GB/T 7595—2017 *Quality of transformer oils in service*
JB/T 10088—2016 *Sound level for 6kV~1000kV power transformers*
IEC 60076-1:2011 *Power transformers – Part 1: General*
IEC 60076-2:2011 *Power transformers – Part 2: Temperature rise for liquid – immersed transformers*
IEC 60076-3:2013+AMD1:2018 *Power transformers – Part 3: Insulation levels, dielectric tests and external clearances in air*
IEC 60076-5:2006 *Power transformers – Part 5: Ability to withstand short circuit*
IEC 60076-10:2016 *Power transformers – Part 10: Determination of sound levels*
Commission requirements

3. Sample description

The power transformer is for outdoor use, and the structure of the coil is rotundate concentric type coil. The type used in this report meets the requirements of JB/T 3837—2016 *Identification method of transformer's product type* and external photos of the sample have been attached.

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Photos of the sample



Test Report		China National Center for Quality Supervision and Test of Electrical Apparatus Products		№: 20M0561-S Total 68 Page 04	
Summary of test results					
No	Test items	Specified value	Measured value		Concl- usion
		Standards (commission requirements)	Before short-circuit test	After short-circuit test	
1	Measurement of d.c. insulation resistance windings-to-earth and between windings (routine test)	Providing value of insulation resistance Providing absorption ratio Providing polarity index	See 4.1	See 4.19.4.1	/
2	Check of core and frame insulation for liquid-immersed transformers with core or frame insulation (routine test)	Providing value of insulation resistance 20℃(MΩ): ≥500	See 4.2	See 4.19.4.2	PASS
3	Measurement of dissipation factor (tanδ) of the insulation system capacitances (routine test)	Providing value of capacitance Providing dielectric dissipation factor tanδ	See 4.3	See 4.19.4.3	/
4	Determination of capacitances windings-to-earth and between windings (routine test)	Providing value of capacitance	See 4.4	See 4.19.4.4	/
5	Measurement of bushing capacitances and dielectric dissipation factor (tanδ) (commission test)	Providing value of capacitance Providing dielectric dissipation factor tanδ	See 4.5	See 4.19.4.5	/
6	Check the ratio and polarity of built-in current transformers (routine test)	Providing the value of ratio and polarity relation	See 4.6	See 4.19.4.6	/
7	Insulation test of auxiliary wiring (routine test)	Wring for auxiliary power and control circuit: 2.0kV 60s Wring for secondary winding of current transformer: 2.5kV 60s	2.0kV 60s 2.5kV 60s	2.0kV 60s 2.5kV 60s	PASS
8	Measurement of voltage ratio and check of phase displacement (routine test)	Voltage ratio tolerance of principal tapping: obtaining the lower of the following values between ±0.5% of declared ratio and ±1/10 of the actual percentage impedance Connection symbol: YNd11	See 4.8	See 4.19.4.8	PASS
9	Measurement of winding resistance (routine test)	Maximum resistance unbalance rate Phase resistance: ≤2% Line resistance: ≤1%	HV (phase):0.33% LV (line):0.36%	HV (phase): 0.31% LV (line):0.39%	PASS

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No	Test items	Specified value		Measured value				Concl- usion		
		Standards (commission requirements)		Before short-circuit test		After short-circuit test				
10	Measurement of no-load loss and current (routine test)	100% Ur	I ₀ (%): 0.2 +0% P ₀ (kW): 44.800 +0%	0.15 43.691	0.15 43.695			PASS		
		90% Ur	I ₀ (%): measured P ₀ (kW): measured	0.12 35.394	0.12 35.390			/		
		110% Ur	I ₀ (%): measured P ₀ (kW): measured	0.50 69.367	0.50 69.343					
11	Measurement of short-circuit impedance and load loss (routine test)	t: 75℃ Z(%): 17.0 ±5% P _k (kW): 232.000 +0% P _{total} (kW): 276.800 +0%		16.92 215.380 259.071	16.94 215.330 259.025			PASS		
12	Tests on on-load tap-changers (routine test)	According to clause 11.7 of GB/T1094.1-2013 and IEC60076-1:2011		Meet the requirements	Meet the requirements			PASS		
13	Lightning impulse test (routine test, type test)	HV : Full wave (kV): 480 ±3% Chopped wave (kV):530 ±3% Neutral point (kV):325 ±3%		/		478.02~482.82 530.72~533.28 324.47~325.93		PASS		
		LV: Full wave (kV): 75 ±3% Chopped wave (kV):85 ±3%				74.96~76.12 84.36~86.82				
14	Separate-source AC withstand voltage test (routine test)	HV neutral point:140kV 60s LV: 35kV 60s		140.0kV 60s 35.0kV 60s	140.0kV 60s 35.0kV 60s			PASS		
15	Line terminal AC withstand test (routine test)	Phase to earth test							PASS	
		Applied voltage (kV):		ac: 21.0	ab: 21.0	bc: 21.0	ac: 21.0	ab: 21.0		bc: 21.0
		Induced voltage (kV): 200		A: 200.0	B: 200.0	C: 200.0	A: 200.0	B: 200.0		C: 200.0
		Duration (s): 120(f _n /f) Frequency (Hz): >50		30 200		30 200				

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No	Test items	Specified value	Measured value		Concl- usion
		Standards (commission requirements)	Before short-circuit test	After short-circuit test	
16	Induced AC withstand voltage test and induced AC withstand voltage test with partial discharge measurement (routine test)	Three-phase applied voltage			PASS
		$0.4U_r/\sqrt{3}$ (kV)	25.4	25.4	
		Discharge magnitude $\leq 50\text{pC}$	A:<14;B:<15;C:<17	A:<16;B:<17;C:<18	
		$1.2U_r/\sqrt{3}$ (kV)	76.2	76.2	
		Duration (min): 1	1	1	
		Discharge magnitude $\leq 100\text{pC}$	A:<45;B:<50;C:<50	A:<47;B:<40;C:<45	
		$1.58U_r/\sqrt{3}$ (kV)	100.3	100.3	
		Duration (min): 5	5	5	
		Discharge magnitude $\leq 250\text{pC}$	A:<87;B:<92;C:<85	A:<85;B:<87;C:<89	
		$2.0U_r/\sqrt{3}$ (kV)	127.1	127.1	
		Duration (min): 0.5	0.5	0.5	
		$1.58U_r/\sqrt{3}$ (kV)	100.3	100.3	
		Duration (min): 60	60	60	
17	Insulating liquid test, measurement of dissolved gasses in dielectric liquid from each separate oil compartment except diverter switch compartment (routine test)	Discharge magnitude $\leq 250\text{pC}$	A:<90;B:<97;C:<92	A:<85;B:<87;C:<88	PASS
		$1.2U_r/\sqrt{3}$ (kV)	76.2	76.2	
		Duration (min): 1	1	1	
		Discharge magnitude $\leq 100\text{pC}$	A:<44;B:<48;C:<50	A:<45;B:<42;C:<42	
		$0.4U_r/\sqrt{3}$ (kV)	25.4	25.4	
18	Measurement of frequency response (special test)	Discharge magnitude $\leq 50\text{pC}$	A:<15;B:<17;C:<16	A:<15;B:<15;C:<17	PASS
		Frequency (Hz): >50	200		
		Breakdown voltage (kV): ≥ 45	61.0	58.1	
17	Insulating liquid test, measurement of dissolved gasses in dielectric liquid from each separate oil compartment except diverter switch compartment (routine test)	$\tan\delta(90^\circ\text{C}): \leq 1.0\%$	0.23%	0.36%	PASS
		Water content (mg/L): ≤ 20	8.9	9.8	
		Providing gas chromatograph analysis:			
17	Insulating liquid test, measurement of dissolved gasses in dielectric liquid from each separate oil compartment except diverter switch compartment (routine test)	Hydrogen: <30 $\mu\text{L}/\text{L}$	See 4.17	See 4.19.4.17	PASS
		Acetylene: 0			
		Total hydrocarbon: <20 $\mu\text{L}/\text{L}$			
18	Measurement of frequency response (special test)	Providing frequency response characteristics curve	See 4.18	See 4.19.4.18	PASS

Test Report		China National Center for Quality Supervision and Test of Electrical Apparatus Products		№: 20M0561-S Total 68 Page 07	
No	Test items	Specified value	Measured value	Concl- usion	
		Standards (commission requirements)			
19	Short-circuit withstand test (special test)	Test times of each phase: 3 times Duration (s): $0.25 \pm 10\%$ The test oscillogram shall be normal. The reactance tolerance of phase before and after the test is not more than 2% The out-of-tank inspection does not reveal any obvious defects. Routine retests shall be passed after short-circuit test.	3 times $0.257 \sim 0.257$ Without abnormality The maximum reactance tolerance of phase is 0.67% Without obvious abnormality Routine retests are passed.	PASS	
20	Measurement of no-load excitation characteristics (commission test)	Providing no-load excitation characteristic curve	See 4.20	/	
21	Long-duration no-load test (commission test)	Applied voltage (kV): $1.1U_r$ Duration (h): 12 Oil without acetylene	$1.1U_r$ 12 For gas chromatograph analysis, see 4.19.4.17	PASS	
22	Measurement of short-circuit impedance on LV (commission test)	Measurement of short-circuit impedance at 380V voltage	See 4.22	/	
23	Measurement of zero-sequence impedances on three-phase transformers (special test)	Providing zero-sequence impedances values (Ω)	See 4.23	/	
24	Measurement of the harmonics of the no-load current (commission test)	Providing harmonics of the no-load current of each phase	Harmonics of the no-load current of $I_1 \sim I_{19}$	/	
25	Temperature-rise test (including calculation of the winding hot-spot temperature-rise) (type test)	Top oil temperature-rise limits (K): 53 Winding temperature-rise limits (K): 60 Winding hot-spot temperature-rise limits (K): 78 Hot-spot temperature-rise limits of tank and metal structural parts (K): 75	Top oil temperature-rise: 48.8 HV winding temperature-rise: 54.9 LV winding temperature-rise: 55.9 HV winding hot-spot temperature-rise: 69.8 LV winding hot-spot temperature-rise: 71.0 39.3	PASS	

Test Report		China National Center for Quality Supervision and Test of Electrical Apparatus Products		№: 20M0561-S Total 68 Page 08	
No	Test items	Specified value Standards (commission requirements)	Measured value	Concl- usion	
26	Leak testing with pressure for liquid-immersed transformers (routine test)	Body: Applied pressure (kPa): 30 Duration (h): 24 No oil leakage or damage On-load tap-changer tank: Applied pressure (kPa): 30 Duration (h): 24 No oil leakage or damage	30.0 24 No oil leakage or damage 30.0 24 No oil leakage or damage	PASS	
27	Determination of sound levels (type test)	Sound pressure level $\overline{L}_{pA}$ dB (A): Sound power level L_{WA} dB(A): ≤ 80	54 74	PASS	
28	Mechanical strength test of tank (type test)	Applied degree of vacuum (kPa): 0.133 Applied positive pressure (kPa): 100 Elastic deformation of tank wall (strengthen) (mm): ≤ 32 Elastic deformation of tank wall (mm): ≤ 40 Elastic deformation of tank cover (mm): ≤ 18 Permanent deformation of tank wall (strengthen) (mm): ≤ 16 Permanent deformation of tank wall (mm): ≤ 20 Permanent deformation of tank cover (mm): ≤ 10 No damage	See 4.28	PASS	
Blank below					

Test Report	China National Center for Quality Supervision and Test of Electrical Apparatus Products			№: 20M0561-S Total 68 Page 09	
4. Test items and results					
4.1 Measurement of d.c. insulation resistance windings-to-earth and between windings (routine test)					
Test date: Apr. 09, 2020 Relative humidity: 46%; Oil temperature: 18.9°C					
Measured parts	R_{15} (GΩ)	R_{60} (GΩ)	R_{600} (GΩ)	Absorption ratio (R_{60}/R_{15})	Polarity index (R_{600}/R_{60})
HV—LV and earth	30.6	40.1	55.9	1.31	1.39
LV—HV and earth	25.3	35.9	53.8	1.42	1.50
HV, LV—earth	15.8	21.6	30.6	1.37	1.42
HV—LV	39.6	51.8	78.8	1.31	1.52
4.2 Check of core and frame insulation for liquid-immersed transformers with core or frame insulation (routine test)					
Test date: Apr. 09, 2020 Relative humidity: 46%; Oil temperature: 18.9°C					
Measured parts	Measured insulation resistance (GΩ)		Insulation resistance corrected to 20°C(GΩ)		
Core—earth	12.5		12.0		
Frame—earth	14.3		13.7		
Core—frame	11.3		10.8		
4.3 Measurement of dissipation factor ($\tan\delta$) of the insulation system capacitances (routine test)					
Test date: Apr. 09, 2020 Relative humidity: 46%; Oil temperature: 18.9°C					
Measured parts	Dielectric dissipation factor $\tan\delta(\%)$		Capacitance (pF)		
HV—LV and earth	0.35		11000		
LV—HV and earth	0.33		17750		
HV, LV—earth	0.38		19330		
HV—LV	0.34		14520		
4.4 Determination of capacitances windings-to-earth and between windings (routine test) Test date: Apr. 09, 2020 See 4.3					

Test Report		China National Center for Quality Supervision and Test of Electrical Apparatus Products			№: 20M0561-S Total 68 Page 10	
4.5 Measurement of bushing capacitances and dielectric dissipation factor (tanδ)(commission test) Test date: Apr. 09, 2020 Relative humidity: 46%; Oil temperature: 18.9℃						
Measured contents	Applied voltage	Measured parts				
		A	B	C	O	
tanδ(%)	10kV	0.36	0.35	0.33	0.34	
Measured capacitance (pF)		298.5	298.5	297.6	349.3	
4.6 Check the ratio and polarity of built-in current transformers (routine test) Test date: Apr. 09, 2020 Relative humidity: 46%; Oil temperature: 18.9℃						
Measured winding	A	B	C	O		
	P1-P2	P1-P2	P1-P2	P1-P2		
Ratio	40.12	40.06	39.95	39.98		
polarity	-	-	-	-		
4.7 Insulation test of auxiliary wiring (routine test) Test date: Apr. 09, 2020 Relative humidity: 46%; Ambient temperature: 19.3℃; Oil temperature: 18.9℃; Air pressure: 102kPa						
Parts of applied voltage		Test voltage (kV)	Test duration (s)	Result		
Wring for auxiliary power and control circuit	On-load tapping power	2.0	60	PASS		
Wring for secondary winding of current transformer	A	2.5	60	PASS		
	B	2.5	60			
	C	2.5	60			
	O	2.5	60			

Test Report		China National Center for Quality Supervision and Test of Electrical Apparatus Products				№: 20M0561-S Total 68 Page 11		
4.8 Measurement of voltage ratio and check of phase displacement (routine test)								Test date: Apr. 09, 2020
HV winding		LV winding		Transformer ratio by calculation	Measured voltage ratio tolerance (%)			Connection symbol
Tapping position	Voltage (kV)	Tapping position	Voltage (kV)		AB/ab	BC/bc	CA/ca	
1	121.000	/	10.5	11.524	0.08	0.11	0.12	YNd11
2	119.625			11.393	0.14	0.07	0.03	
3	118.250			11.262	0.10	-0.03	0.16	
4	116.875			11.131	0.01	-0.05	-0.13	
5	115.500			11.000	-0.10	-0.11	-0.10	
6	114.125			10.869	-0.04	-0.06	-0.02	
7	112.750			10.738	0.10	0.05	0.06	
8	111.375			10.607	0.08	0.09	-0.03	
9b	110.000			10.476	0.12	0.10	0.07	
10	108.625			10.345	0.06	0.09	0.08	
11	107.250			10.214	0.03	0.04	0.14	
12	105.875			10.083	-0.10	0.14	0.08	
13	104.500			9.952	-0.08	-0.10	-0.11	
14	103.125			9.821	-0.08	-0.11	-0.08	
15	101.750			9.690	0.07	0.10	0.11	
16	100.375			9.560	0.12	0.12	0.12	
17	99.000			9.429	0.06	-0.11	0.08	

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4.9 Measurement of winding resistance (routine test)					Test date: Apr. 10, 2020 Oil temperature: 18.8℃
Winding	Tapping position	Measured values (Ω)			Resistance unbalance rate (%)
		A~O a~b	B~O b~c	C~O c~a	
HV	1	0.32172	0.32157	0.32201	0.28
	2	0.31617	0.31672	0.31721	0.33
	3	0.31178	0.31201	0.31255	0.25
	4	0.30663	0.30690	0.30721	0.19
	5	0.30214	0.30256	0.30284	0.23
	6	0.29841	0.29869	0.29901	0.20
	7	0.29261	0.29302	0.29317	0.19
	8	0.28989	0.29007	0.29068	0.27
	9b	0.28131	0.28163	0.28195	0.23
	10	0.28793	0.28827	0.28856	0.22
	11	0.29283	0.29310	0.29337	0.18
	12	0.29782	0.29805	0.29832	0.17
	13	0.30276	0.30290	0.30331	0.18
	14	0.30697	0.30724	0.30757	0.20
	15	0.31127	0.31152	0.31178	0.16
	16	0.31558	0.31582	0.31609	0.16
	17	0.32049	0.32070	0.32112	0.20
LV	/	3.5195×10 ⁻³	3.5227×10 ⁻³	3.5324×10 ⁻³	0.36

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4.10 Measurement of no-load loss and current (routine test)						Test date: Apr. 10, 2020		
Applied voltage	r.m.s. voltage (kV)		No-load current		No-load loss (kW)			
	Average voltmeter reading	r.m.s. voltmeter reading	(A)	(%)	Measured values	Corrected value		
100%Ur	10.506	10.513	5.14	0.15	43.719	43.691		
90%Ur	9.456	9.459	4.03	0.12	35.408	35.394		
110%Ur	11.552	11.564	17.16	0.50	69.440	69.367		
Remarks: the difference between r.m.s voltmeter reading and average voltmeter reading is within 3%.								
4.11 Measurement of short-circuit impedance and load loss (routine test)						Test date: Apr. 10, 2020 Oil temperature: 18.8℃		
Winding	Tapping position	Applied current I		Measured voltage (kV)	Short-circuit impedance (for each phase)		Load loss (kW)	Total loss (kW)
		(A)	I/I _r (%)		HV impedance (Ω)	(%)	Corrected value	Corrected value
					t=75℃ I=I _r	t=75℃ I=I _r	t=75℃ I=I _r	t=75℃ I=I _r
HV LV	1	163.60	54.42	11.276	39.80	17.12	208.019	251.710
	9b	191.36	57.87	10.768	32.49	16.92	215.380	259.071
	17	206.41	56.18	9.255	25.89	16.64	248.905	292.596
4.12 Tests on on-load tap-changers (routine test)						Test date: Apr. 10, 2020		
Operation tests:								
a. with the transformer de-energized, eight complete cycles of operation (a cycle of operation goes from one end of the tapping range to the other, and back again);								
b. with the transformer de-energized, and with the auxiliary voltage reduced to 85 % of its rated value, one complete cycle of operation;								
c. with the transformer energized at rated voltage and frequency at no load, one complete cycle of operation;								
d. with one winding short-circuited and, as far as practicable, rated current in the tapped winding, 10 cycles of tap-change operations across the range of two steps on each side from where a coarse or reversing changeover selector operates, or otherwise from the middle tapping (the tapchanger will pass 20 times through the changeover position).								
Test result: PASS								

Test Report	China National Center for Quality Supervision and Test of Electrical Apparatus Products		№: 20M0561-S Total 68 Page 14																																							
4.13 Lightning impulse test (routine test) The test is not applied before the short-circuit withstand test. 4.14 Separate-source AC withstand voltage test (routine test) Test date: Apr. 10, 2020 Relative humidity: 54%; Ambient temperature: 19.1℃; Oil temperature: 18.8℃; Air pressure: 102kPa <table border="1"> <tr> <th>Parts of applied voltage</th> <th>Test voltage (kV)</th> <th>Test duration (s)</th> <th>Result</th> </tr> <tr> <td>HV neutral point—LV and earth</td> <td>140.0</td> <td>60</td> <td rowspan="2">PASS</td> </tr> <tr> <td>LV—HV and earth</td> <td>35.0</td> <td>60</td> </tr> </table> 4.15 Line terminal AC withstand test (routine test) Test date: Apr. 10, 2020 Relative humidity: 54%; Ambient temperature: 19.1℃; Oil temperature: 18.8℃; Air pressure: 102kPa Phase to earth test <table border="1"> <tr> <th rowspan="2">Parts of applied voltage</th> <th rowspan="2">Tapping position</th> <th>Applied voltage (kV)</th> <th colspan="2">Induced voltage (kV)</th> <th rowspan="2">Frequency (Hz)</th> <th rowspan="2">Test duration (s)</th> <th rowspan="2">Result</th> </tr> <tr> <th>LV</th> <th colspan="2">HV</th> </tr> <tr> <td>a-c</td> <td rowspan="3">5</td> <td>21.0</td> <td>A</td> <td>200.0</td> <td rowspan="3">200</td> <td rowspan="3">30</td> <td rowspan="3">PASS</td> </tr> <tr> <td>a-b</td> <td>21.0</td> <td>B</td> <td>200.0</td> </tr> <tr> <td>b-c</td> <td>21.0</td> <td>C</td> <td>200.0</td> </tr> </table>					Parts of applied voltage	Test voltage (kV)	Test duration (s)	Result	HV neutral point—LV and earth	140.0	60	PASS	LV—HV and earth	35.0	60	Parts of applied voltage	Tapping position	Applied voltage (kV)	Induced voltage (kV)		Frequency (Hz)	Test duration (s)	Result	LV	HV		a-c	5	21.0	A	200.0	200	30	PASS	a-b	21.0	B	200.0	b-c	21.0	C	200.0
Parts of applied voltage	Test voltage (kV)	Test duration (s)	Result																																							
HV neutral point—LV and earth	140.0	60	PASS																																							
LV—HV and earth	35.0	60																																								
Parts of applied voltage	Tapping position	Applied voltage (kV)	Induced voltage (kV)		Frequency (Hz)	Test duration (s)	Result																																			
		LV	HV																																							
a-c	5	21.0	A	200.0	200	30	PASS																																			
a-b		21.0	B	200.0																																						
b-c		21.0	C	200.0																																						

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4.16 Induced AC withstand voltage test and induced AC withstand voltage test with partial discharge measurement (routine test) Test date: Apr. 10, 2020 Relative humidity: 54%; Ambient temperature: 19.1℃; Oil temperature: 18.8℃; Air pressure: 102kPa HV tapping position is 9b, frequency is 200Hz.					
Applied voltage		Duration (min)	Partial discharge magnitude (pC)		
Multiple	Phase to earth voltage (kV)		A	B	C
$0.4U_r/\sqrt{3}$	25.4	/	<14	<15	<17
$1.2U_r/\sqrt{3}$	76.2	1	<45	<50	<50
$1.58U_r/\sqrt{3}$	100.3	5	<87	<92	<85
$2.0U_r/\sqrt{3}$	127.1	0.5	/	/	/
$1.58U_r/\sqrt{3}$	100.3	5	<89	<95	<88
		10	<85	<95	<88
		15	<88	<93	<90
		20	<90	<95	<90
		25	<90	<90	<92
		30	<88	<90	<90
		35	<85	<95	<88
		40	<85	<97	<85
		45	<88	<97	<87
		50	<90	<95	<87
		55	<87	<95	<85
		60	<90	<90	<85
$1.2U_r/\sqrt{3}$	76.2	1	<44	<48	<50
$0.4U_r/\sqrt{3}$	25.4	/	<15	<17	<16
Remarks: $U_r=110\text{kV}$.					

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4.17 Insulating liquid test, measurement of dissolved gasses in dielectric liquid from each separate oil compartment except diverter switch compartment (routine test)							
Test date: Apr. 09, 2020 Relative humidity: 50%; Ambient temperature: 18.5°C							
Dielectric dissipation factor(90℃)		Breakdown voltage (kV)			Water content (mg/L)		
0.23%		61.0			8.9		
Gas chromatograph analysis (before all tests)							
Test date: Apr. 09, 2020 μL/L							
H ₂	CO	CO ₂	CH ₄	C ₂ H ₆	C ₂ H ₄	C ₂ H ₂	Total hydrocarbon
1.65	10.53	46.78	1.14	0.00	0.00	0.00	1.14
Gas chromatograph analysis (after dielectric test, before short-circuit test)							
Test date: Apr. 11, 2020 μL/L							
H ₂	CO	CO ₂	CH ₄	C ₂ H ₆	C ₂ H ₄	C ₂ H ₂	Total hydrocarbon
1.97	12.75	63.29	1.31	0.00	0.00	0.00	1.31
Gas chromatograph analysis (after short-circuit test, before dielectric retest)							
Test date: Apr. 19, 2020 μL/L							
H ₂	CO	CO ₂	CH ₄	C ₂ H ₆	C ₂ H ₄	C ₂ H ₂	Total hydrocarbon
3.56	18.54	113.15	2.46	0.00	0.00	0.00	2.46
Gas chromatograph analysis (after dielectric retest, before long-duration no-load test)							
Test date: Apr. 20, 2020 μL/L							
H ₂	CO	CO ₂	CH ₄	C ₂ H ₆	C ₂ H ₄	C ₂ H ₂	Total hydrocarbon
3.83	20.37	132.65	2.83	0.00	0.00	0.00	2.83
Gas chromatograph analysis (after long-duration no-load test, before temperature-rise test)							
Test date: Apr. 21, 2020 μL/L							
H ₂	CO	CO ₂	CH ₄	C ₂ H ₆	C ₂ H ₄	C ₂ H ₂	Total hydrocarbon
3.91	21.48	135.77	2.90	0.00	0.00	0.00	2.90
Gas chromatograph analysis (after temperature-rise test)							
Test date: Apr. 22, 2020 μL/L							
H ₂	CO	CO ₂	CH ₄	C ₂ H ₆	C ₂ H ₄	C ₂ H ₂	Total hydrocarbon
4.26	23.29	139.46	3.12	0.00	0.00	0.00	3.12

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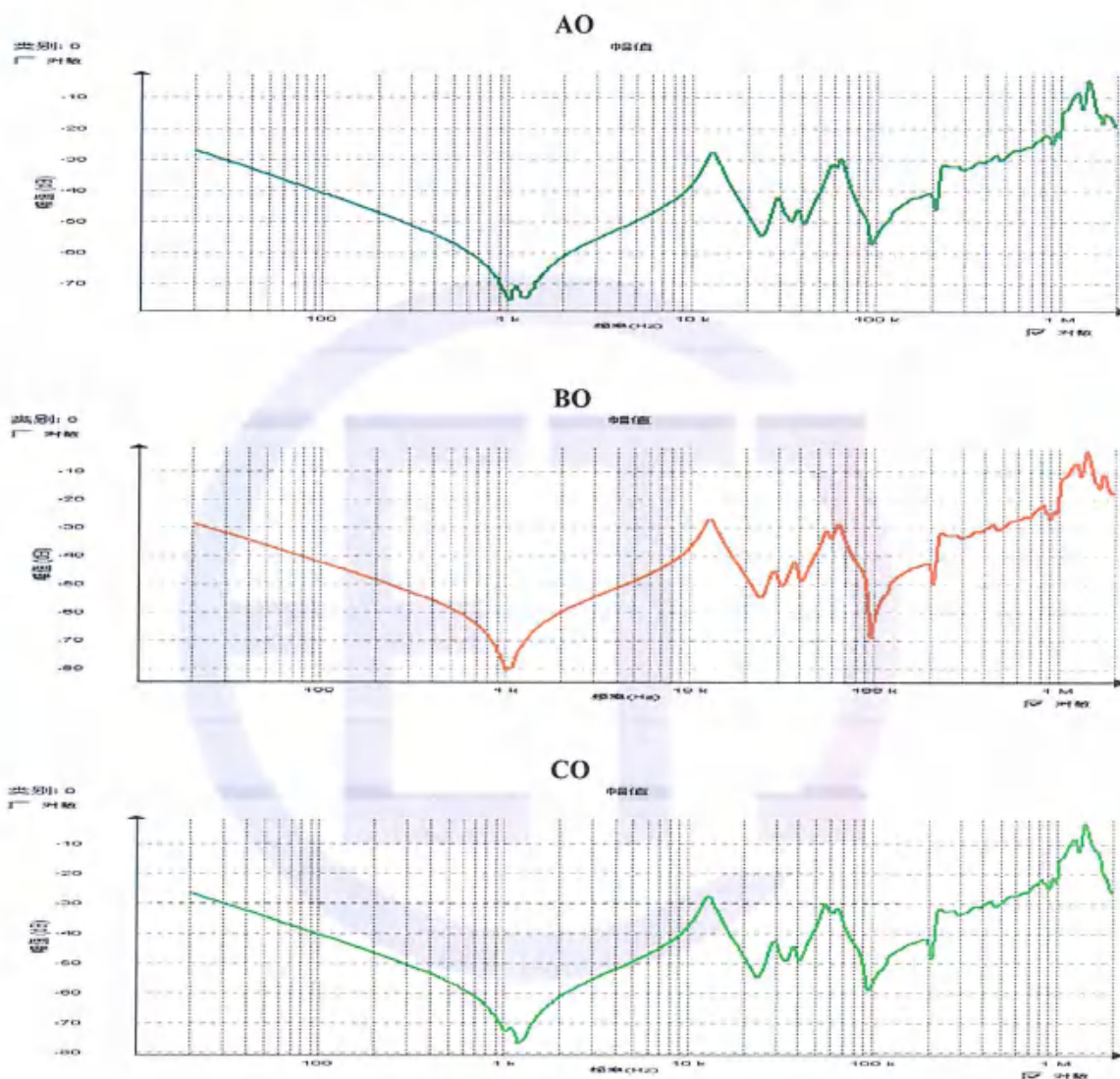
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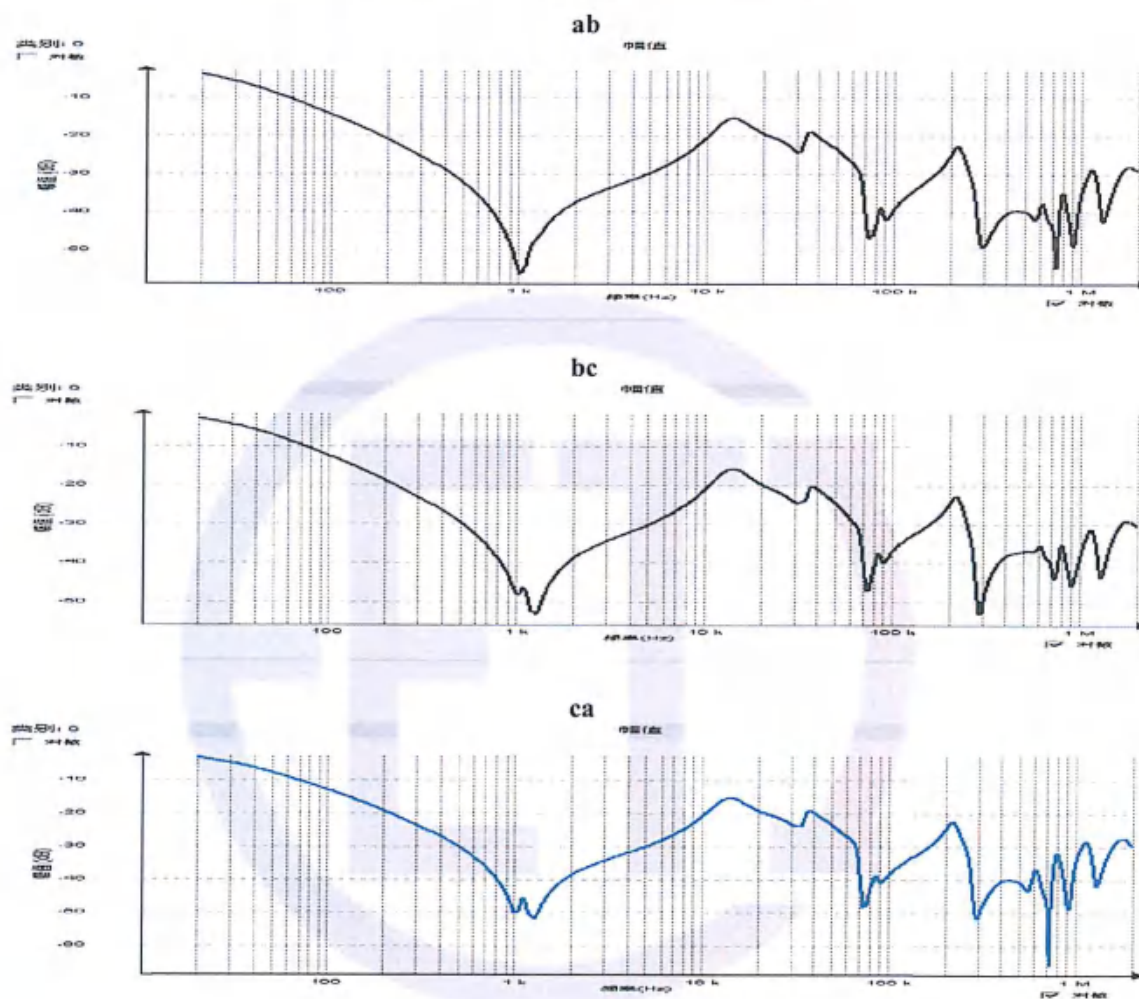
4.18 Measurement of frequency response (special test)

Test date: Apr. 17, 2020

HV winding frequency response curves before short-circuit test



LV winding frequency response curves before short-circuit test



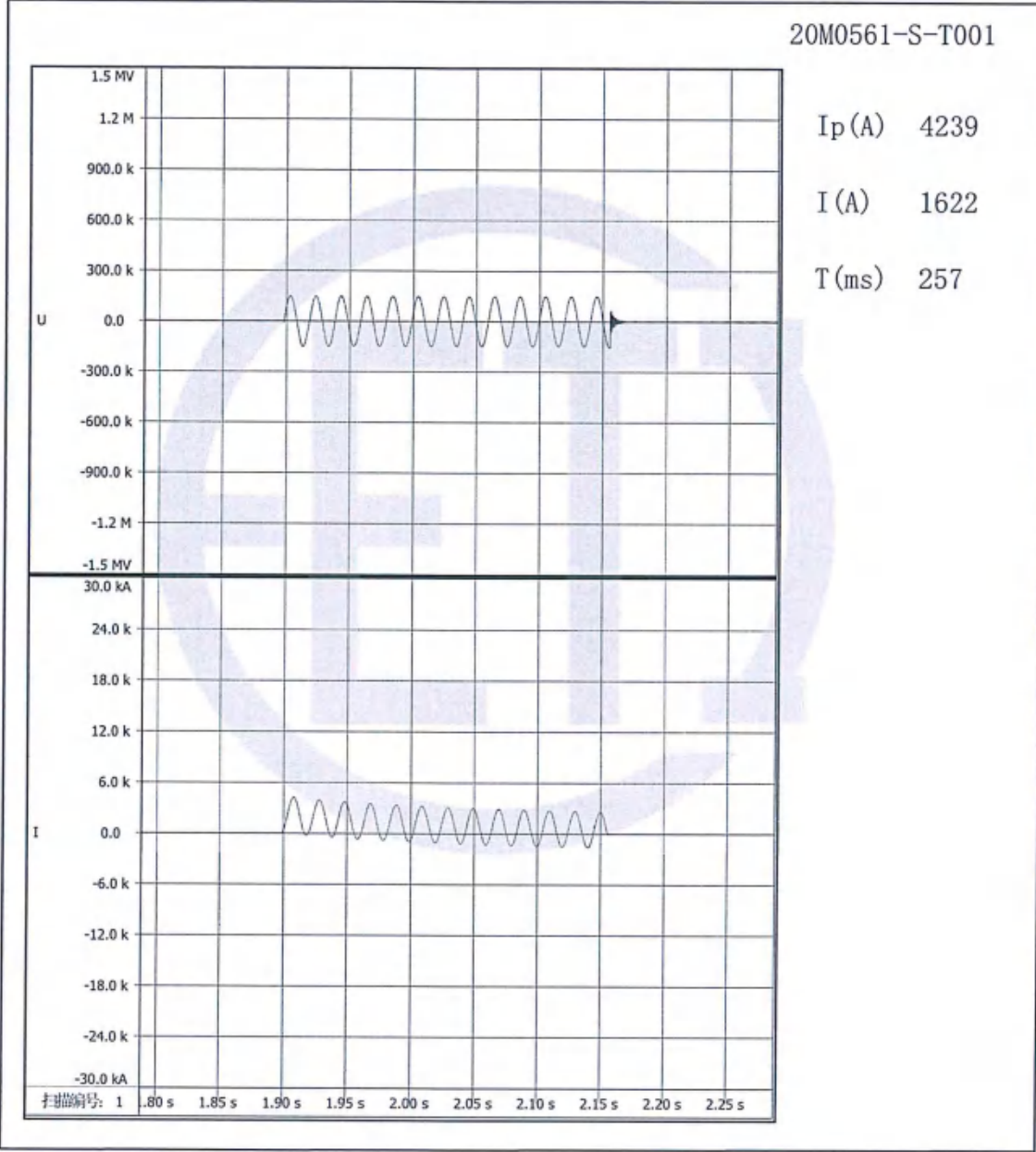
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4.19 Short-circuit withstand test (special test)						Test date: Apr. 17, 2020		
Single-phase supply should be used, and test voltage shall be supplied between HV line terminal and the other two line terminals connected together. HV neutral point is earthed, LV is connected by short-circuit and earthed and the test bushing tap is earthed. The test oscillogram shall be normal. For the test oscillogram, see P ₂₂₋₃₀ . The percentages of peak current and symmetrical current are the ratio of applied current to calculated current								
4.19.1 Current calculation of short-circuit test (reference temperature 75℃)								
Tapping position		Symmetrical current value of phase (A)		Peak current value of phase (A)		Peak coefficient ($K\sqrt{2}$)		
1		1699		4332		2.550		
9b		1877		4786		2.550		
17		2099		5352		2.550		
4.19.2 Current injection of short-circuit test								
Tapping position	Phase of peak current injection	Times	Measurement of current					Oscillogram No
			Symmetrical current value of phase		Peak current value of phase		Duration (s)	
			Measured values (A)	(%)	Measured values (A)	(%)		
1	A-BC	The first test	1622	95.47	4239	97.85	0.257	20M0561-S-T001
		The second test	1668	98.18	4347	100.35	0.257	20M0561-S-T002
		The third test	1650	97.12	4315	99.61	0.257	20M0561-S-T003
		Times	Measurement of reactance					
			Reactance values of phase (Ω)			Reactance variation of phase (%)		
			A	B	C	A	B	C
		Before tests	38.012	38.483	39.271	/	/	/
		The first test	38.051	38.486	39.267	0.10	0.01	-0.01
		The second test	38.107	38.491	39.271	0.25	0.02	0.00
		The third test	38.151	38.496	39.276	0.37	0.03	0.01
The maximum reactance variation of phase is 0.37%.								

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Tapping position	Phase of peak current injection	Times	Measurement of current					
			Symmetrical current value of phase		Peak current value of phase		Duration (s)	Oscillogram No
			Measured values (A)	(%)	Measured values (A)	(%)		
9b	B-CA	The first test	1818	96.86	4713	98.47	0.257	20M0561-S-T004
		The second test	1829	97.44	4752	99.29	0.257	20M0561-S-T005
		The third test	1844	98.24	4813	100.56	0.257	20M0561-S-T006
		Times	Measurement of reactance					
			Reactance values of phase (Ω)			Reactance variation of phase (%)		
			A	B	C	A	B	C
		Before tests	31.212	31.843	31.661	/	/	/
		The first test	31.332	31.886	31.667	0.38	0.14	0.02
		The second test	31.335	31.941	31.672	0.39	0.31	0.04
		The third test	31.340	32.003	31.677	0.41	0.50	0.05
The maximum reactance variation of phase is 0.50%.								

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Tapping position	Phase of peak current injection	Times	Measurement of current					
			Symmetrical current value of phase		Peak current value of phase		Duration (s)	Oscillogram No
			Measured values (A)	(%)	Measured values (A)	(%)		
17	C-AB	The first test	2043	97.33	5328	99.55	0.257	20M0561-S-T007
		The second test	2019	96.19	5267	98.41	0.257	20M0561-S-T008
		The third test	2087	99.43	5414	101.16	0.257	20M0561-S-T009
		Times	Measurement of reactance					
			Reactance values of phase (Ω)			Reactance variation of phase (%)		
			A	B	C	A	B	C
		Before tests	24.362	25.364	25.270	/	/	/
		The first test	24.468	25.494	25.349	0.44	0.51	0.31
		The second test	24.472	25.498	25.399	0.45	0.53	0.51
		The third test	24.477	25.501	25.440	0.47	0.54	0.67
The maximum reactance variation of phase is 0.67%.								
4.19.3 The out-of-tank inspection					Test date: Apr. 16, 2020 and Apr. 19, 2020			
The out-of-tank inspection does not reveal any obvious distortion and displacement of coil, lead and supporting structures after the short-circuit test and no traces of discharge are found. For the pictures before and after the short-circuit test, see P ₅₉₋₆₀ .								

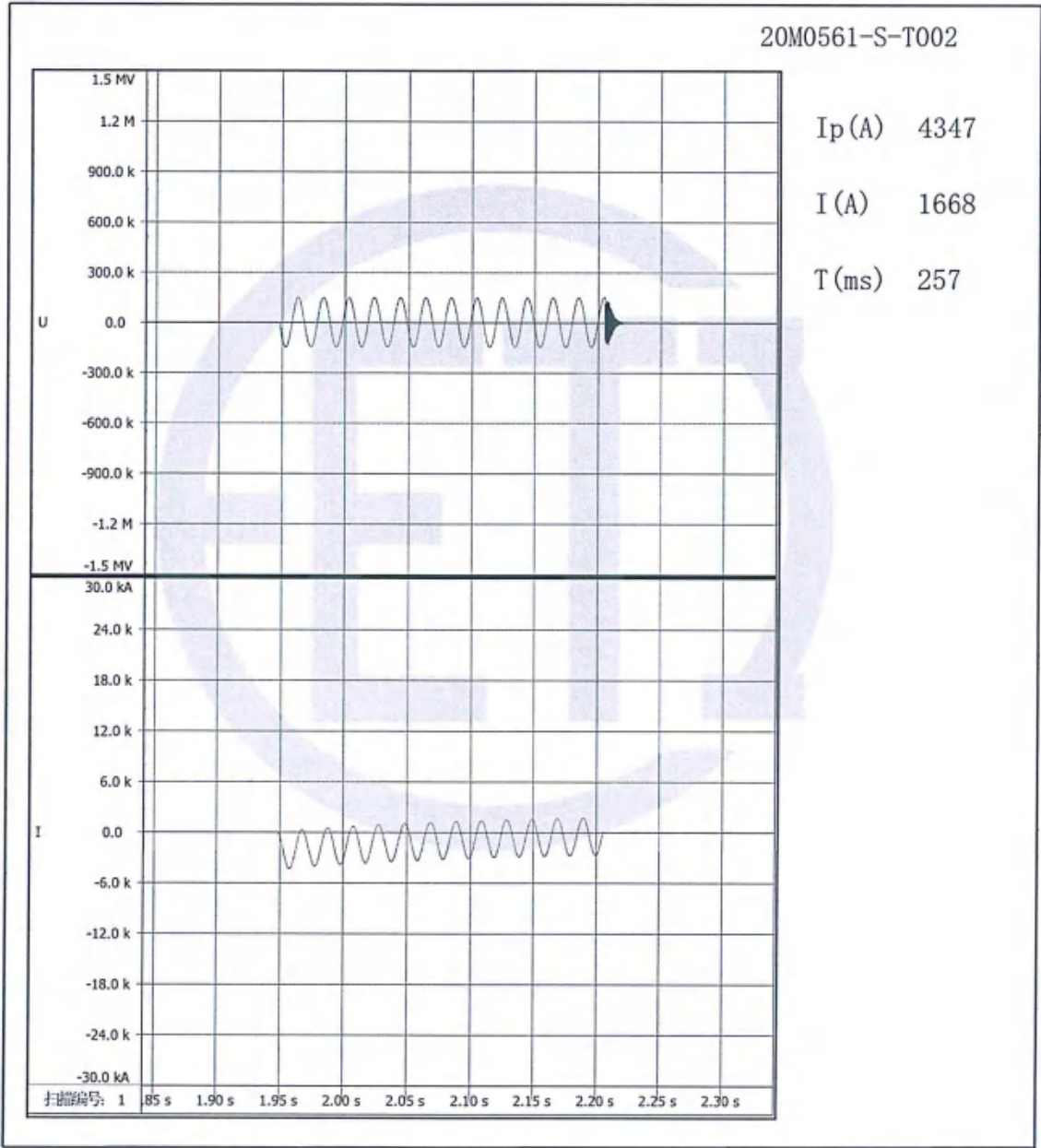
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Oscillogram



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Oscillogram

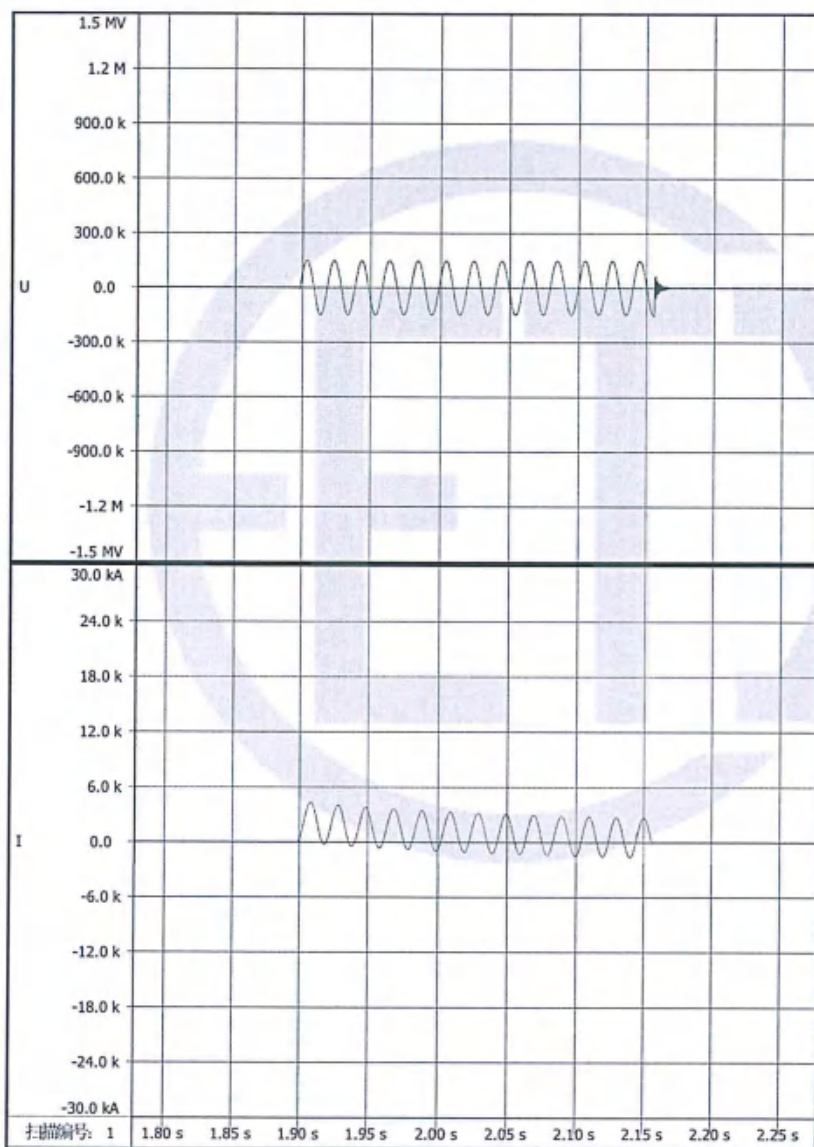


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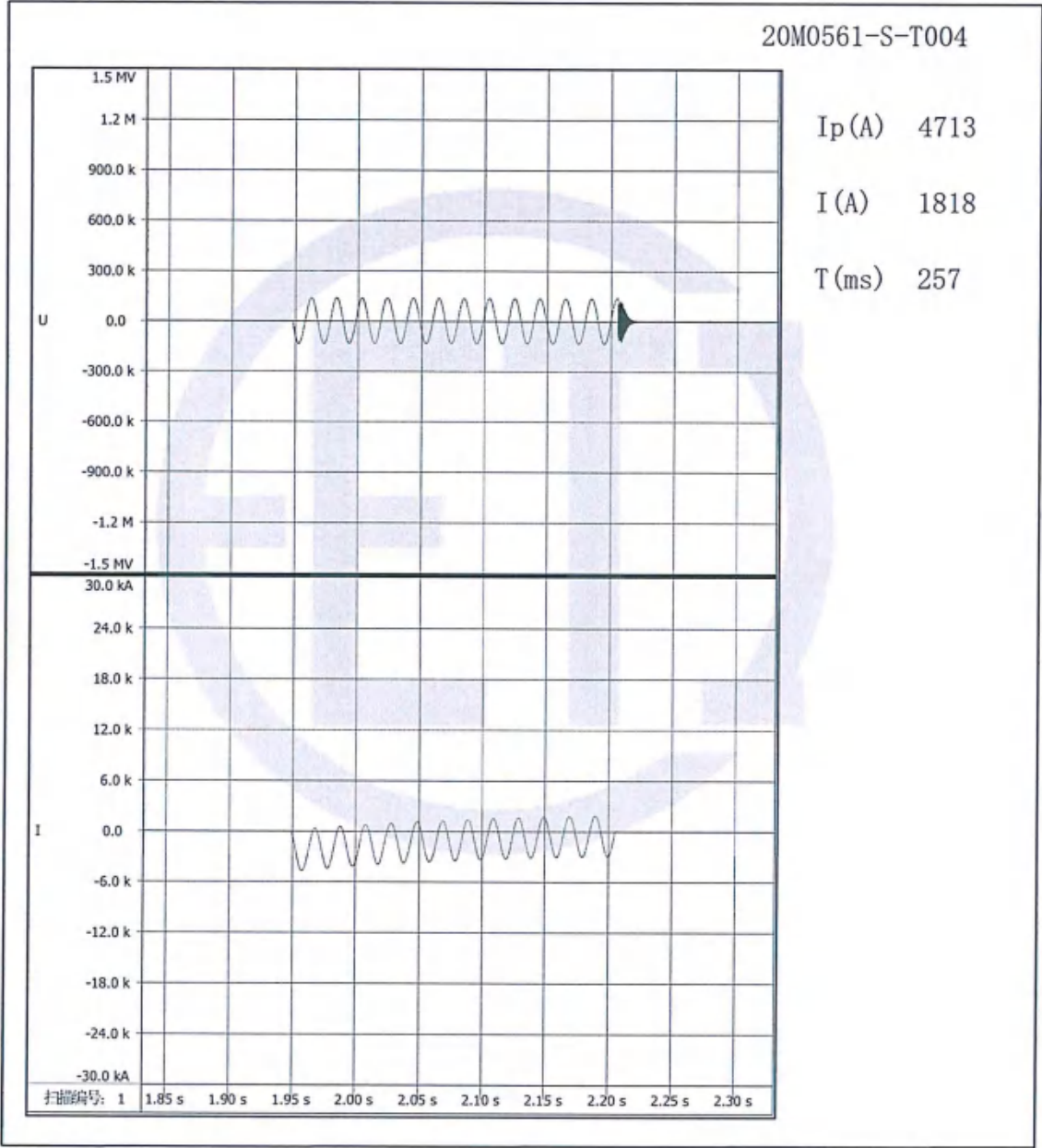
Oscillogram

20M0561-S-T003



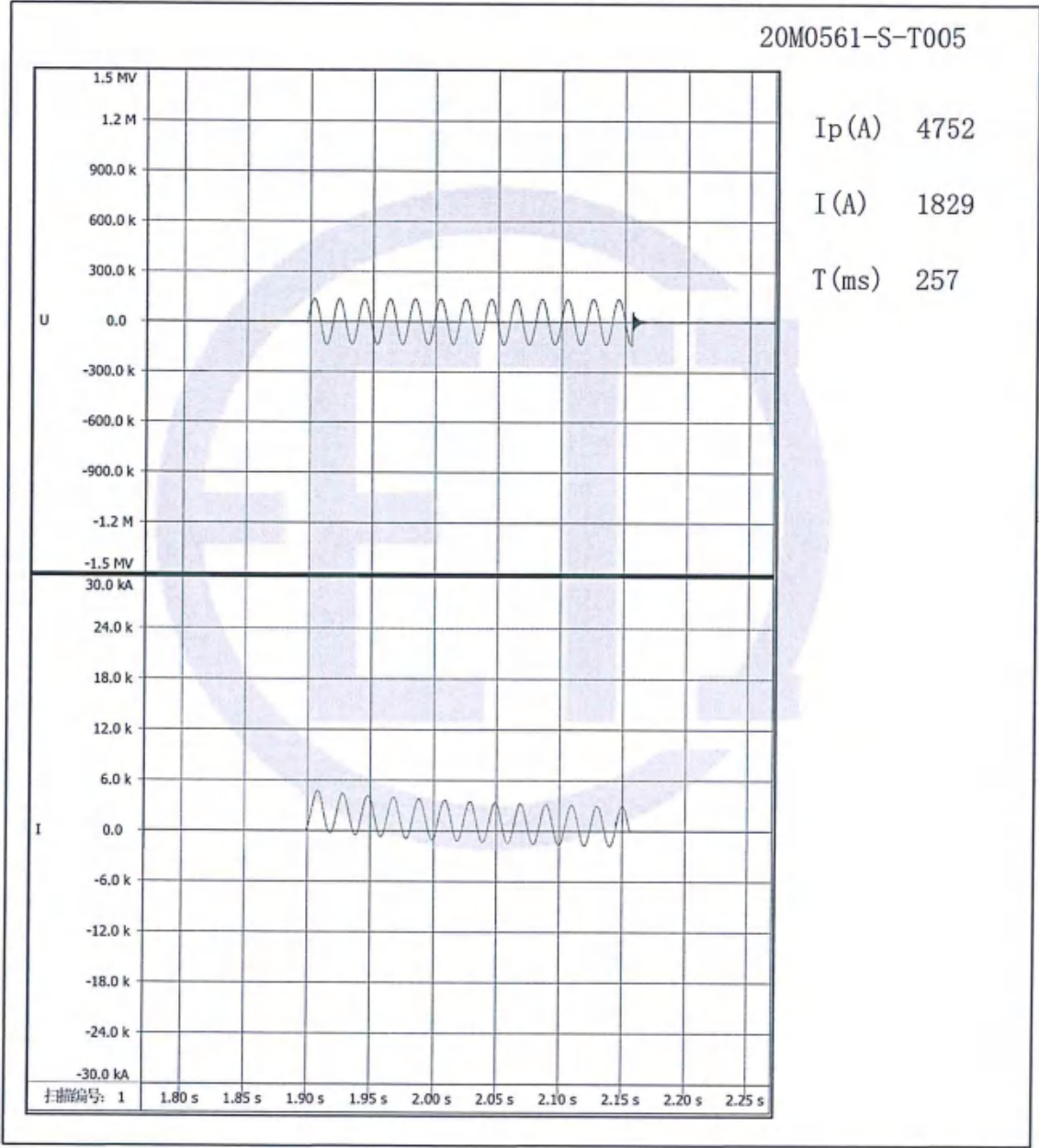
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Oscillogram



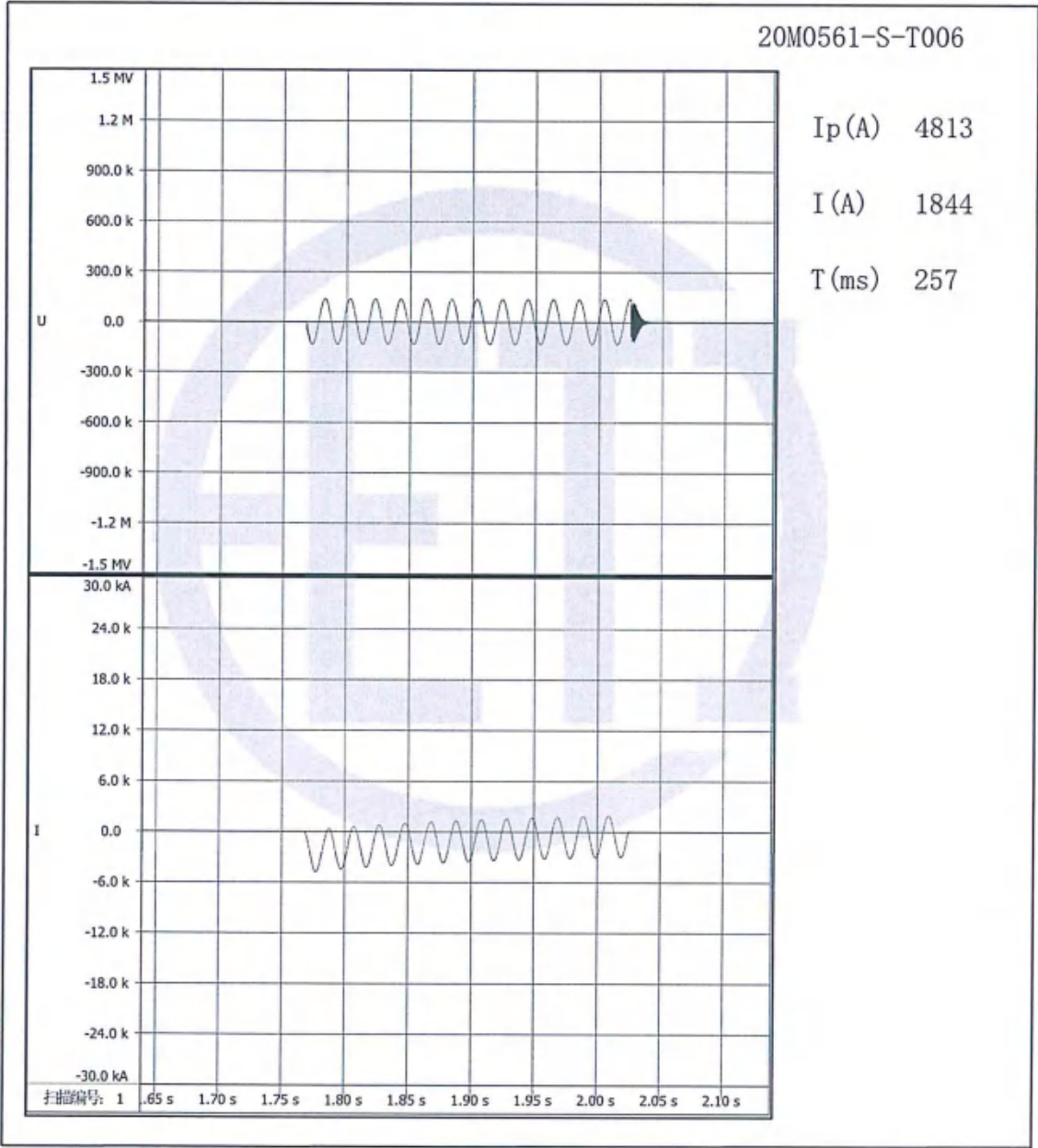
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Oscillogram



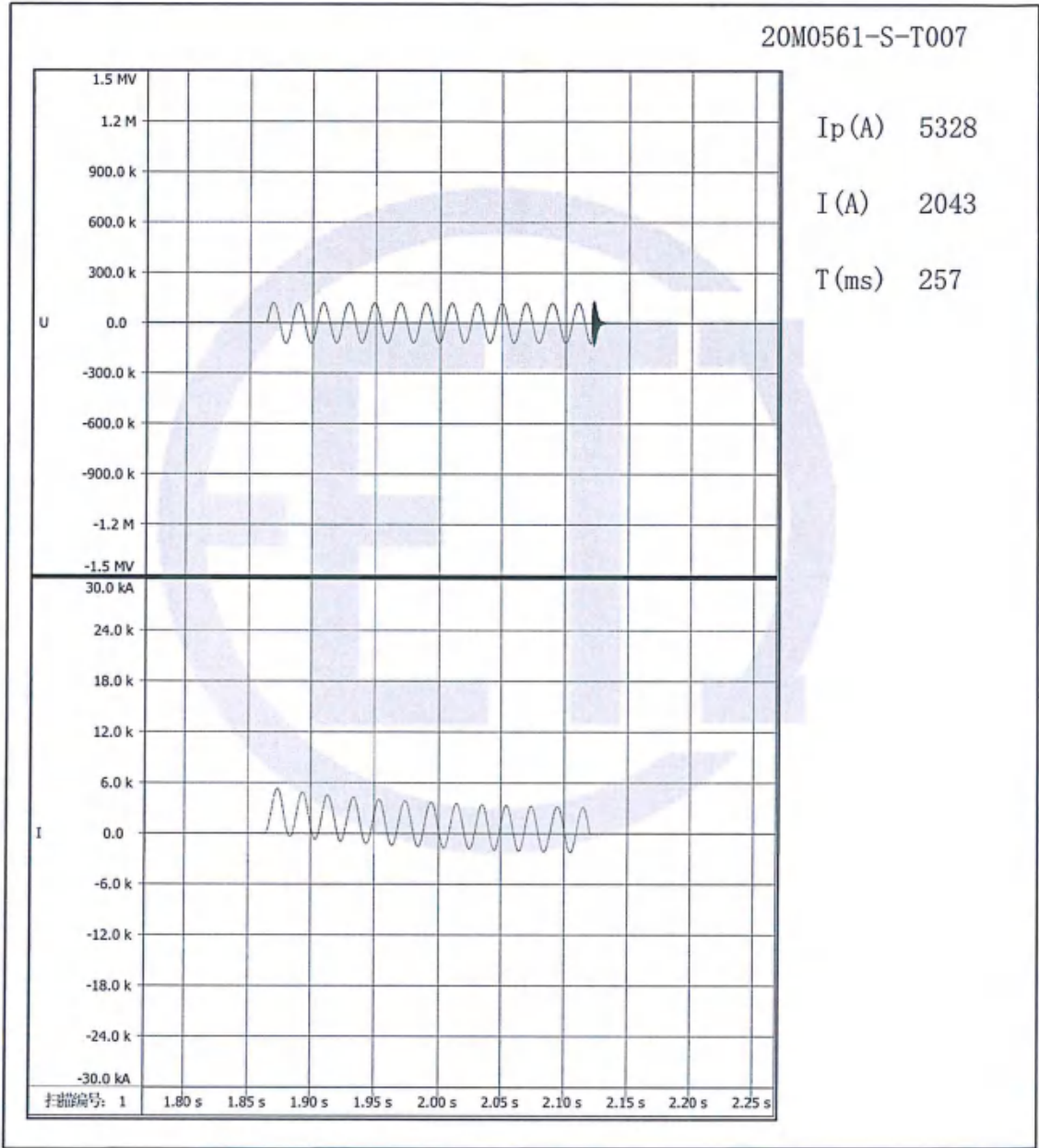
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Oscillogram



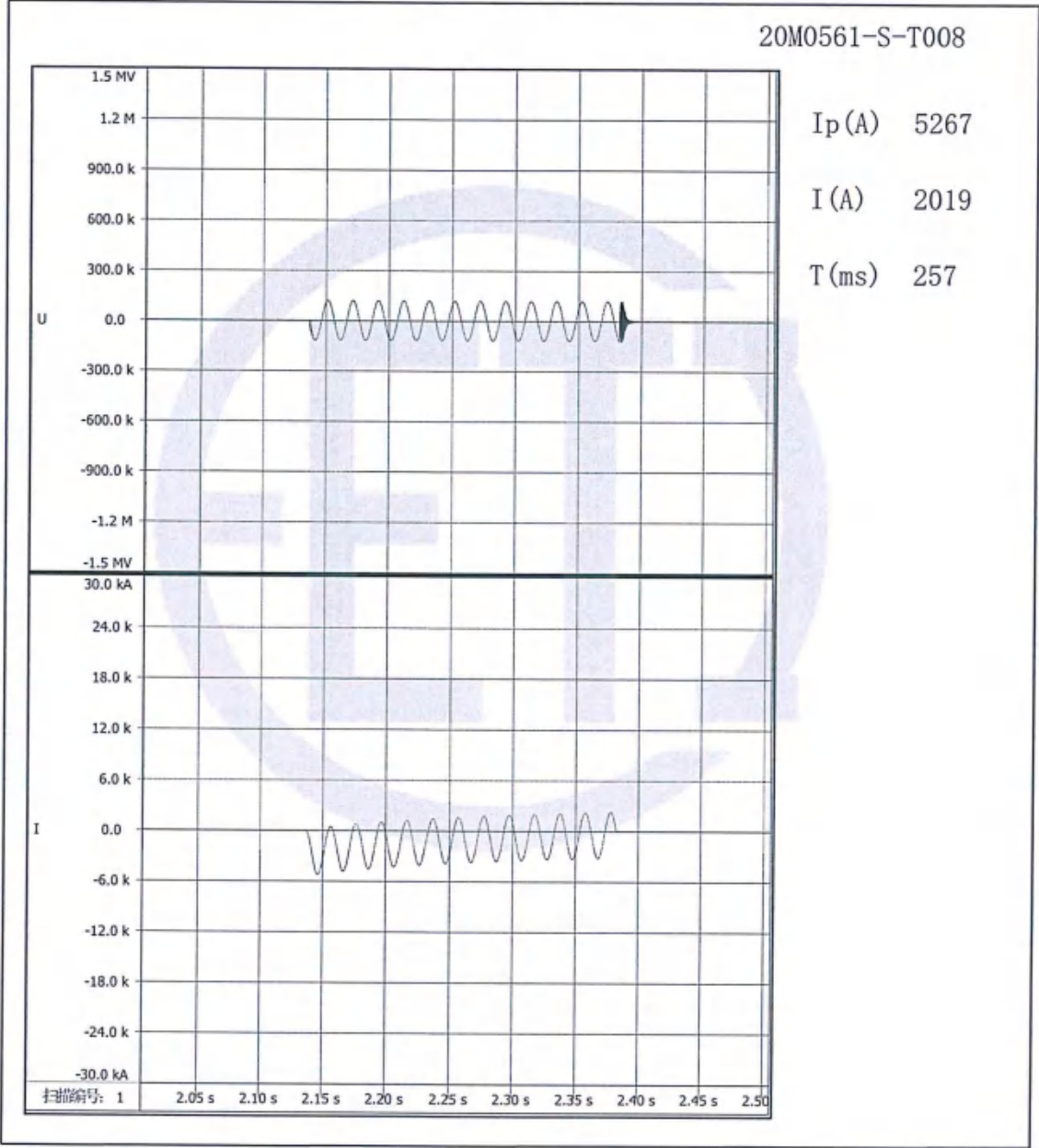
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Oscillogram



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Oscillogram

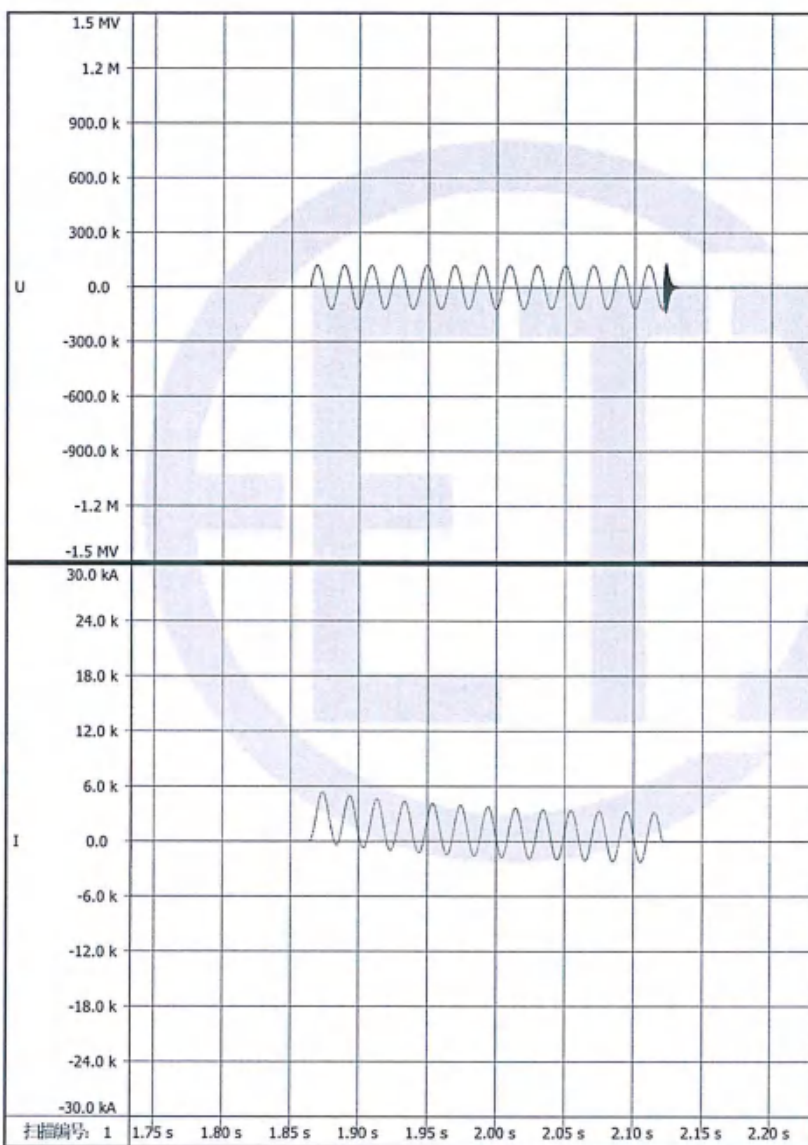


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Oscillogram

20M0561-S-T009



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4.19.4 Routine retests					
4.19.4.1 Measurement of d.c. insulation resistance windings-to-earth and between windings (routine test)					
Test date: Apr. 19, 2020 Relative humidity: 49%; Oil temperature: 21.3 °C					
Measured parts	R ₁₅ (GΩ)	R ₆₀ (GΩ)	R ₆₀₀ (GΩ)	Absorption ratio (R ₆₀₀ /R ₁₅)	Polarity index (R ₆₀₀ /R ₆₀)
HV—LV and earth	28.6	38.9	53.2	1.36	1.37
LV—HV and earth	23.4	37.1	55.1	1.58	1.48
HV, LV—earth	13.2	20.5	32.2	1.55	1.57
HV—LV	36.2	48.8	79.5	1.55	1.63
4.19.4.2 Check of core and frame insulation for liquid-immersed transformers with core or frame insulation (routine test)					
Test date: Apr. 19, 2020 Relative humidity: 49%; Oil temperature: 21.3 °C					
Measured parts	Measured insulation resistance (GΩ)		Insulation resistance corrected to 20 °C (GΩ)		
Core—earth	10.9		11.5		
Frame—earth	13.5		14.2		
Core—frame	10.3		10.9		
4.19.4.3 Measurement of dissipation factor (tanδ) of the insulation system capacitances (routine test)					
Test date: Apr. 19, 2020 Relative humidity: 49%; Oil temperature: 21.3 °C					
Measured parts	Dielectric dissipation factor tanδ(%)		Capacitance (pF)		
HV—LV and earth	0.35		11080		
LV—HV and earth	0.33		17730		
HV, LV—earth	0.38		19340		
HV—LV	0.34		14530		
4.19.4.4 Determination of capacitances windings-to-earth and between windings (routine test)					
Test date: Apr. 19, 2020					
See 4.19.4.3					

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4.19.4.5 Measurement of bushing capacitances and dielectric dissipation factor ($\tan\delta$) (commission test) Test date: Apr. 19, 2020 Relative humidity: 49%; Oil temperature: 21.1 °C					
Measured contents	Applied voltage	Measured parts			
		A	B	C	O
$\tan\delta(\%)$	10kV	0.34	0.33	0.34	0.34
Measured capacitance (pF)		298.2	298.4	297.3	350.1
4.19.4.6 Check the ratio and polarity of built-in current transformers (routine test) Test date: Apr. 19, 2020 Relative humidity: 49%; Oil temperature: 21.1 °C					
Measured winding	A	B	C	O	
	P1-P2	P1-P2	P1-P2	P1-P2	
Ratio	40.17	40.03	39.97	39.96	
polarity	-	-	-	-	
4.19.4.7 Insulation test of auxiliary wiring (routine test) Test date: Apr. 19, 2020 Relative humidity: 48%; Ambient temperature: 20.0 °C; Oil temperature: 20.2 °C; Air pressure: 102kPa					
Parts of applied voltage		Test voltage (kV)	Test duration (s)	Result	
Wring for auxiliary power and control circuit	On-load tapping power	2.0	60	PASS	
Wring for secondary winding of current transformer	A	2.5	60	PASS	
	B	2.5	60	PASS	
	C	2.5	60	PASS	
	O	2.5	60	PASS	

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4.19.4.8 Measurement of voltage ratio and check of phase displacement (routine test) Test date: Apr. 19, 2020								
HV winding		LV winding		Transformer ratio by calculation	Measured voltage ratio tolerance (%)			Connection symbol
Tapping position	Voltage (kV)	Tapping position	Voltage (kV)		AB/ab	BC/bc	CA/ca	
1	121.000	/	10.5	11.524	0.18	0.11	0.10	YNd11
2	119.625			11.393	0.07	0.13	0.05	
3	118.250			11.262	0.14	0.06	0.12	
4	116.875			11.131	0.07	0.04	-0.15	
5	115.500			11.000	-0.02	-0.05	-0.10	
6	114.125			10.869	0.05	0.13	-0.02	
7	112.750			10.738	0.06	0.03	0.08	
8	111.375			10.607	0.10	-0.06	-0.03	
9b	110.000			10.476	0.03	0.10	0.07	
10	108.625			10.345	0.06	-0.10	0.08	
11	107.250			10.214	0.01	0.13	0.05	
12	105.875			10.083	-0.10	-0.12	0.12	
13	104.500			9.952	-0.08	-0.10	-0.10	
14	103.125			9.821	-0.06	-0.11	-0.10	
15	101.750			9.690	0.07	0.15	0.11	
16	100.375			9.560	0.17	0.15	0.13	
17	99.000			9.429	0.09	-0.04	0.10	

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4.19.4.9 Measurement of winding resistance (routine test)					Test date: Apr. 19, 2020 Oil temperature: 19.7℃
Winding	Tapping position	Measured values (Ω)			Resistance unbalance rate (%)
		A~O a~b	B~O b~c	C~O c~a	
HV	1	0.32250	0.32284	0.32328	0.24
	2	0.31752	0.31797	0.31846	0.30
	3	0.31301	0.31324	0.31378	0.25
	4	0.30784	0.30811	0.30842	0.19
	5	0.30344	0.30375	0.30403	0.20
	6	0.29966	0.29987	0.30019	0.18
	7	0.29383	0.29417	0.29433	0.17
	8	0.29093	0.29121	0.29183	0.31
	9b	0.28247	0.28274	0.28306	0.21
	10	0.28913	0.28941	0.28970	0.20
	11	0.29403	0.29425	0.29453	0.17
	12	0.29907	0.29922	0.29950	0.14
	13	0.30376	0.30409	0.30451	0.24
	14	0.30822	0.30845	0.30878	0.18
	15	0.31249	0.31275	0.31301	0.17
	16	0.31688	0.31706	0.31734	0.14
	17	0.32173	0.32196	0.32239	0.20
LV	/	3.5325×10 ⁻³	3.5366×10 ⁻³	3.5463×10 ⁻³	0.39

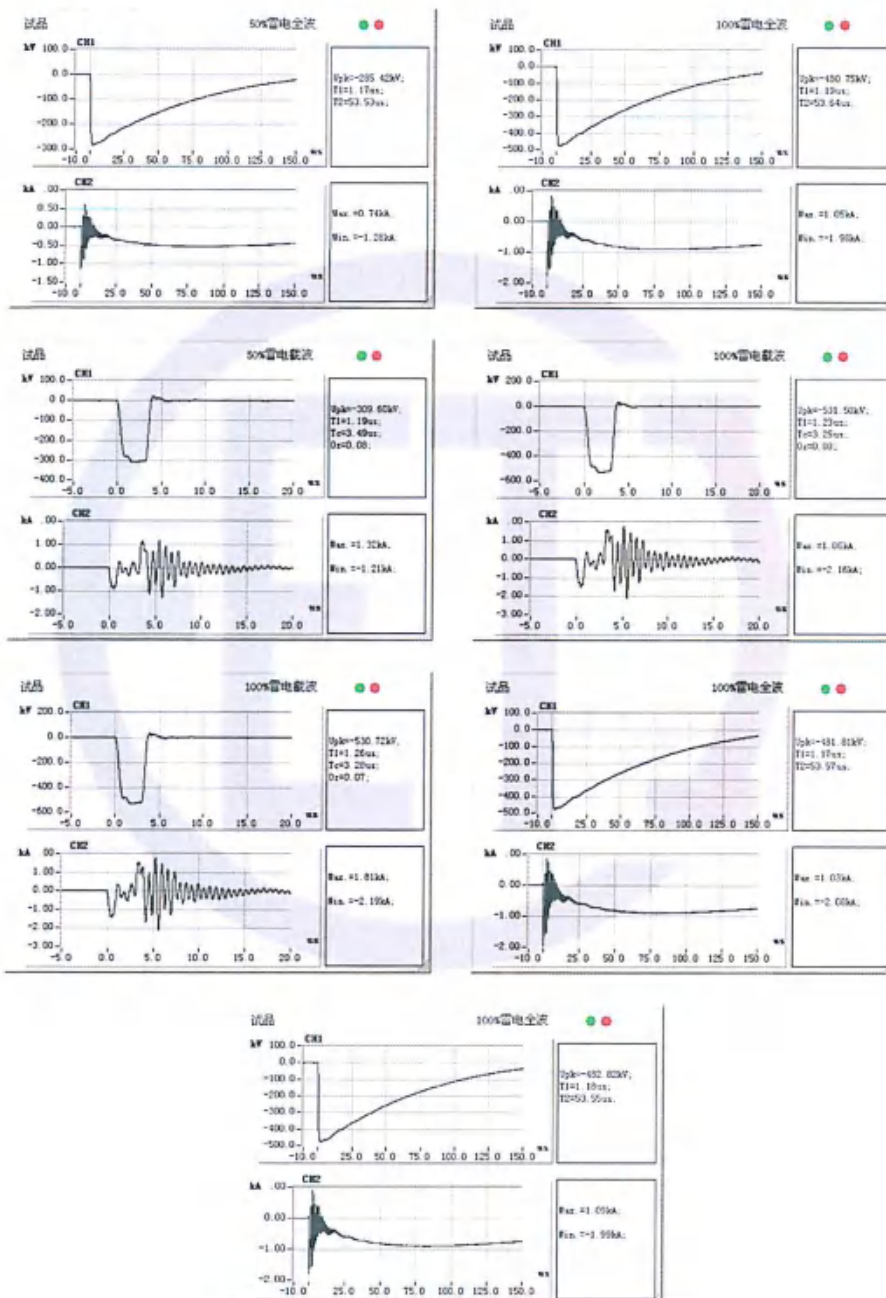
Test Report	China National Center for Quality Supervision and Test of Electrical Apparatus Products				№: 20M0561-S Total 68 Page 35			
4.19.4.10 Measurement of no-load loss and current (routine test)					Test date: Apr. 19, 2020			
Applied voltage	r.m.s. voltage (kV)		No-load current		No-load loss (kW)			
	Average voltmeter reading	r.m.s. voltmeter reading	(A)	(%)	Measured values	Corrected value		
100%Ur	10.508	10.515	5.11	0.15	43.724	43.695		
90%Ur	9.456	9.461	4.02	0.12	35.409	35.390		
110%Ur	11.552	11.564	17.23	0.50	69.411	69.343		
Remarks: the difference between r.m.s voltmeter reading and average voltmeter reading is within 3%.								
4.19.4.11 Measurement of short-circuit impedance and load loss (routine test)					Test date: Apr. 19, 2020 Oil temperature: 19.7°C			
Winding	Tapping position	Applied current I		Measured voltage (kV)	Short-circuit impedance (for each phase)		Load loss (kW)	Total loss (kW)
		(A)	I/Ir (%)		HV impedance (Ω)	(%)	Corrected value	Corrected value
					t=75°C I=Ir	t=75°C I=Ir	t=75°C I=Ir	t=75°C I=Ir
HV LV	1	165.37	55.01	11.415	39.86	17.15	207.982	251.677
	9b	189.73	57.38	10.693	32.54	16.94	215.330	259.025
	17	202.44	55.10	9.088	25.92	16.66	248.866	292.561
4.19.4.12 Tests on on-load tap-changers (routine test)					Test date: Apr. 19, 2020			
Operation tests:								
a. with the transformer de-energized, eight complete cycles of operation (a cycle of operation goes from one end of the tapping range to the other, and back again);								
b. with the transformer de-energized, and with the auxiliary voltage reduced to 85 % of its rated value, one complete cycle of operation;								
c. with the transformer energized at rated voltage and frequency at no load, one complete cycle of operation;								
d. with one winding short-circuited and, as far as practicable, rated current in the tapped winding, 10 cycles of tap-change operations across the range of two steps on each side from where a coarse or reversing changeover selector operates, or otherwise from the middle tapping (the tapchanger will pass 20 times through the changeover position).								
Test result: PASS								

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4.19.4.13 Lightning impulse test (routine test, type test) Test date: Apr. 20, 2020			
Atmospheric conditions of test: Relative humidity: 59%; Ambient temperature: 18.9℃; Oil temperature: 18.8℃; Air pressure: 102kPa.			
Test items and voltage			
Withstand terminals	Rated withstand voltage (kV)		Tapping position
	Lightning full wave	Lightning chopped wave	
A, B, C	480	530	A:1; B:9b; C:17
O	325	/	1
a, b, c	75	85	/
Test sequence: Line terminal One negative reduced level full impulse; One negative rated level full impulse; One negative reduced level chopped impulse; Two negative rated level chopped impulse; Two negative rated level full impulse. Neutral point: One negative reduced level full impulse; Three negative rated level full impulse. Test records: T1: wave front time, T2: time to half peak value, Tc: chopped wave time, Up: peak voltage. For waveform diagram, see P ₃₇ ~P ₄₃ . Voltage ranges of oscillograms are as below:			
Withstand terminals	Full wave (kV)	Chopped wave (kV)	
A, B, C	478.02~4882.82	530.72~533.28	
O	324.47~325.93	/	
a, b, c	74.96~76.12	84.36~86.82	

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Tested terminal: A Test polarity: negative Channel 1: voltage wave Channel 2: current wave



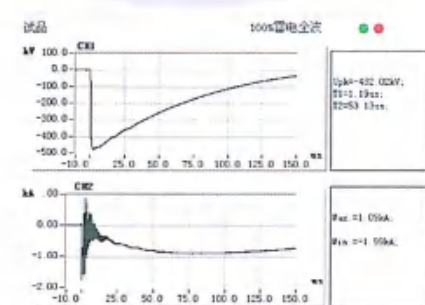
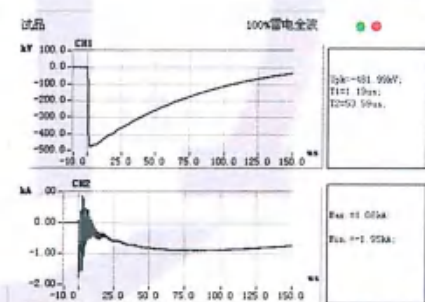
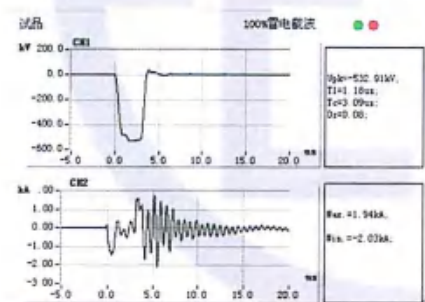
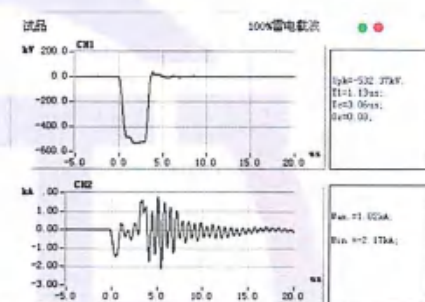
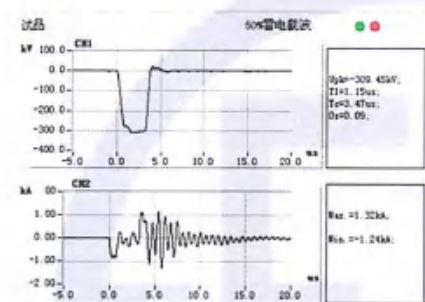
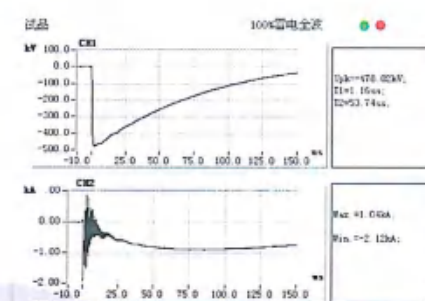
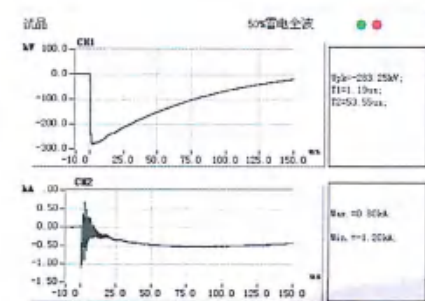
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Tested terminal: B Test polarity: negative Channel 1: voltage wave Channel 2: current wave

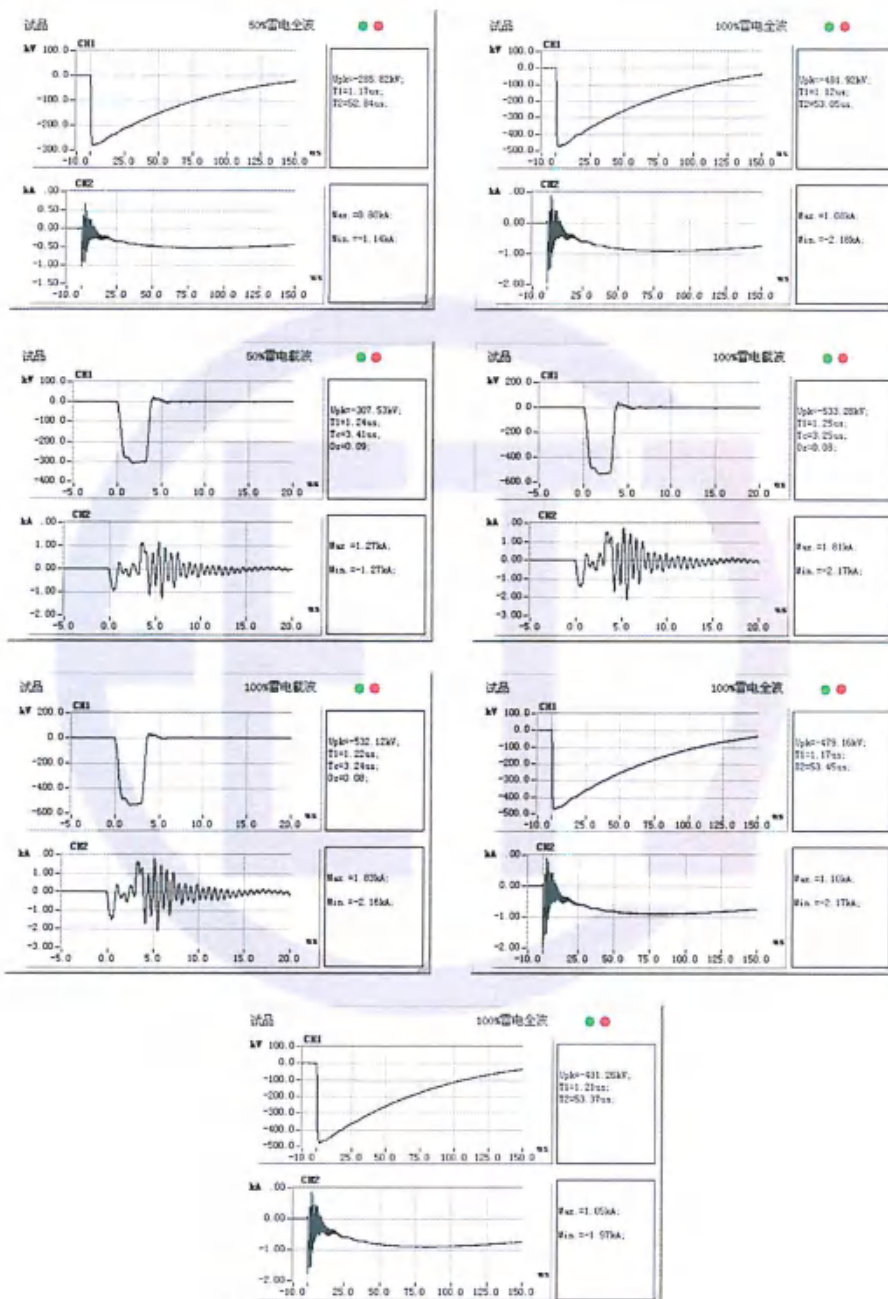


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Tested terminal: C Test polarity: negative Channel 1: voltage wave Channel 2: current wave



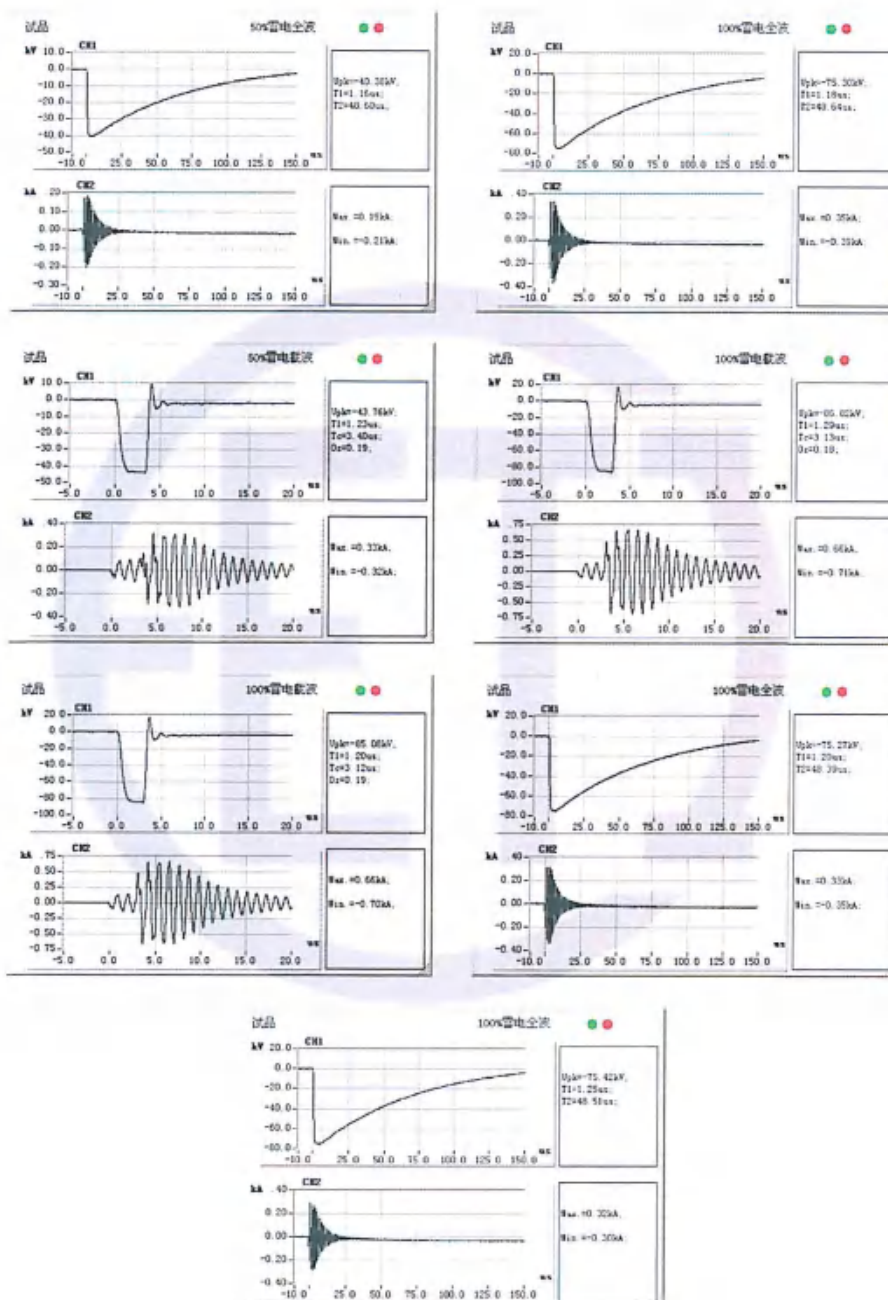
Test Report	China National Center for Quality Supervision and Test of Electrical Apparatus Products	№: 20M0561-S Total 68 Page 40
Tested terminal: O Test polarity: negative Channel 1: voltage wave Channel 2: current wave		
试品 50%雷电全波 Channel 1: $U_{pk} = -200.0kV$, $T_1 = 1.54\mu s$, $T_2 = 54.00\mu s$ Channel 2: $I_{pk} = 0.44kA$, $I_{in} = 0.42kA$ 试品 100%雷电全波 Channel 1: $U_{pk} = -224.0kV$, $T_1 = 1.56\mu s$, $T_2 = 54.29\mu s$ Channel 2: $I_{pk} = 0.60kA$, $I_{in} = 0.52kA$ 试品 100%雷电全波 Channel 1: $U_{pk} = -225.0kV$, $T_1 = 1.54\mu s$, $T_2 = 53.94\mu s$ Channel 2: $I_{pk} = 0.72kA$, $I_{in} = 0.61kA$ 试品 100%雷电全波 Channel 1: $U_{pk} = -224.47kV$, $T_1 = 1.57\mu s$, $T_2 = 53.25\mu s$ Channel 2: $I_{pk} = 0.63kA$, $I_{in} = 0.52kA$		

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Tested terminal: a Test polarity: negative Channel 1: voltage wave Channel 2: current wave



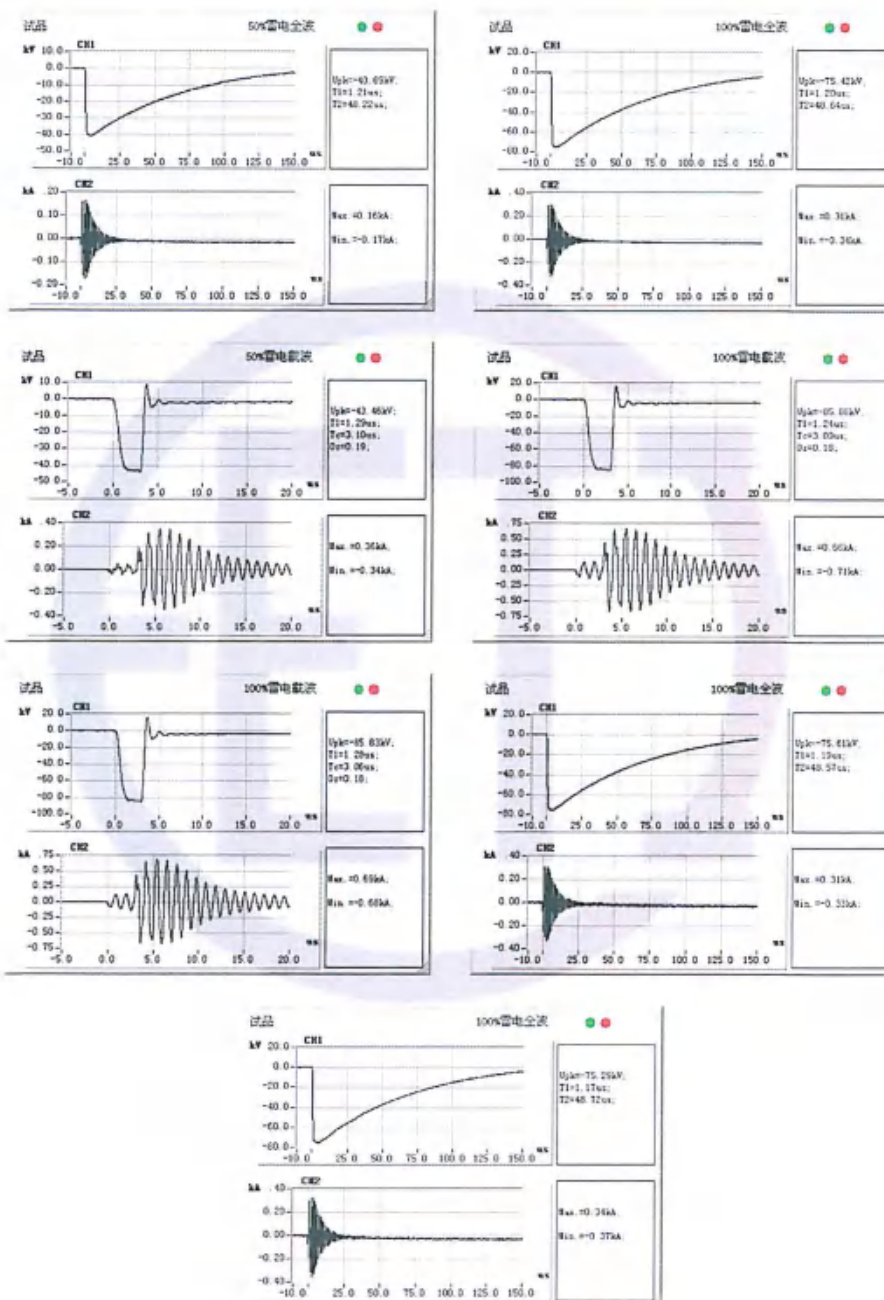
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Tested terminal: b Test polarity: negative Channel 1: voltage wave Channel 2: current wave



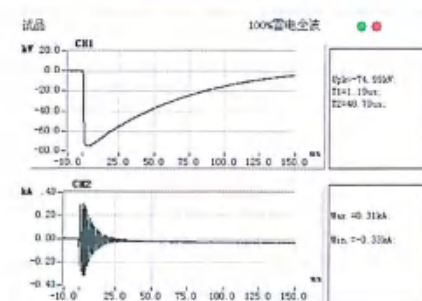
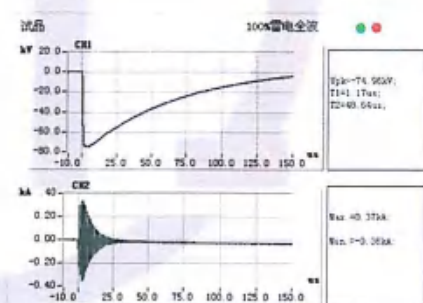
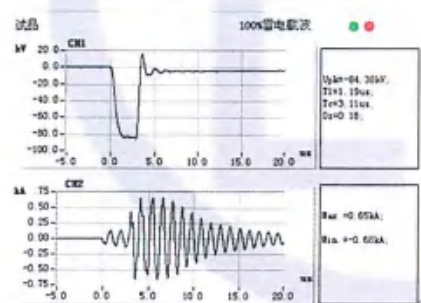
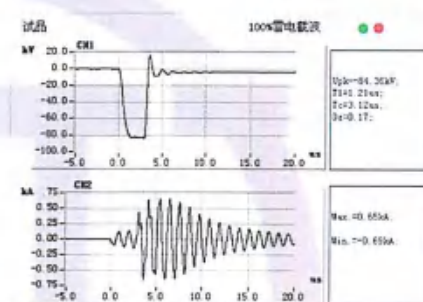
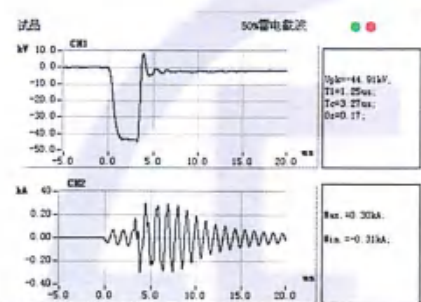
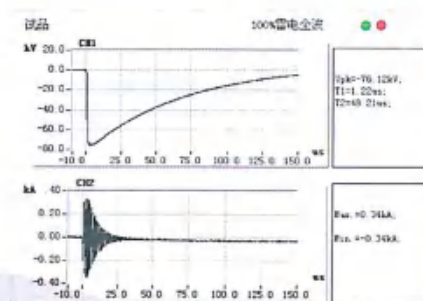
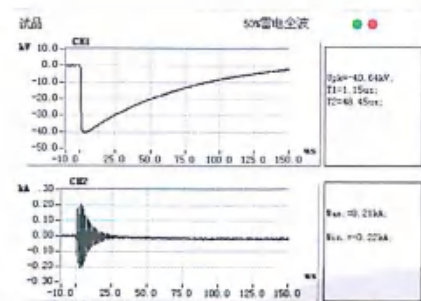
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Tested terminal: c Test polarity: negative Channel 1: voltage wave Channel 2: current wave



Test Report	China National Center for Quality Supervision and Test of Electrical Apparatus Products				№: 20M0561-S Total 68 Page 44		
4.19.4.14 Separate-source AC withstand voltage test (routine test) Relative humidity: 59%; Ambient temperature: 18.9℃; Oil temperature: 18.8℃; Air pressure: 102kPa							
Test date: Apr. 20, 2020							
Parts of applied voltage		Test voltage (kV)		Test duration (s)		Result	
HV neutral point—LV and earth		140.0		60		PASS	
LV—HV and earth		35.0		60			
4.19.4.15 Line terminal AC withstand test (routine test) Relative humidity: 59%; Ambient temperature: 18.9℃; Oil temperature: 18.8℃; Air pressure: 102kPa Phase to earth test							
Parts of applied voltage	Tapping position	Applied voltage (kV)	Induced voltage (kV)		Frequency (Hz)	Test duration (s)	Result
		LV	HV				
a-c	5	21.0	A	200.0	200	30	PASS
a-b		21.0	B	200.0			
b-c		21.0	C	200.0			

Test Report		China National Center for Quality Supervision and Test of Electrical Apparatus Products		№: 20M0561-S Total 68 Page 45	
4.19.4.16 Induced AC withstand voltage test and induced AC withstand voltage test with partial discharge measurement (routine test) Test date: Apr. 20, 2020 Relative humidity: 59%; Ambient temperature: 18.9℃; Oil temperature: 18.8℃; Air pressure: 102kPa HV tapping position is 9b, frequency is 200Hz.					
Applied voltage		Duration (min)	Partial discharge magnitude (pC)		
Multiple	Phase to earth voltage (kV)		A	B	C
$0.4U_r/\sqrt{3}$	25.4	/	<16	<17	<18
$1.2U_r/\sqrt{3}$	76.2	1	<47	<40	<45
$1.58U_r/\sqrt{3}$	100.3	5	<85	<87	<89
$2.0U_r/\sqrt{3}$	127.1	0.5	/	/	/
$1.58U_r/\sqrt{3}$	100.3	5	<84	<87	<87
		10	<84	<87	<87
		15	<84	<87	<87
		20	<84	<87	<87
		25	<85	<86	<87
		30	<85	<86	<87
		35	<85	<86	<88
		40	<85	<86	<88
		45	<85	<86	<88
		50	<84	<86	<88
		55	<84	<86	<88
		60	<84	<86	<88
$1.2U_r/\sqrt{3}$	76.2	1	<45	<42	<42
$0.4U_r/\sqrt{3}$	25.4	/	<15	<15	<17
Remarks: $U_r=110\text{kV}$.					

Test Report	China National Center for Quality Supervision and Test of Electrical Apparatus Products	No: 20M0561-S Total 68 Page 46						
4.19.4.17 Insulating liquid test, measurement of dissolved gasses in dielectric liquid from each separate oil compartment except diverter switch compartment (routine test) Test date: Apr. 19, 2020 Relative humidity: 61%; Ambient temperature: 20.0℃ <table border="1"> <tr> <td>Dielectric dissipation factor(90℃)</td> <td>Breakdown voltage (kV)</td> <td>Water content (mg/L)</td> </tr> <tr> <td>0.36%</td> <td>58.1</td> <td>9.8</td> </tr> </table> Remarks: for measurement of dissolved gasses in dielectric liquid, see 4.17.			Dielectric dissipation factor(90℃)	Breakdown voltage (kV)	Water content (mg/L)	0.36%	58.1	9.8
Dielectric dissipation factor(90℃)	Breakdown voltage (kV)	Water content (mg/L)						
0.36%	58.1	9.8						

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China National Center for Quality Supervision and
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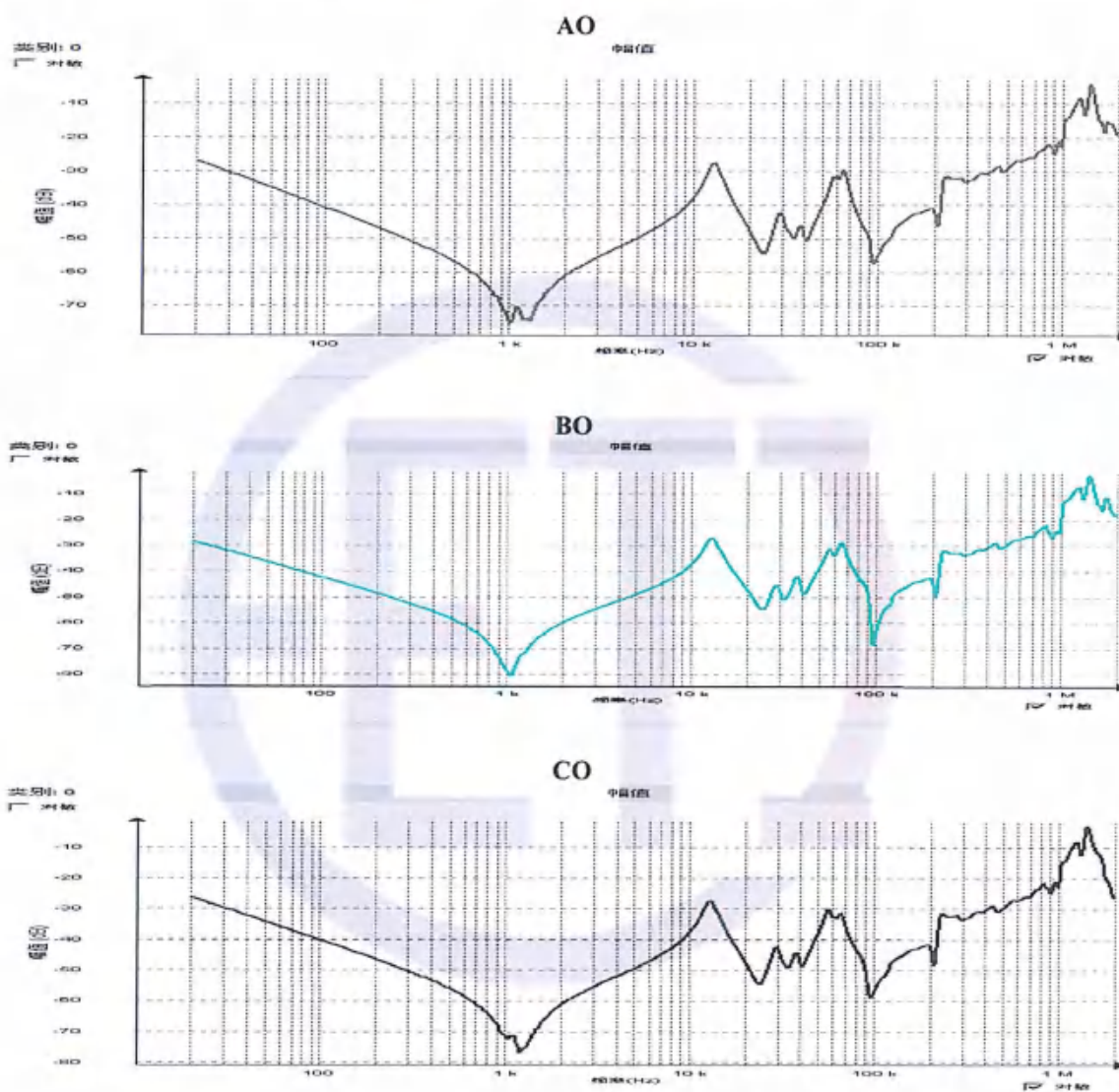
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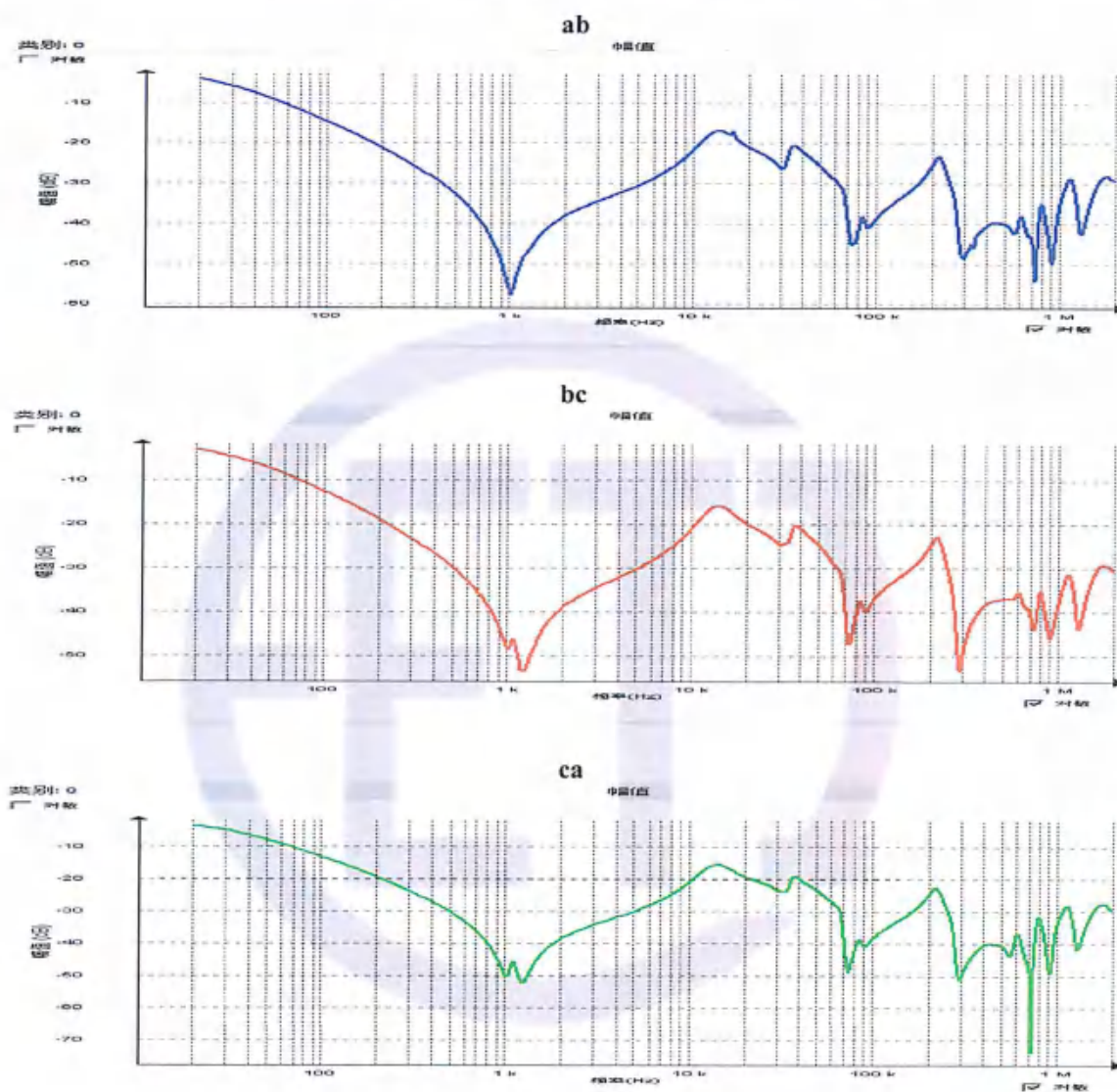
4.19.4.18 Measurement of frequency response (special test)

Test date: Apr. 18, 2020

HV winding frequency response curves after short-circuit test



LV winding frequency response curves after short-circuit test



Test Report	China National Center for Quality Supervision and Test of Electrical Apparatus Products	№: 20M0561-S Total 68 Page 49																						
4.20 Measurement of no-load excitation characteristics (commission test)		Test date: Apr. 21, 2020																						
Voltage	Measured voltage (kV)	Measured current (A)																						
0.50U _r	5.253	2.114																						
0.60U _r	6.304	2.588																						
0.70U _r	7.352	3.045																						
0.80U _r	8.398	3.520																						
0.90U _r	9.452	4.025																						
0.95U _r	9.973	4.515																						
1.00U _r	10.506	5.104																						
1.05U _r	11.029	8.614																						
1.10U _r	11.552	17.231																						
1.15U _r	12.056	35.145																						
Remarks: U _r =10.5kV.																								
No-load excitation characteristic curve																								
<table border="1"><thead><tr><th>Voltage (V)</th><th>Current (A)</th></tr></thead><tbody><tr><td>5253</td><td>2.114</td></tr><tr><td>6304</td><td>2.588</td></tr><tr><td>7352</td><td>3.045</td></tr><tr><td>8398</td><td>3.520</td></tr><tr><td>9452</td><td>4.025</td></tr><tr><td>9973</td><td>4.515</td></tr><tr><td>10506</td><td>5.104</td></tr><tr><td>11029</td><td>8.614</td></tr><tr><td>11552</td><td>17.231</td></tr><tr><td>12056</td><td>35.145</td></tr></tbody></table>			Voltage (V)	Current (A)	5253	2.114	6304	2.588	7352	3.045	8398	3.520	9452	4.025	9973	4.515	10506	5.104	11029	8.614	11552	17.231	12056	35.145
Voltage (V)	Current (A)																							
5253	2.114																							
6304	2.588																							
7352	3.045																							
8398	3.520																							
9452	4.025																							
9973	4.515																							
10506	5.104																							
11029	8.614																							
11552	17.231																							
12056	35.145																							

Test Report		China National Center for Quality Supervision and Test of Electrical Apparatus Products				№: 20M0561-S Total 68 Page 50	
4.21 Long-duration no-load test (special test)						Test date: Apr. 21, 2020	
Test with 1.1 times rated voltage applied on LV side for 12h. No C ₂ H ₂ is found in oil and the content of total hydrocarbon has no obvious variation before and after the test. For gas chromatograph analysis data, see 4.17.							
Duration (h)		Voltage (kV)		Current (A)		No-load loss (kW)	
1		11.553		17.228		69.453	
2		11.554		17.230		69.448	
3		11.552		17.232		69.457	
4		11.551		17.234		69.505	
5		11.553		17.231		69.512	
6		11.552		17.228		69.517	
7		11.552		17.228		69.505	
8		11.551		17.229		69.512	
9		11.553		17.228		69.522	
10		11.558		17.230		69.523	
11		11.557		17.234		69.528	
12		11.559		17.232		69.530	
4.22 Measurement of short-circuit impedance on LV (commission test)						Test date: Apr. 19, 2020 Oil temperature: 19.7°C	
Winding	Tapping position	Applied currentI		Measured voltage (kV)	Short-circuit impedance (for each phase)		
					HV impedance (Ω)	(%)	
		(A)	I/I _r (%)		t=75°C I=I _r	t=75°C I=I _r	
HV LV	1	5.53	1.84	0.3821	39.88	17.16	
	9b	6.79	2.05	0.3816	32.44	16.89	
	17	8.46	2.30	0.3810	26.01	16.72	
4.23 Measurement of zero-sequence impedances on three-phase transformers (special test)						Test date: Apr. 19, 2020	
Connection symbol	Power supply terminal	Open-circuit terminal	Short-circuit terminal	Tapping position	Applied current (A)	Measured voltage (V)	Impedance (Ω)
YNd11	ABC-O	abc	/	9b	105.7	957.2	27.167

Test Report		China National Center for Quality Supervision and Test of Electrical Apparatus Products				№: 20M0561-S Total 68 Page 51	
4.24 Measurement of the harmonics of the no-load current (commission test)					Test date: Apr. 19, 2020		
No	CH-A THD =13.53		CH-B THD =14.44		CH-C THD =12.21		
	In(A)	In/I1(%)	In(A)	In/I1(%)	In(A)	In/I1(%)	
01	5.05	100.00	4.69	100.00	5.58	100.00	
02	0.02	0.35	0.03	0.70	0.03	0.60	
03	0.11	2.24	0.10	2.22	0.10	1.85	
04	0.07	1.45	0.07	1.41	0.10	1.86	
05	0.59	11.60	0.57	12.25	0.61	10.95	
06	0.14	2.73	0.14	2.93	0.12	2.16	
07	0.18	3.55	0.20	4.17	0.05	0.87	
08	0.04	0.78	0.04	0.85	0.04	0.70	
09	0.01	0.25	0.03	0.54	0.02	0.36	
10	0.01	0.11	0.01	0.18	0.01	0.22	
11	0.13	2.56	0.11	2.44	0.10	1.84	
12	0.03	0.52	0.04	0.88	0.07	1.25	
13	0.19	3.67	0.19	4.15	0.18	3.27	
14	0.01	0.22	0.02	0.32	0.01	0.17	
15	0.01	0.25	0.01	0.18	0.01	0.20	
16	0.01	0.11	0.00	0.08	0.01	0.14	
17	0.00	0.00	0.00	0.00	0.00	0.00	
18	0.00	0.00	0.00	0.00	0.00	0.00	
19	0.00	0.00	0.00	0.00	0.00	0.00	

Test Report			China National Center for Quality Supervision and Test of Electrical Apparatus Products						№: 20M0561-S Total 68 Page 52		
4.25 Temperature-rise test (including calculation of the winding hot-spot temperature-rise) (type test) Test date: Apr. 22, 2020											
Measurement of top oil temperature rise: The method of temperature rise is the equivalent test in short-circuit connection. The HV (tapping position 17) is supplying power. Test duration is 12h and of which the stabilization time is 3h. it is required to apply 292.561kW of total loss and 292.918kW is actually applied during testing.											
Measurement of winding temperature rise: 367.42A current is required and 367.55A is actually applied during testing.											
Measured data											
Top oil temperature-rise and average oil temperature-rise			Measurement of average temperature-rise windings to oil							Ambient temperature (°C)	
Top oil temperature (°C)	Average oil temperature (°C)	Total loss injection/ specified total loss (%)	Current injection/ rated current (%)	Cold resistance (Ω)		Average oil temperature (°C)		Average winding temperature (°C)		Total loss	Measurement of cold resistance
70.6	59.2	100.12	100.04	HV	0.6488	At the instant of power off	58.9	HV	76.5	21.8	19.7
				LV	3.5325×10^{-3}	At the end of cooling curve	58.4	LV	77.5		
Calculations of temperature-rise											
Top oil temperature-rise (K)				48.8							
Winding temperature-rise (K)				HV		54.9					
				LV		55.9					
Winding hot-spot temperature-rise (K)				HV		69.8					
				LV		71.0					
Temperature-rise of tank surface and metal structural parts (K)				39.3							
Remarks: the calculated of temperature-rise are the corrected value under specified total loss and rated current. HV winding hot-spot coefficient is 1.2 and LV winding hot-spot coefficient is 1.2.											

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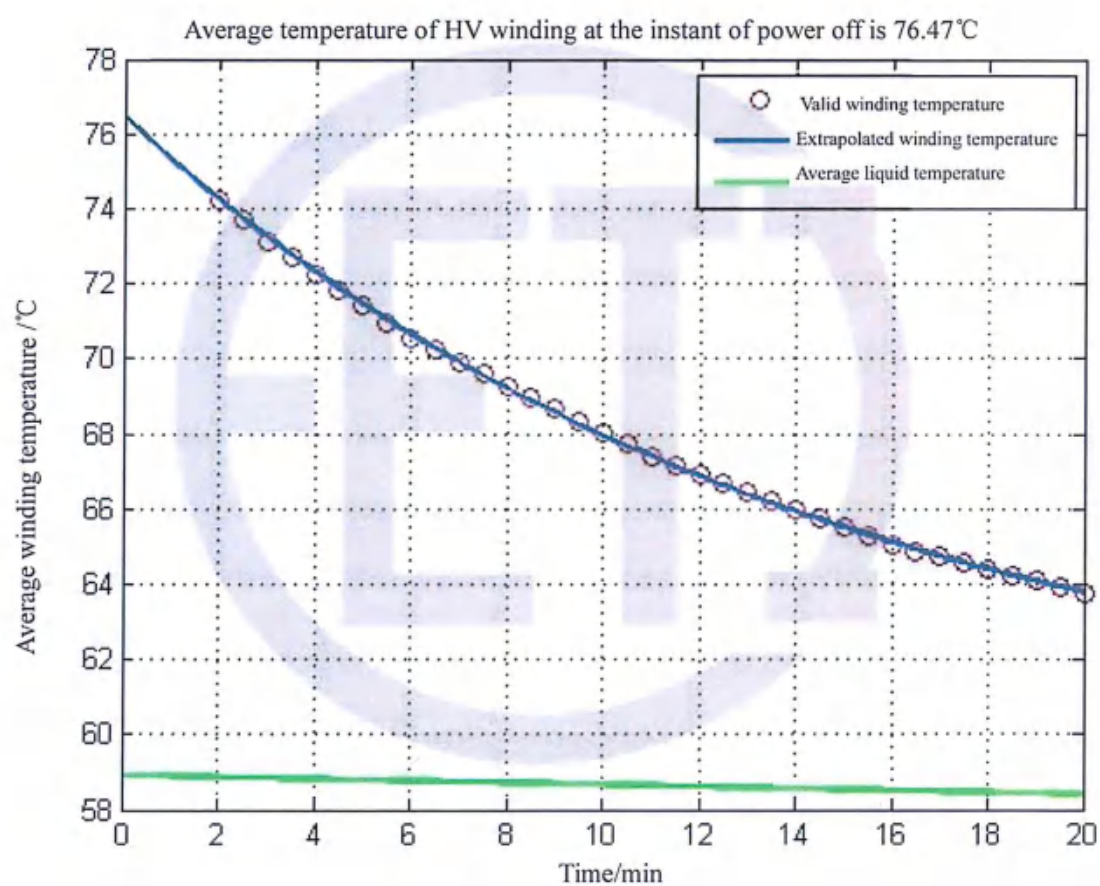
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Winding temperature curve

Average winding temperature data

Average HV winding
temperature

76.5°C



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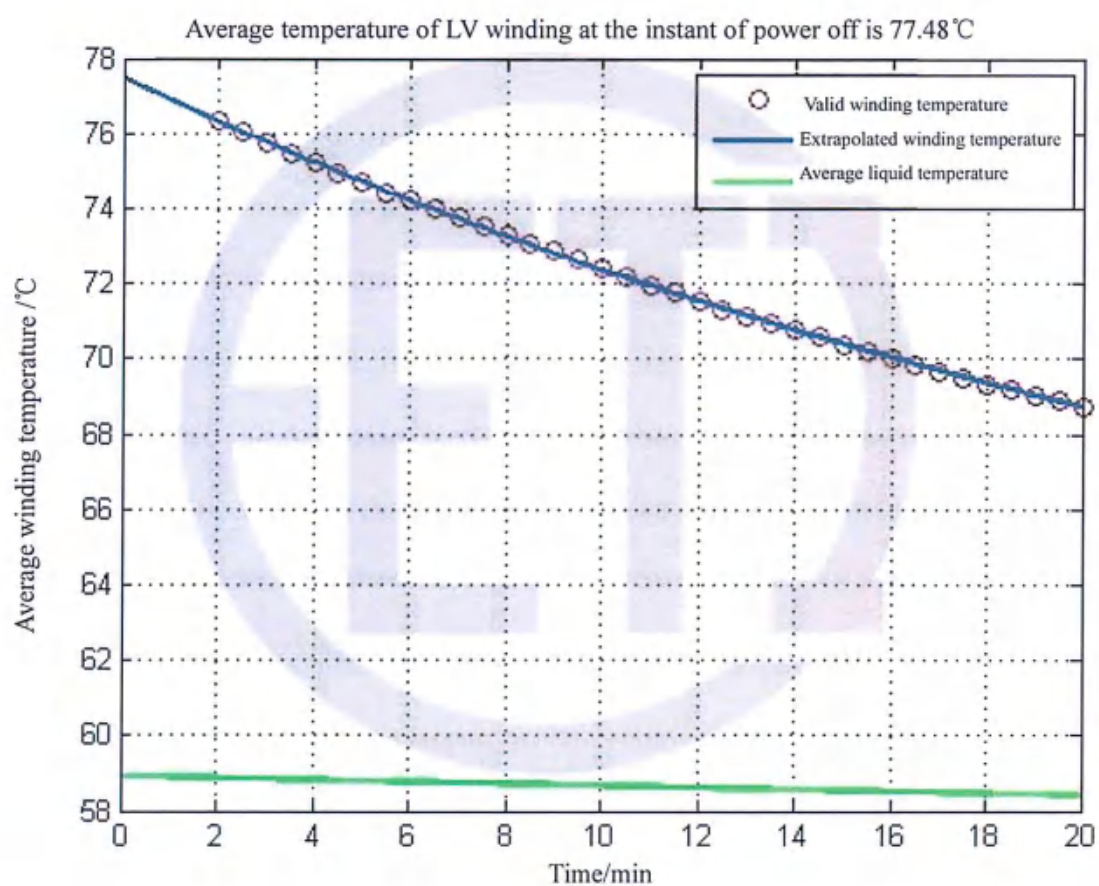
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Winding temperature curve

Average winding temperature data

Average LV winding
temperature

77.5°C



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Thermograph of tank and metal structural parts



Test Report	China National Center for Quality Supervision and Test of Electrical Apparatus Products			№: 20M0561-S Total 68 Page 56	
4.26 Leak testing with pressure for liquid-immersed transformers (routine test) Test date: from Apr. 11, 2020 to Apr. 13, 2020					
Test method	Parts of applied voltage	Applied pressure (kPa)	Duration (h)	Residual pressure (kPa)	Result
Static pressure method	Body	30.0	24	29.5	No oil leakage or damage
	On-load tap-changer tank	30.0	24	29.6	No oil leakage or damage
Remarks: the product is a general structure tank.					

Test Report	China National Center for Quality Supervision and Test of Electrical Apparatus Products	№: 20M0561-S Total 68 Page 57			
4.27 Determination of sound levels (type test) Test date: Apr. 19, 2020 4.27.1 Rough estimation of the load current sound power level Equation: $L_{WA,IN} \approx 39 + 18 \lg \frac{S_r}{S_p} = 71.4 \text{ dB(A)}$ where: S_r—the rated power is 63MVA; S_p—the reference power is 1MVA. Because $L_{WA,IN}$ is less 8.6dB (A) than limit value 80dB (A) of assured sound power level, according to standard requirement, it need not to measure load current sound level. 4.27.2 Measurement of sound pressure level and calculation of sound power level The transformer is rated excitation; the prescribed contour shall be spaced 0.3m away from the principal radiating surface, the distance between measured points is 0.96m, the number of measured points is 24, the height of measured point 1 is 1.07m and point 2 is 2.15m.					
Test environment					
The total area of the surface of the test room $S_v \text{ (m}^2\text{)}$	The average acoustic absorption coefficient α	The amount of acoustic absorption A $\text{(m}^2\text{)}$			
3293.2	0.1	329.3			
Distance from the principal radiating surface (m)	The area of the measurement surface S $\text{(m}^2\text{)}$	Environmental correction K (dB)			
0.3	93.8	3.3			
Measured values (dB)					
Status of cooling device	Average of background noise		Average noise value of transformer $\overline{L_{pA0}}$	A weighted sound pressure level $\overline{L_{pA}} = 10 \lg(10^{0.1\overline{L_{pA0}}} - 10^{0.1\overline{L_{bgA}}}) - K$	A weighted sound power level $L_{WA} = \overline{L_{pA}} + 10 \lg(S/S_0)$
	Before the test	After the test			
/	31.7	31.8	57.2	54	74
Remarks: $\overline{L_{pA0}}$: the uncorrected average A-weighted sound pressure level; $\overline{L_{pA0}} = 10 \lg(\frac{1}{N} \sum_{i=1}^N 10^{0.1L_{pAi}})$ $\overline{L_{bgA}}$: the lower of the two calculated average A weighted background noise pressure level.					

Test Report		China National Center for Quality Supervision and Test of Electrical Apparatus Products										№: 20M0561-S Total 68 Page 58				
4.28 Mechanical strength test of tank (type test)												Test date: Apr. 13, 2020				
Test method		Applied pressure (kPa)								Duration (min)						
Degree of vacuum		0.133								5						
Positive pressure		100								5						
Measured items		Measured point														
		Tank wall												Tank cover		
		HV side				LV side				Left side		Right side		Middle of length		
		strengthen	Left	Middle	Right	strengthen	Left	Middle	Right	strengthen	Middle	strengthen	Middle	Left	Middle	Right
Degree of vacuum	Initial distance (mm)	400	400	400	400	400	400	400	400	350	350	350	350	300	300	300
	Distance after pressure injection (mm)	412	415	414	413	412	414	415	417	363	367	364	365	311	312	310
	Distance without pressure (mm)	406	408	407	407	405	407	407	408	356	359	357	358	305	306	304
	Elastic deformation (mm)	12	15	14	13	12	14	15	17	13	17	14	15	11	12	10
	Permanent deformation (mm)	6	8	7	7	5	7	7	8	6	9	7	8	5	6	4
Positive pressure	Initial distance (mm)	406	408	407	407	405	407	407	408	356	359	357	358	305	306	304
	Distance after pressure injection (mm)	395	393	393	392	394	396	395	393	346	343	342	345	293	295	295
	Distance without pressure (mm)	401	399	400	401	400	401	399	401	350	351	350	351	299	301	301
	Elastic deformation (mm)	11	15	14	15	11	11	12	15	10	16	15	13	12	11	9
	Permanent deformation (mm)	5	9	7	6	5	6	8	7	6	8	7	7	6	5	3
Remarks		No damage														
Remarks: 1. the product is a general structure tank. 2. the described left and right sides of test point are viewed from HV side. 3. the left, middle and right test points of HV and LV side are obtained from the 1/2 height in vertical direction, 1/4,1/2 and 3/4 position respectively in horizontal direction.																

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HV side before short-circuit:



LV side before short-circuit:



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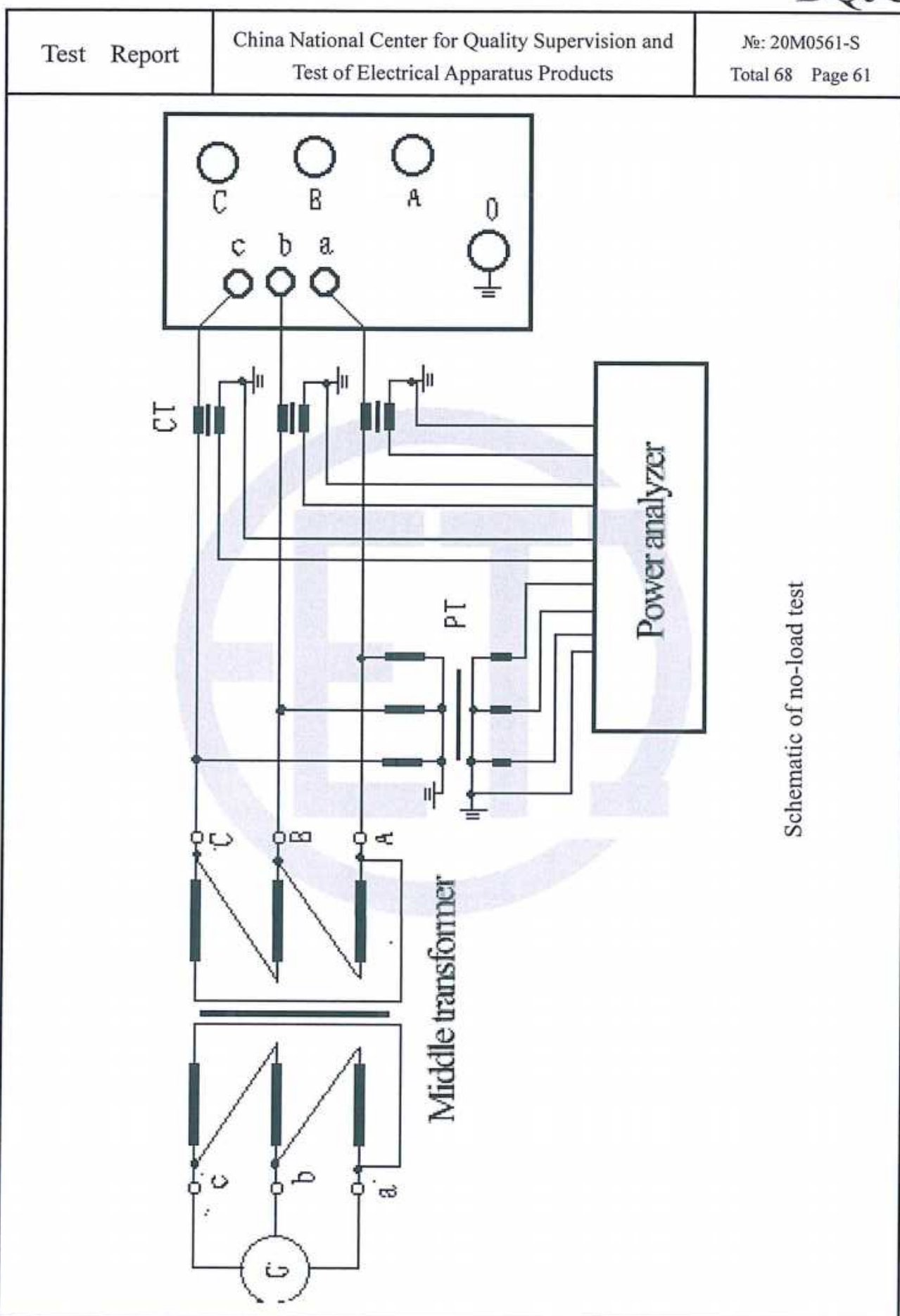
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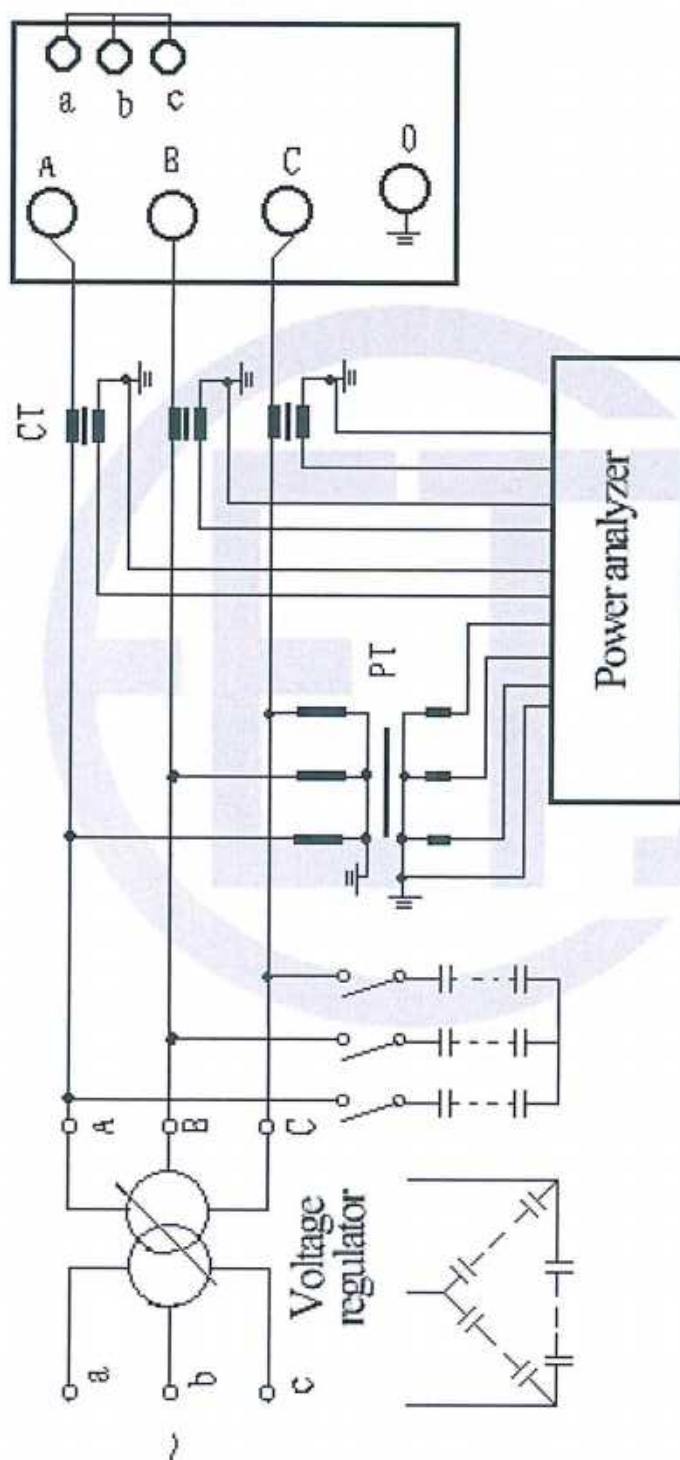
HV side after short-circuit:



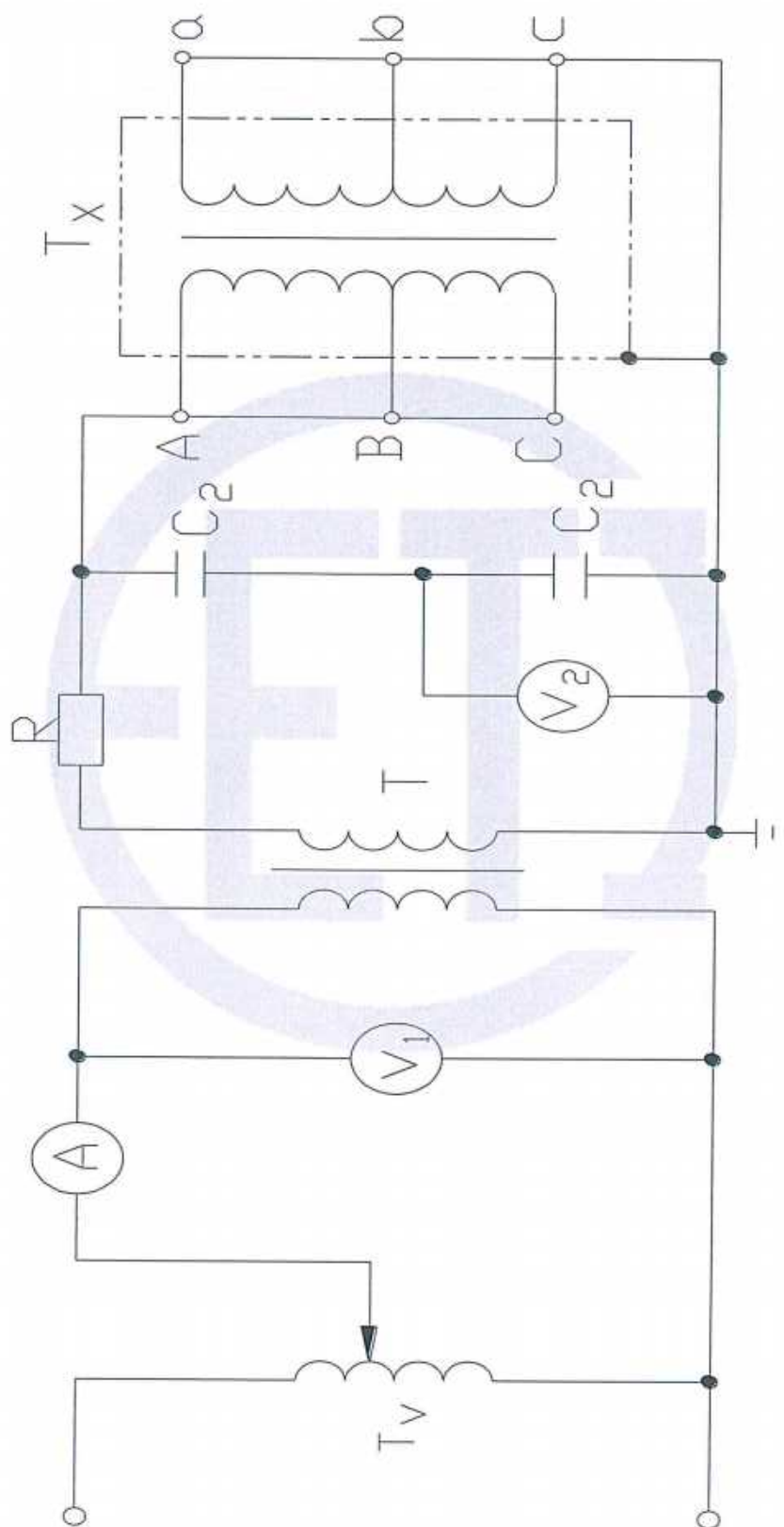
LV side after short-circuit:







Schematic of load test



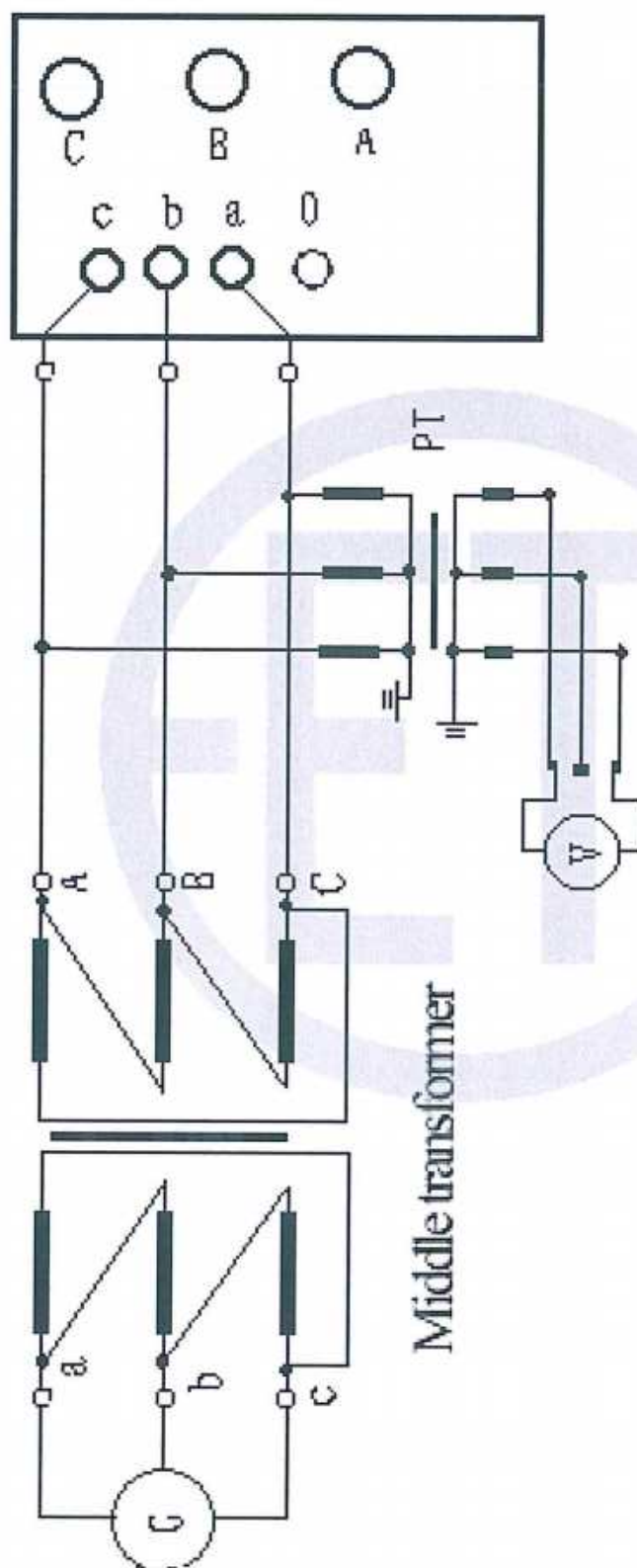
Schematic of separate-source AC withstand voltage test

Test Report

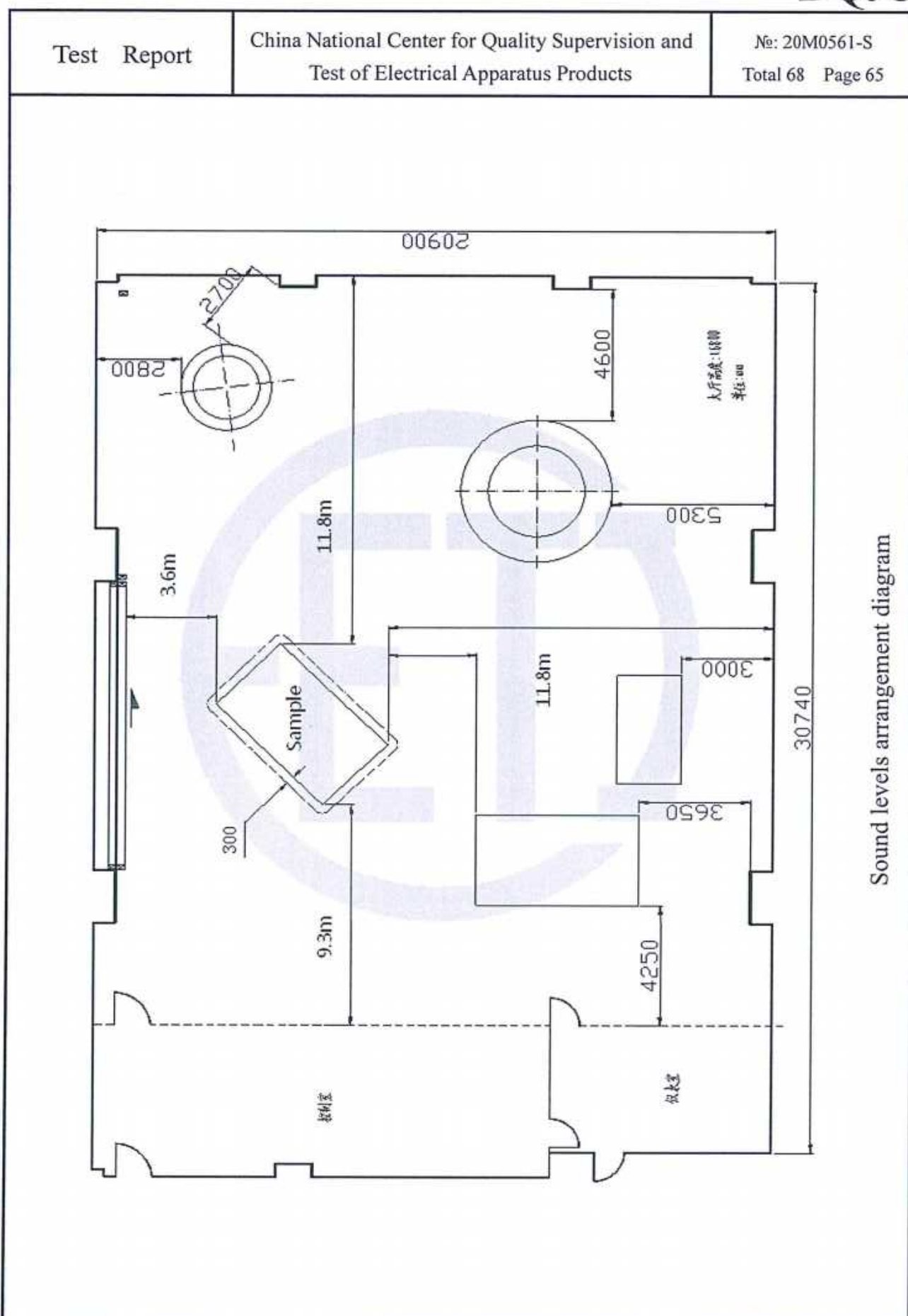
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Schematic of induced AC withstand voltage test



Test Report		China National Center for Quality Supervision and Test of Electrical Apparatus Products		№: 20M0561-S Total 68 Page 66	
Instruments used in the tests					
No	Test items	Name & type of instrument	Number & validity	Accuracy level	
1	Measurement of d.c. insulation resistance windings-to-earth and between windings	Digital mega-ohm meter F1550C	ER17-017 2020-06-17	200k~5/10/20/50/ 100GΩ class 5, others class 20	
2	Check of core and frame insulation for liquid-immersed transformers with core or frame insulation				
3	Measurement of dissipation factor (tanδ) of the insulation system capacitances	Movable insulation diagnostic and analysis system MIDAS2880	ER19-002 2021-03-19	Capacitance: ±0.3%rdg±0.3pF Inductance: ±0.5%rdg±0.5mH	
4	Determination of capacitances windings-to-earth and between windings				
5	Measurement of bushing capacitances and dielectric dissipation factor (tanδ)				
6	Check the ratio and polarity of built-in current transformers	Multi-function transformer ratio tester YTB	RI15-012 2021-02-28	Ratio±0.2% Phase position 0.2°	
7	Insulation test of auxiliary wiring	Power-frequency withstand voltage tester PFT6-5	745-083 2020-11-24	/	
8	Measurement of voltage ratio and check of phase displacement	Full-automatic three-phase transformer ratio tester 2796	RI15-014 2020-09-03	±0.1mA, ±0.05°	
9	Measurement of winding resistance	DC resistance tester JYR(50C)	ER16-056 2020-10-09	0.2%±0.2μΩ	
10	Measurement of short-circuit impedance and load loss	Transformer power loss test systemTMS580-200-4000	749-1237 2020-08-25	Voltage range: 100V~200kV, accuracy; 0.12% current range: 1A~4000A, accuracy; 0.15%	
11	Measurement of no-load loss and current				
12	Tests on on-load tap-changers				
13	Separate-source AC withstand voltage test	Power-frequency partial discharge-free test transformer YDTCW-1000kVA/1000kV	745-034 2021-09-24	/	
		Capacitance voltage divider TRF1000-0.0005	745-034-1 2021-09-24	/	
14	Line terminal AC withstand test	Transformer power loss test system TMS580-200-4000	749-1237 2020-08-25	Voltage range: 100V~200kV, accuracy; 0.12% current range: 1A~4000A, accuracy; 0.15%	
15	Induced AC withstand voltage test and induced AC withstand voltage test with partial discharge measurement	Transformer power loss test system TMS580-200-4000	749-1237 2020-08-25	Voltage range: 100V~200kV, accuracy; 0.12% current range: 1A~4000A, accuracy; 0.15%	
		Multi-channel digital partial discharge comprehensive tester TWPD-2F	RU10-013 2020-12-04	Discharge magnitude: 10,50,100,500pC; 5,10,20,50,100pC Pulse rise time <60ns Frequency range: 50Hz~1000Hz Measuring range of the whole: 0.1pC~10000nC Measuring channel: independent 4 channel Detection sensitivity: 0.1pC Sampling accuracy: 12Bit Sampling rate: 20MHz Non-linear error of the span: 5% Range switching: <1, ×10, ×100, ×1000, ×10000, ×100000 Capacitance range of the testable sample: 6pF~250μF Measuring band: 3dB bandwidth 10kHz~1MHz	

Test Report		China National Center for Quality Supervision and Test of Electrical Apparatus Products		№: 20M0561-S Total 68 Page 67	
Instruments used in the tests					
No	Test items	Name & type of instrument	Number & validity		Accuracy level
16	Insulating liquid test, measurement of dissolved gasses in dielectric liquid from each separate oil compartment except diverter switch compartment	Automatic dielectric strength tester NRNY-1004	ER18-005	2020-12-03	±3%
		High precision full-automatic capacitance, inductance and dielectric loss measuring bridge 2840-Combi	ER18-003	2020-07-22	±0.02%rdg±0.01pF;±0.5%rdg±1×10 ⁻⁵
		Gas chromatogram analyzer 7890B	749-1732	2020-12-17	/
		Moisture analyzer CA-200	CA02-002	2020-05-09	±3μg (water for 10μg to 1mg or above) RSD 0.3% or under (water for 1mg or above)
17	Measurement of frequency response	Transformer winding deformation tester FRAX99	ER16-021	2021-01-15	/
18	Short-circuit withstand test	Voltage transformer TEMP-1000HU	EH112-001	2020-11-08	/
		Voltage transformer VEOS525	EH111-001	2020-10-09	/
		Voltage transformer VEOS525	EH111-002	2020-10-09	/
		Voltage transformer VEOS525	EH111-003	2020-10-09	/
		LCR automatic tester UC2860XD	ER16-063	2020-08-06	/
		Data collection 1-GEN16T-2	EI56-019	2021-01-02	/
		Current divider FLT1-30/2.5	EI30-016	2021-10-28	/
		Current divider FLT1-30/2.5	EI30-017	2021-10-28	/
		Current divider FLT1-30/2.5	EI30-018	2021-10-28	/
		Low sensitivity current divider FLP1	EI31-081	2021-02-26	/
		Low sensitivity current divider FLP1	EI31-082	2021-02-26	/
19	Lightning impulse test	Impulse voltage generator CJDY-1050kV/59kJ	750-009	2020-08-02	/
20	Measurement of no-load excitation characteristics	Transformer power loss test system TMS580-200-4000	749-1237	2020-08-25	Voltage range: 100V~200kV, accuracy; 0.12% current range: 1A~4000A, accuracy; 0.15%
21	Long-duration no-load test				
22	Measurement of short-circuit impedance on LV				
23	Measurement of zero-sequence impedances on three-phase transformers				
24	Measurement of the harmonics of the no-load current				

Test Report		China National Center for Quality Supervision and Test of Electrical Apparatus Products		№: 20M0561-S Total 68 Page 68	
Instruments used in the tests					
No	Test items	Name & type of instrument	Number & validity		Accuracy level
25	Temperature-rise test	Transformer power loss test system TMS580-200-4000	749-1237 2020-08-25		Voltage range: 100V~200kV, accuracy; 0.12% current range: 1A~4000A, accuracy; 0.15%
		Thermocouple Type T	TT33-129/130/131/132/133/134 2021-02-16		/
		Data acquisition/switch unit 34970A	TT11-065 2021-02-16		V±5.25%, A±1.5%, T±1℃, Ω±0.81%
		DC resistance tester JYR(50C)	ER16-055 2020-10-09		0.2%±0.2μΩ
		DC resistance tester JYR(50C)	ER16-056 2020-10-09		0.2%±0.2μΩ
		Electronic stopwatch PC396	HT15-010 2021-03-23		/
		Infrared gas leak detector and temperature imager GF306	TT14-017 2020-11-13		±2%(reading range) or ±2℃
26	Leak testing with pressure for liquid-immersed transformers	Pressure gauge Y-100	FP81-428 2020-10-07		Class 1.6
27	Determination of sound levels	Transformer power loss test system TMS580-200-4000	749-1237 2020-08-25		Voltage range: 100V~200kV, accuracy; 0.12% current range: 1A~4000A, accuracy; 0.15%
		Sound level meter 2270	SP01-013 2020-08-12		Class 1
		Sound level calibrator 4231	SP01-020 2020-07-22		Class 1
		Steel tapeline	LS05-032 2021-04-15		/
28	Mechanical strength test of tank	Pressure gauge Y-100	FP81-428 2020-10-07		Class 1.6
		Steel tapeline	LS05-032 2021-04-15		/
		Vacuum gauge	FP81-514 2020-07-07		Class 2.5
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DECLARATION

- 1.The report is invalid without special seal for testing and page combining seal on the report;
2. The report is invalid if altered;
3. The report is invalid without signatures of persons for drawing up,
proof-reading, reviewing and approval;
4. The report is valid only for the inspected and tested samples.

NOTICE

1. In case there is any objection to this report, please raise it to the laboratory within fifteen days starting from the date of receiving the report, Thank you for your cooperation.
2. In case there is no objection, please take back the samples within one month starting from the date of receiving the report, when the manufacturer is going to take back the samples, certificate for sample taking and along with the written approval for the report should be brought in presence, only then the samples could be taken back. On time due, the samples will be in the laboratory's own disposal.

The test report is in total 68 pages including 28 figures and 3 photos

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110KV (60kV) Oil-immersed Power Transformer

LOW CONSUMPTION & ENERGY SAVING





Founded in 1990, CEEG has been focusing on manufacturing for 30 years and exporting quality power equipment to the world with the core values of "Vision, Innovation and Responsibility". So far, CEEG has three major industries: power transmission and distribution, new energy and system solutions, with industrial bases in Nanjing and Yangzhong.

CEEG was successively awarded the honorary titles of National Innovative Enterprise, Top 500 Asian Brands, Most Influential Brand of China Electrical Industry, China Environmental Label, and National Contract-observing and Creditable Enterprise. In 2011, CEEG was ranked 183rd among the top 500 private enterprises in China with sales of 10.9 billion.

China Electric Equipment (Jiangsu) Transformer Manufacture Co., Ltd. is a modern enterprise integrating manufacturing, sales and scientific research. It has a complete set of shearing machines, automatic wrapping machine, robotic automatic laminating machine, German Hedrich vacuum casting tank, vacuum impregnation, electric transfer vehicle and other advanced equipments representing a high level in the industry, and is the first in the industry to develop and apply transformer collaborative design platform to effectively combine product data, product development and production process. CEEG's products include VPI transformer, cast resin transformer, semi-envelope transformer, oil-immersed transformers, traction transformers, 220kV power transformers, 110kV power transformer, mining explosion-proof transformer, mining explosion-proof switches, high and low voltage switchgear, frequency conversion transformer, amorphous alloy transformer, anti-harmonic transformer, Scott transformer, substation, wind power transformer, marine transformer, etc. Its sales cover many industries such as electric power, electronics, hydropower, nuclear power, wind power, coal mines, communications, construction, petroleum, chemical industry, aviation, transportation, railroad, etc.

Walking with giants and keeping pace with the world. CEEG has established long-term strategic partnerships with world-class companies such as DuPont, Schneider, DSI. Pursuing innovation, fulfilling responsibilities, and constantly surpassing products, quality, services and actions, it has developed into a domestic giant power transmission and distribution equipment supplier with a solid industrial foundation. Its cast resin dry type transformers have been exported to more than 40 countries and regions in the world. The strategic layout of brand internationalization and service globalization has been formed!

Make CEEG the world's first choice!





110kV(60kV)



Flexible and customized design to meet the needs of different customers

First-class product quality

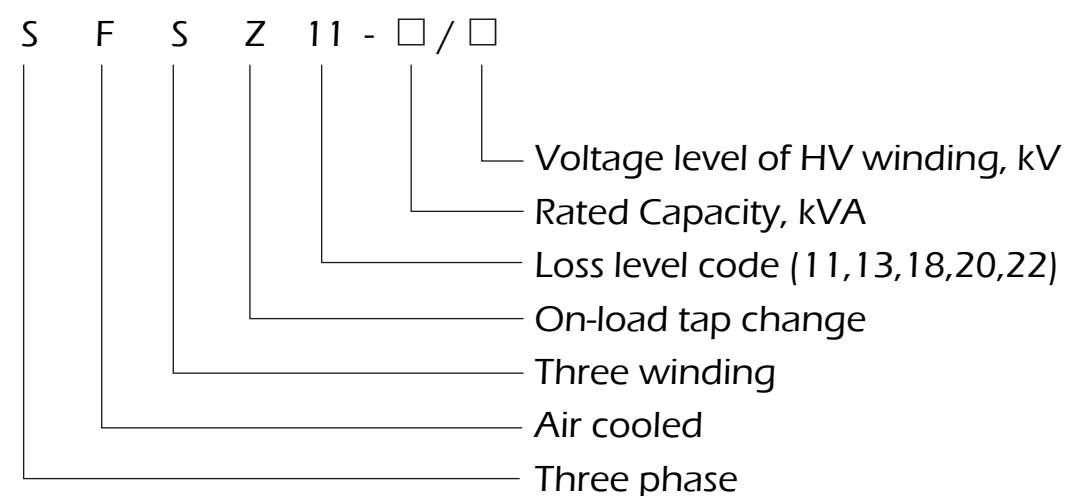
The first-class R & D team in the industry ensures that all performance indicators of products meet or exceed national standards, introduces scientific management mode and standardized operation of process flow in all links to ensure the excellent quality of each product.

The product structure can be flexibly designed according to the actual needs of customers, and all kinds of accessories can select corresponding models according to user requirements to meet the personalized needs of different customers.





110kV (60kV) Oil Immersed Power Transformer



The new high-temperature resistant transformer independently developed by CEEG adopts a mixed insulation structure, and the hot spot temperature part of the body uses DuPont's Nomex insulation material (grade C heat resistance) and mineral oil, which truly meets the operational requirements of "high overload, safety and reliability" in the whole life cycle. This product is the best choice for users with special high requirements for transformers or renewal and transformation (capacity expansion and transformation on the basis of the original transformer).



Low energy consumption and large capacity

The no-load loss of the product is more than 10% lower than that of the current national standard gb6451-2015, and the load loss is more than 5% lower than that of the current national standard gb6451-2015. The performance meets the energy efficiency standard of gb20052-2020. The noise level of self-cooling is lower than the national standard. According to the needs of users, the advanced Nomex insulating material and transformer insulating oil of DuPont can be used to make the product performance meet the requirements of high overload, high service life, high reliability, high safety and high capacity density.



Performance characteristics



Low Loss

The no-load loss is more than 10% lower than the current national standard GB6451-2015, the load loss is more than 5% lower than the current national standard GB6451-2015, and the performance meets the energy efficiency standard of GB20052-2020.



Low Noise

The self cooling noise level will reach below 60dB, nearly 20dB lower than the national standard. If users have special requirements, they can also customize ultra-low noise transformers;



Low Partial Discharge

The company has introduced modern enterprise management mode. The whole process of 110kV products will be dust-free operation, all metal parts and insulating parts inside the body will be rounded, and the local discharge capacity will be controlled below 100pc;



Strong Short Circuit Resistance

110kV transformer has passed national certification. Ensure that no product is damaged due to sudden short circuit, with strong reliability;



Beautiful Appearance

Full polishing and derusting, powder electric spraying paint can achieve the spraying effect of household appliances, wide chip radiator, never leg color.



No Leakage

All seals are made of acrylate material and adopt one-time molding technology. There is no interface. We solemnly promise that there will be no leakage. Fluorescence, positive pressure and negative pressure are used for leakage test.

Service Conditions

It is conducive to peak summer. It is applicable to the main power grid with high load rate under high temperature and places with impact load and continuous overload requirements. Such as iron and steel, metallurgical industry, railway transportation, power plant, hydropower station, etc.

Product Introduction

Main structural features

NOMEX Insulation + Transformer Insulation Oil

1. High Temperature Resistant and Safer

When the ambient temperature is 40 °C, it can operate continuously under 100% load for a long time.

At the same temperature, the continuous load rate is 20% higher than that of oil immersed transformer.

Ambient Temperature(°C)	-10	0	10	20	30	40
S13(K24)	1.25	1.17	1.09	1.00	0.91	0.81
SRN(K24)	1.37	1.3	1.25	1.18	1.10	1.00

2. Low loss and energy saving

20% energy saving compared with ordinary oil immersed transformer

3. Maintenance free and more environmentally friendly

The seal has the same service life as the transformer

All materials can be recycled

Technological innovation

1

High temperature resistant hybrid insulation system;

2

Compact structure design;

3

Seven step temperature control technology to ensure operation safety;

4

30-year life pan design;

5

The iron core adopts a fully inclined 45 degree 7-step joint structure.



110kV(60kV)

Original Core Technology

High temperature resistant hybrid insulation system



The hot spot temperature distribution of the coil is determined by using the temperature field analysis software, and the insulation materials with different temperature resistance grades are reasonably selected, so that the components of the overall insulation system of the transformer can reach the same service life, and the design service life of the product is more than 30 years.

7-step Temperature Control Technology

The mature structure and technology of traditional transformer shall be adopted as far as possible in the structure of high-temperature liquid immersed transformer, which retains the advantages of reliability, good manufacturability and economy of the traditional transformer. The biggest difference between this transformer and the traditional transformer is that the actual situation of the temperature field in the transformer is reasonably considered in the design, and the insulation materials with different temperature resistance grades are reasonably used according to the temperature distribution to form a hybrid insulation system. With the help of transformer temperature field simulation technology, the temperature distribution of the transformer (mainly winding and its vicinity) can be determined more accurately. According to different temperature ranges, different grades of insulating materials can be selected to give full play to the high-temperature resistance characteristics of materials, and at the same time, it has a good economy. The actual maximum oil temperature of this liquid immersed transformer is set at 95 °C, which ensures that the transformer has good safety, thermal performance margin and long expected life. For the temperature design of the whole transformer, we propose and implement the concept of "seven-step temperature control technology" as the design principle, that is, gradually extend from the vicinity of the winding hot spot with the highest temperature to the external low-temperature area and divide it into five levels, and consider the short circuit and overload to form a seven-level thermal state for temperature control:

(1) Insulation material temperature control technology: different insulation materials shall be selected according to the temperature of different parts of the winding and body. The control winding hot spot temperature.

(2) Temperature control technology of liquid flow circuit: it is a technology to determine and control the liquid flow temperature of each part by comprehensively considering the relationship between liquid velocity field and temperature field. Control the boundary layer liquid temperature and top layer liquid temperature near the hot spot of the winding.

(3) Overload temperature control technology: temperature rise control of various parts of the transformer under overload state. The temperature distribution under overload conditions is different from that under rated load operation. Attention should be paid to the temperature rise change under overload conditions in design.

(4) Iron core temperature control technology: temperature control of insulating parts in contact with iron core.

(5) Sealed temperature control technology: the thermal expansion, deformation, strength, etc. of the fully sealed oil tank, the influence and control with the change of temperature, so as to ensure the normal operation of the transformer within its allowable temperature range.

(6) Component temperature control technology: components shall be made of insulation materials of the corresponding grade according to the temperature of their location, such as sealing gasket, etc.

(7) Short circuit temperature control technology: in case of transformer fault short circuit, the value of short-circuit current flowing through the winding is very large, but the time is very short. It is usually calculated according to the adiabatic process. Under the condition of multiple short-circuit reclosing, the heat accumulation and heat dissipation effect shall be considered. Generally speaking, due to Nomex ® The paper has good high-temperature resistance, mechanical strength, and the change of dielectric coefficient and dielectric loss with temperature is very small. Even under the condition of multiple short-circuit reclosing, it will not cause mechanical damage and electrical failure due to temperature rise, and will not lose the service life of insulating materials.

Measures for anti sudden short circuit capacity of 110kV oil immersed power transformer

Improving the ability of 110kV power transformer against sudden short circuit is mainly guaranteed from two aspects: design calculation and manufacturing process.

1. In terms of design, there are the following points:

(1) Reasonable ampere turn balance calculation of transformer coil can effectively control the maximum unbalanced ampere turn and reduce the short-circuit mechanical force to the greatest extent.

(2) Mechanical stress belongs to the tolerance test. Copper conductor is a plastic material. When the deformation of copper wire is less than 0.2% after the transformer short circuit, the winding can recover deformation. Soft copper wire shall be selected according to the maximum short-circuit mechanical force borne by the transformer ($\Sigma 0.2 = 90\text{Mpa}$) or semi-rigid copper wire ($\Sigma 0.2 = 120 \sim 260\text{mpa}$) so that the average critical stress of copper wire $\Sigma 0.2$ within the reasonable safety range.

(3) The strength and stiffness of clamp, pull plate, selected pressing plate and pressing device shall be calculated to meet the safety requirements of maximum short-circuit mechanical force.

(4) The winding cushion block shall be densified and made of hard cardboard with large elastic modulus as far as possible.

2. In terms of the manufacturing process, there are the following points:

(1) The transformer body shall be reasonably controlled in three aspects: first, the coil shall be wound tightly, second, the body shall be sleeved tightly, and third, the body shall be compressed.

(2) The designed ampere turn balance shall be calculated with the ampere turn balance after manufacturing and processing, and the maximum unbalanced ampere turn shall be strictly controlled.

(3) Prestress shall be added during the manufacturing process to prevent looseness during the operation of the transformer, so as to increase the short-circuit mechanical force of the transformer.

(4) The height tolerance of in-phase winding after drying treatment shall be strictly controlled so that each winding can be pressed evenly.



110kV(60kV)

Guarantee measures for low partial discharge of 110kV oil immersed power transformer

The generation of transformer partial discharge mainly depends on the design process assurance and process control. We change the traditional concept, use the viewpoint of "field strength" instead of "voltage" to determine the insulation parameters and insulation structure, select more appropriate insulation materials and adopt advanced production technology to ensure the low partial discharge of the transformer.

1. Design: study the mechanism and external performance of partial discharge, make a targeted adjustment, and invite experts in the industry to demonstrate and discuss, so as to fundamentally solve the causes of partial discharge;

(1) Accurately calculate the field strength distribution and reasonably adjust it to make it evenly distributed, reduce the electric field distortion, and ensure that the maximum field strength of the component with the most concentrated electric field is lower than the initial discharge field strength;
(2) Reasonably design the high-voltage outlet components, fillet treatment of internal structural parts of the body, reasonably design and distribute the lead components for low partial discharge, and reasonably adjust the ground distance parameters;

2. Process assurance:

(1) Purified production environment (main components such as iron core, coil, body and assembly are completed in the fully sealed and painted workshop, and the personnel in and out of the workshop can enter the workshop only after changing shoes or wearing shoes covers).

(2) The body and lead are made in a fully enclosed plant.

(3) Round the outside of all iron clamps as a whole

(4) Rounding of the inner cavity of the transformer oil tank

(5) When inserting the iron yoke on the iron core of the transformer, wrap the coil on the core column with a clean cloth, and then insert the iron yoke to prevent trace metal particles generated in the cutting process on the upper iron yoke from falling into the coil.

(6) Special improvements are made to the track crane: a box is installed at a proper position under the wheel of the crane to absorb the metal particles generated by the friction between the wheel and the track during the operation of the crane.



WORKSHOP

Main Equipments



Vertical Winding Machine



Horizontal Winding Machine



Vacuum Drying Equipment



Air Cushion Car

Utility model patent and invention patent

1. Hoisting structure of 110kV transformer body: ZL2008 2 0238182.6;

2. Outgoing line structure of 110kV plug-in cable terminal transformer body: Z L2008 2 0159647.9;

3. On load voltage regulation structure of 110kV power transformer: ZL2010 2 9044115.5;

4. Current transformer structure for transformer winding temperature measurement: ZL2010 2 9044111.7;

5. Magnetic shielding structure of large capacity transformer: ZL2010 2 0635851.0.

The above utility model patents and invention patents have played a significant role in promoting and promoting the quality control and product performance improvement of CEEG's 110kV ~ 220kV products, and laid a solid foundation for the product innovation and development of CEEG.



110kV(60kV)

Technical Advantages

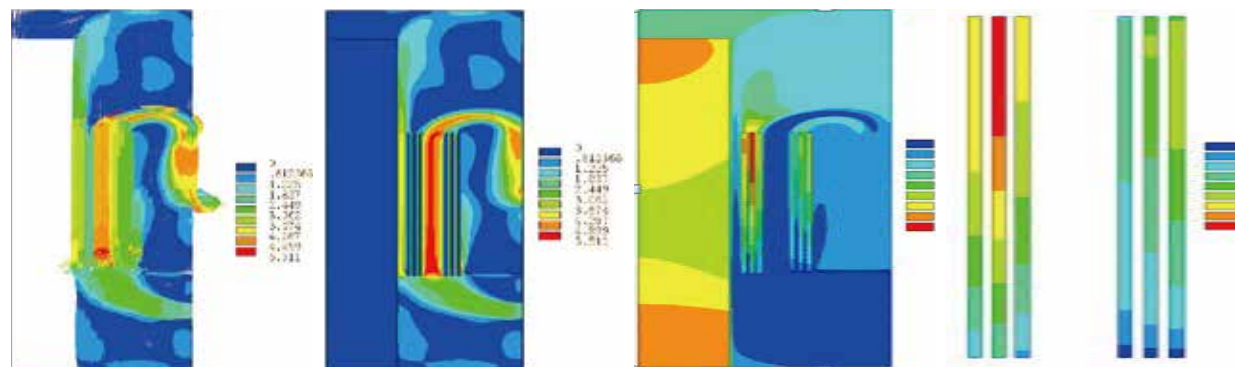
R & D Team

CEEG has established a strong technology R & D team, with technology R & D platforms such as postdoctoral workstation, Jiangsu power transformation equipment engineering technology research center, Jiangsu graduate workstation and Jiangsu technology center, in conjunction with the Institute of electrical engineering, Chinese Academy of Sciences, Southeast University, Nanjing University of Aeronautics and Astronautics, Jiangsu University China University of mining and technology and other well-known scientific research institutions and universities jointly carry out a series of technological R & D and innovation.



R & D Cloud Platform

It integrates the functions of electromagnetic optimization design, parametric drawing, performance analysis, structural optimization and automatic drawing of transformer, so as to realize the sharing of transformer design resources, search, modification and version control of various data information.



Intelligent Operation and Maintenance Platform

Online power quality analysis and fault alarm can be realized by collecting key data such as transformer temperature, current, voltage, vibration and grid harmonic, and can be installed on mobile phone.



Technical Parameter

S18-6300 -180000/110kV oil-immersed three-phase double winding non-excitation voltage regulating power transformer (Class III energy efficiency)

Rated Capacity kVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0 %	UK %	
	HV kV	HV Tapping	LV kV						
6300	110 115 121	±2×2.5%	6.3 6.6 10.5	YNd11	5.90	33	0.62	10.5	
8000					7.10	40	0.62		
10000					8.40	48	0.58		
12500					9.90	56	0.58		
16000					12.00	69	0.54		
20000					14.10	84	0.54		
25000					16.60	99	0.50		
31500					19.70	117	0.48		
40000					23.50	141	0.45		
50000					28.20	166	0.42		
63000					33.30	198	0.38		
75000			13.8 15.75 18 21		37.80	224	0.33	12~14	
90000					43.50	258	0.30		
120000					54.20	320	0.27		
150000					64.10	379	0.24		
180000					72.00	434	0.20		

S20-6300-180000 / 110kV oil immersed three-phase double winding non excitation voltage regulating power transformer (Class II energy efficiency)

Rated Capacity kVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0 %	UK %
	HV kV	HV Tapping	LV kV					
6300	110 115 121	±2×2.5%	6.3 6.6 10.5	YNd11	4.80	32	0.62	10.5
8000					5.80	38	0.62	
10000					6.80	45	0.58	
12500					8.10	53	0.58	
16000					9.80	65.7	0.54	
20000					11.40	79	0.54	
25000					13.50	94	0.50	
31500					16.00	111	0.48	
40000					19.10	133	0.45	
50000					22.90	158	0.42	
63000			27.00		187	0.38		
75000			13.8 15.75 18 21		30.70	212	0.33	12~14
90000					35.40	245	0.30	
120000					44.10	303	0.27	
150000					52.10	359	0.24	
180000					58.50	411	0.20	



110kV(60kV)

Technical Parameter

S22-6300 -180000/110kV oil-immersed three-phase double winding non- excitation voltage regulating power transformer (class I energy efficiency)

Rated Capacity kVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0 %	UK %	
	HV kV	HV Tapping	LV kV						
6300	110 115 121	±2×2.5%	6.3 6.6 10.5	YNd11	4.10	32	0.62	10.5	
8000					4.90	38	0.62		
10000					5.80	45	0.58		
12500					6.80	53	0.58		
16000					8.30	65.7	0.54		
20000					9.70	79	0.54		
25000					11.40	94	0.50		
31500					13.50	111	0.48		
40000					16.20	133	0.45		
50000					19.40	158	0.42		
63000					22.90	187	0.38		
75000			13.8 15.75 18 21		26.00	212	0.33	12 - 14	
90000					29.90	245	0.30		
120000					37.30	303	0.27		
150000					44.10	359	0.24		
180000					49.50	411	0.20		

S18-6300-63000/110kV/35kV oil-immersed three-phase double winding non-excitation voltage regulating power transformer (Class III energy efficiency)

Rated Capacity kVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0 %	UK %
	HV kV	HV Tapping	LV kV					
6300	110 115 121	±2×2.5%	35 36 37 38.5	YNd11	6.40	35	0.62	10.5
8000					7.70	42	0.62	
10000					9.00	49	0.58	
12500					10.50	59	0.58	
16000					12.50	72	0.54	
20000					14.80	89	0.54	
25000					17.50	105	0.50	
31500					20.70	126	0.48	
40000					24.60	147	0.45	
50000					29.50	183	0.42	
63000					34.90	220	0.38	

Technical Parameter

S20-6300-63000/110kV/35kV oil-immersed three-phase double winding non-excitation voltage regulating power transformer (Class II energy efficiency)

Rated Capacity kVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0 %	UK %
	HV kV	HV Tapping	LV kV					
6300	110 115 121	±2×2.5%	35 36 37 38.5	YNd11	5.20	33	0.62	10.5
8000					6.20	40	0.62	
10000					7.30	47	0.58	
12500					8.50	56	0.58	
16000					10.10	68	0.54	
20000					12.00	85	0.54	
25000					14.20	99	0.50	
31500					16.80	120	0.48	
40000					20.00	140	0.45	
50000					24.00	174	0.42	
63000					28.30	209	0.38	

S22-6300-63000/110kV/35kV oil-immersed three-phase double winding non-excitation voltage regulating power transformer (Class I energy efficiency)

Rated Capacity kVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0 %	UK %
	HV kV	HV Tapping	LV kV					
6300	110 115 121	±2×2.5%	35 36 37 38.5	YNd11	4.40	33	0.62	10.5
8000					5.30	40	0.62	
10000					6.20	47	0.58	
12500					7.20	56	0.58	
16000					8.60	68	0.54	
20000					10.20	85	0.54	
25000					12.10	99	0.50	
31500					14.30	120	0.48	
40000					16.90	140	0.45	
50000					20.30	174	0.42	
63000					24.00	209	0.38	



Technical Parameter

SS18-6300-63000/110kV oil-immersed three-phase three winding non-excitation voltage regulating power transformer (Class III energy efficiency)

Rated Capacity kVA	Voltage combination and tapping range				Vector Group	P0 kW	PK kW (75°C)	I0 %	Uk %	
	HV kV	Tapping Range	MV kV	LV kV					Step-up	Step-down
6300	110	±2×2.5%	36	6.3	YNyn0d11	7.10	42	0.66	HV-MV 17.5~18.5	HV-MV 10.5 HV-LV
8000						8.50	50	0.62		
10000						10.10	59	0.59		
12500						11.80	70	0.56		
16000						14.30	86	0.53		
20000						16.90	101	0.54	HV-LV 10.5 MV-LV 6.5	17.5~18.5 MV-LV 6.5
25000						19.70	120	0.48		
31500						23.50	142	0.48		
40000						27.80	170	0.44		
50000						33.30	202	0.42		
63000	121		38.5	6.6 10.5 21		39.40	243	0.40		

SS20-6300-63000/110kV oil-immersed three-phase three winding non-excitation voltage regulating power transformer (Class II energy efficiency)

Rated Capacity kVA	Voltage combination and tapping range				Vector Group	P0 kW	PK kW (75°C)	I0 %	Uk %	
	HV kV	Tapping Range	MV kV	LV kV					Step-up	Step-down
6300	110	±2×2.5%	36	6.3	YNyn0d11	5.80	40	0.66	HV-MV 17.5~18.5	HV-MV 10.5 HV-LV
8000						6.90	48	0.62		
10000						8.20	56	0.59		
12500						9.60	67	0.56		
16000						11.60	81	0.53		
20000						13.70	95	0.54	HV-LV 10.5 MV-LV 6.5	17.5~18.5 MV-LV 6.5
25000						16.00	113	0.48		
31500						19.10	134	0.48		
40000						22.60	161	0.44		
50000						27.00	192	0.42		
63000	121		38.5	6.6 10.5 21		32.00	230	0.40		

Technical Parameter

SS22-6300-63000/110kV oil-immersed three-phase three winding non-excitation voltage regulating power transformer (Class I energy efficiency)

Rated Capacity kVA	Voltage combination and tapping range				Vector Group	P0 kW	PK kW (75°C)	I0 %	Uk %	
	HV kV	Tapping Range	MV kV	LV kV					Step-up	Step-down
6300	110	±2×2.5%	36	6.3	YNyn0d11	4.90	40	0.66	HV-MV 17.5~18.5	HV-MV 10.5 HV-LV
8000						5.80	48	0.62		
10000						6.90	56	0.59		
12500						8.10	67	0.56		
16000						9.80	81	0.53	HV-LV 10.5 MV-LV 6.5	17.5~18.5 MV-LV 6.5
20000						11.60	95	0.54		
25000						13.50	113	0.48		
31500						16.20	134	0.48		
40000						19.10	161	0.44	HV-MV 17.5~18.5	HV-MV 10.5 HV-LV
50000						22.90	192	0.42		
63000						27.10	230	0.40		

SZ18-6300-63000-110kV oil-immersed three-phase double winding on load voltage regulating power transformer (Class III energy efficiency)

Rated Capacity kVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0 %	Uk %
	HV kV	HV Tapping	LV kV					
6300	110	±8×1.25%	6.3 6.6 10.5 21	YNd11	6.40	33	0.64	10.5
8000					7.70	40	0.64	
10000					9.00	48	0.59	
12500					10.70	56	0.59	
16000					12.90	69	0.55	
20000					15.40	84	0.55	
25000					18.20	99	0.51	
31500					21.60	117	0.51	
40000					25.80	148	0.46	
50000					30.60	184	0.46	
63000					36.30	220	0.42	



110kV(60kV)

Technical Parameter

SZ20-6300 - 63000 / 110kV oil-immersed three-phase double winding on load voltage regulating power transformer (Class II efficiency)

Rated Capacity kVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0 %	UK %
	HV kV	HV Tapping	LV kV					
6300	110	±8×1.25%	6.3 6.6 10.5 21	YNd11	5.20	32	0.64	10.5
8000					6.20	38	0.64	
10000					7.30	45	0.59	
12500					8.70	53	0.59	
16000					10.50	66	0.55	
20000					12.50	79	0.55	
25000					14.80	94	0.51	
31500					17.60	111	0.51	
40000					21.00	140	0.46	
50000					24.80	175	0.46	
63000					29.50	209	0.42	

SZ22-6300 - 63000 / 110kV oil immersed three-phase double winding on load voltage regulating power transformer (Class I energy efficiency)

Rated Capacity kVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0 %	UK %
	HV kV	HV Tapping	LV kV					
6300	110	±8×1.25%	6.3 6.6 10.5 21	YNd11	4.40	32	0.64	10.5
8000					5.30	38	0.64	
10000					6.20	45	0.59	
12500					7.40	53	0.59	
16000					8.90	66	0.55	
20000					10.60	79	0.55	
25000					12.50	94	0.51	
31500					14.90	111	0.51	
40000					17.80	140	0.46	
50000					21.00	175	0.46	
63000					25.00	209	0.42	

Technical Parameter

SSZ18-6300 - 63000 / 110kV oil-immersed three-phase three winding on load voltage regulating power transformer (Class III energy efficiency)

Rated Capacity kVA	Voltage combination and tapping range				Vector Group	P0 kW	PK kW (75°C)	I0 %	UK %	
	HV kV	Tapping Range	MV kV	LV kV					Step-up	Step-down
6300	110	±8× 1.25%	36 37 38.5	6.3 6.6 10.5 21	YNyn0d11	7.70	42	0.76	HV-MV 10.5 HV-LV 18~19 MV-LV 6.5	
8000						9.20	50	0.76		
10000						10.90	59	0.71		
12500						12.90	70	0.71		
16000						15.40	86	0.67		
20000						18.20	101	0.67		
25000						21.60	120	0.62		
31500						25.70	142	0.62		
40000						30.80	170	0.58		
50000						36.40	202	0.58		
63000						43.30	243	0.53		

SSZ20-6300 - 63000 / 110kV oil immersed three-phase three winding on load voltage regulating power transformer (Class II efficiency)

Rated Capacity kVA	Voltage combination and tapping range				Vector Group	P0 kW	PK kW (75°C)	I0 %	UK %	
	HV kV	Tapping Range	MV kV	LV kV					Step-up	Step-down
6300	110	±8× 1.25%	36 37 38.5	6.3 6.6 10.5 21	YNyn0d11	6.20	40	0.76	HV-MV 10.5 HV-LV 18~19 MV-LV 6.5	
8000						7.50	48	0.76		
10000						8.80	56	0.71		
12500						10.50	67	0.71		
16000						12.50	81	0.67		
20000						14.80	95	0.67		
25000						17.60	113	0.62		
31500						20.90	134	0.62		
40000						25.00	161	0.58		
50000						29.60	192	0.58		
63000						35.20	230	0.53		

Technical Parameter

SSZ22-6300 - 63000 / 110kV oil-immersed three-phase three winding on load voltage regulating power transformer (Class I energy efficiency)

Rated Capacity kVA	Voltage combination and tapping range				Vector Group	P0 kW	PK kW (75°C)	I0%	Uk %	
	HV kV	Tapping Range	MV kV	LV kV					Step-up	Step-down
6300	110	±8× 1.25%	36	6.3	YNyn0d11	5.30	40	0.76	HV-MV 10.5 HV-LV 18~19 MV-LV 6.5	
8000						6.30	48	0.76		
10000						7.50	56	0.71		
12500						8.90	67	0.71		
16000						10.60	81	0.67		
20000						12.50	95	0.67		
25000						14.90	113	0.62		
31500						17.70	134	0.62		
40000						21.20	161	0.58		
50000						25.00	192	0.58		
63000	121		38.5	21		29.80	230	0.53		

SS11-6300 - 90000 / 110kV oil-immersed three winding non-excitation voltage regulating power transformer

Rated Capacity kVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0%	Uk %	
	HV kV	MV kV	LV kV					Step-up	Step-down
6300	110±2× 2.5%	35	6.3	YNyn0d11	9.0	45	0.75	HV-MV 17~18 HV-LV 10.5 10.5 MV-LV 17~18 6.5	HV-MV 10.5 HV-LV 17~18 MV-LV 6.5
8000					10.8	53	0.71		
10000					12.7	62	0.68		
12500					15	73	0.64		
16000					18	90	0.6		
20000					21.3	106	0.56		
25000					25.2	125	0.53		
31500					30	148	0.49		
40000					35.8	178	0.41		
50000					42.3	212	0.38		
63000	121±2× 2.5%	38.5	10.5		50.2	255	0.38		
90000					65.6	333	0.3		

Note:

1. The capacity distribution of high, medium and low voltage windings is (100 / 100 / 100)%;
2. The connection group label can be YNd11y10 as required;
3. According to the needs of users, the voltage value or tap different from that in the table can be selected for medium voltage;
4. The maximum current tap is - 5% tap position.

Technical Parameter

SSZ11-6300 - 90000 / 110kV oil-immersed three winding on load voltage regulating power transformer

Rated Capacity kVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0%	Uk %
	HV kV	MV kV	LV kV					
6300	110±8× 1.25%	35	6.3	YNyn0d11	9.7	45	0.89	HV-MV 10.5 HV-LV 17~18 MV-LV 6.5
8000					11.7	53	0.89	
10000					13.8	62	0.84	
12500					15.9	73	0.84	
16000					19.7	90	0.79	
20000					23.3	106	0.79	
25000					27.5	125	0.74	
31500					32.7	148	0.74	
40000					39.2	178	0.68	
50000					46.4	212	0.68	
63000		38.5	10.5		55.2	255	0.63	
90000					72.1	333	0.48	

Note:

1. On load voltage regulating transformer, temporarily provide step-down structure products;
2. The capacity distribution of high, medium and low voltage windings is (100 / 100 / 100)%;
3. The connection group label can be YNd11y10 as required;
4. The maximum current tapping is - 10% tapping position;
5. According to the needs of users, the voltage value or tap different from that in the table can be selected for medium voltage.

S11-6300 - 90000 / 110kV oil-immersed double winding non-excitation voltage regulating power transformer

Rated Capacity kVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0 %	Uk%
	HV kV	HV Tapping	LV kV					
6300	110	±2×2.5%	6.3	YNd11	7.5	34	0.68	10.5
8000					9	42	0.64	
10000					10.5	50	0.6	
12500					12.3	59	0.56	
16000					15	73	0.53	
20000					17.7	88	0.49	
25000					21	104	0.45	
31500					24.9	125	0.41	
40000					29.8	147	0.38	
50000					35.2	183	0.34	
63000	121		10.5		41.8	221	0.3	
90000					54.6	289	0.3	

Note:

1. The maximum current tap is - 5%



Technical Parameter

S11-6300 - 90000/110kV oil-immersed double winding low voltage 35kV non-excitation voltage regulating power transformer

Rated Capacity kVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0 %	Uk%
	HV kV	HV Tapping	LV kV					
6300	110 121	±2×2.5%	35 38.5	YNd11	8.1	37	0.79	10.5
8000					9.7	45	0.79	
10000					11.4	52	0.74	
12500					13.3	62	0.74	
16000					15.9	77	0.68	
20000					18.9	93	0.68	
25000					22.2	109	0.63	
31500					26.2	132	0.63	
40000					31.2	155	0.58	
50000					36.6	192	0.58	
63000					43.3	232	0.53	
90000					56.6	303	0.41	

Note:

1. The maximum current tap is - 5% tap position.

SZ11-6300 - 90000/110kV oil-immersed double winding on load voltage regulating power transformer

Rated Capacity kVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0 %	Uk%
	HV kV	HV Tapping	LV kV					
6300	110	±8×21.25%	6.3 6.6 10.5 11	YNd11	8.1	34	0.74	10.5
8000					9.7	42	0.74	
10000					11.7	50	0.68	
12500					13.6	59	0.68	
16000					16.5	73	0.63	
20000					19.5	88	0.63	
25000					22.7	104	0.58	
31500					27.4	125	0.58	
40000					32.9	148	0.53	
50000					38.9	183	0.53	
63000					46.3	221	0.47	
90000					60.5	289	0.36	

Note:

1. On load voltage regulating transformer, temporarily provide step-down structure products;
2. Negotiate with the manufacturer according to the user department; Products that can provide other voltage combinations;
3. The maximum current tap is - 10% tap position.

SS13-6300 - 90000/110kV oil-immersed three winding non excitation voltage regulating power transformer

Rated Capacity kVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0%	Uk %	
	HV kV	MV kV	LV kV					Step-up	Step-down
6300	110±2× 2.5% 121±2× 2.5%	35 38.5	6.3 6.6 10.5 11	YNyn0d11	7.2	45	0.75	HV-MV 17~18 HV-LV 10.5 MV-LV 6.5	HV-MV 10.5 HV-LV 17~18 MV-LV 6.5
8000					8.6	53	0.71		
10000					10.2	62	0.68		
12500					12	73	0.64		
16000					14.4	90	0.6		
20000					17	106	0.56		
25000					20.2	125	0.53		
31500					24	148	0.49		
40000					28.6	178	0.41		
50000					33.8	212	0.38		
63000					40.2	255	0.38		
90000					52.5	333	0.3		

Note:

1. The capacity distribution of high, medium and low voltage windings is (100 / 100 / 100)%;
2. The connection group label can be YNd11y10 as required;
3. According to the needs of users, the voltage value or tap different from that in the table can be selected for medium voltage;
4. The maximum current tap is - 5% tap position.

SSZ13-6300 - 90000/110kV oil-immersed three winding on load voltage regulating power transformer

Rated Capacity kVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0%	Uk %
	HV kV	MV kV	LV kV					
6300	110±8× 1.25%	35 38.5	6.3 6.6 10.5 11	YNyn0d11	7.8	45	0.89	HV-MV 10.5 HV-LV 17~18 MV-LV 6.5
8000					9.4	53	0.89	
10000					11	62	0.84	
12500					12.7	73	0.84	
16000					15.8	90	0.79	
20000					18.6	106	0.79	
25000					22	125	0.74	
31500					26.2	148	0.74	
40000					31.4	178	0.68	
50000					37.1	212	0.68	
63000					44.2	255	0.63	
90000					57.7	333	0.48	

Note:

1. On load voltage regulating transformer, temporarily provide step-down structure products;
2. The capacity distribution of high, medium and low voltage windings is (100 / 100 / 100)%;
3. The connection group label can be YNd11y10 as required;
4. The maximum current tapping is - 10% tapping position;
5. According to the needs of users, the voltage value or tap different from that in the table can be selected for medium voltage.



110kV(60kV)

Technical Parameter

S13-6300 - 90000 / 110kV oil-immersed double winding non excitation voltage regulating power transformer

Rated Capacity KVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0 %	Uk%
	HV kV	HV Tapping	LV kV					
6300	110 121	±2×2.5%	6.3 6.6 10.5 11	YNd11	5.92	34	0.68	10.5
8000					7.2	42	0.64	
10000					8.4	50	0.6	
12500					9.8	59	0.56	
16000					12	73	0.53	
20000					14.2	88	0.49	
25000					16.8	104	0.45	
31500					19.9	125	0.41	
40000					23.8	147	0.38	
50000					28.2	183	0.34	
63000					33.4	221	0.3	
90000					43.7	289	0.3	

Note: 1. The maximum current tapping is - 5%.

S13-6300 - 90000 / 110kV/35kV oil-immersed double winding non excitation voltage regulating power transformer

Rated Capacity KVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0 %	Uk%
	HV kV	HV Tapping	LV kV					
6300	110 121	±2×2.5%	35 38.5	YNd11	6.5	37	0.79	10.5
8000					7.8	45	0.79	
10000					9.1	52	0.74	
12500					10.6	62	0.74	
16000					12.7	77	0.68	
20000					15.1	93	0.68	
25000					17.8	109	0.63	
31500					21	132	0.63	
40000					25	155	0.58	
50000					29.3	192	0.58	
63000					34.6	232	0.53	
90000					45.3	303	0.41	

Note: 1. The maximum current tapping position is - 5%.

Technical Parameter

SZ13-6300 - 90000 / 110kV oil-immersed double winding on load voltage regulating power transformer

Rated Capacity KVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0 %	Uk%
	HV kV	HV Tapping	LV kV					
6300	110	±8×1.25%	6.3 6.6 10.5 11	YNd11	6.5	34	0.74	10.5
8000					7.8	42	0.74	
10000					9.4	50	0.68	
12500					10.9	59	0.68	
16000					13.2	73	0.63	
20000					15.6	88	0.63	
25000					18.2	104	0.58	
31500					21.9	125	0.58	
40000					26.3	148	0.53	
50000					31.1	183	0.53	
63000					37	221	0.47	
90000					48.4	289	0.36	

Note:

1. On load voltage regulating transformer, temporarily provide step-down structure products;
2. Negotiate with the manufacturer according to the user department; Products that can provide other voltage combinations;
3. The maximum current tap is - 10% tap position.

S18-3150 – 63000 / 66kV oil-immersed three-phase double winding non excitation voltage regulating power transformer (Class III energy efficiency)

Rated Capacity KVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0 %	Uk%
	HV kV	HV Tapping	LV kV					
3150	63 66 69	±5% ±2×2.5%	6.3 6.6 10.5	YNd11	3.20	21.9	0.84	8.0
4000					3.80	25.9	0.80	
5000					4.60	29.2	0.68	
6300					5.80	32.5	0.60	9.0
8000					7.10	38.5	0.60	
10000					8.40	45.4	0.56	
12500					9.90	54	0.56	
16000					12.00	66.3	0.52	
20000					14.10	80.4	0.52	
25000					16.60	95	0.48	
31500					19.70	114	0.44	
40000					23.50	134	0.44	
50000					28.20	158.7	0.40	
63000					33.30	188.1	0.36	

Technical Parameter

S20-3150 – 63000 / 66kV oil-immersed three-phase double winding non-excitation voltage regulating power transformer (Class II energy efficiency)

Rated Capacity kVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0 %	Uk%
	HV kV	HV Tapping	LV kV					
3150	63 66 69	±5% ±2×2.5%	6.3 6.6 10.5	YNd11	2.60	20.7	0.84	8.0
4000					3.10	24.6	0.80	
5000					3.70	27.6	0.68	
6300					4.70	30.8	0.60	
8000					5.80	36.5	0.60	9.0
10000					6.80	43	0.56	
12500					8.10	51.1	0.56	
16000					9.80	62.8	0.52	
20000					11.40	76.1	0.52	
25000					13.50	90	0.48	
31500					16.00	108	0.44	
40000					19.10	126.9	0.44	
50000					22.90	150.3	0.40	
63000					27.00	178.2	0.36	

S22-3150 – 63000 / 66kV oil-immersed three-phase double winding non-excitation voltage regulating power transformer (Class I energy efficiency)

Rated Capacity kVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0 %	Uk%
	HV kV	HV Tapping	LV kV					
3150	63 66 69	±5% ±2×2.5%	6.3 6.6 10.5	YNd11	2.20	20.7	0.84	8.0
4000					2.60	24.6	0.80	
5000					3.10	27.6	0.68	
6300					4.00	30.8	0.60	
8000					4.90	36.5	0.60	9.0
10000					5.80	43	0.56	
12500					6.80	51.1	0.56	
16000					8.30	62.8	0.52	
20000					9.70	76.1	0.52	
25000					11.40	90	0.48	
31500					13.50	108	0.44	
40000					16.20	126.9	0.44	
50000					19.40	150.3	0.40	
63000					22.90	178.2	0.36	

Technical Parameter

SZ18-6300 – 63000 / 66kV oil-immersed three-phase double winding on load voltage regulating power transformer (Class III energy efficiency)

Rated Capacity kVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0 %	Uk%
	HV kV	HV Tapping	LV kV					
6300	63 66 69	±8×1.25%	6.3 6.6 10.5	YNd11	6.40	32.5	0.60	9.0
8000					7.70	38.5	0.60	
10000					9.00	45.4	0.56	
12500					10.70	54	0.56	
16000					12.90	66.3	0.52	
20000					15.40	80.4	0.52	
25000					18.20	95	0.48	
31500					21.50	114	0.44	
40000					25.80	134	0.44	
50000					30.40	158.7	0.40	
63000					35.90	188.1	0.36	

SZ20-6300 – 63000 / 66kV oil immersed three-phase double winding on load voltage regulating power transformer (Class II energy efficiency)

Rated Capacity kVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0 %	Uk%
	HV kV	HV Tapping	LV kV					
6300	63 66 69	±8×1.25%	6.3 6.6 10.5	YNd11	5.20	30.8	0.60	9.0
8000					6.20	36.5	0.60	
10000					7.30	43	0.56	
12500					8.70	51.1	0.56	
16000					10.50	62.8	0.52	
20000					12.50	76.1	0.52	
25000					14.80	90	0.48	
31500					17.50	108	0.44	
40000					20.90	126.9	0.44	
50000					24.70	150.3	0.40	
63000					29.20	178.2	0.36	



110kV(60kV)

Technical Parameter

SZ22-6300 – 63000 / 66kV oil immersed three-phase double winding on load voltage regulating power transformer (Class I energy efficiency)

Rated Capacity kVA	Voltage combination and tapping range			Vector Group	P0 kW	PK kW (75°C)	I0 %	Uk%
	HV kV	HV Tapping	LV kV					
6300	63	±8×1.25%	6.3	YNd11	4.40	30.8	0.60	9.0
8000					5.30	36.5	0.60	
10000					6.20	43	0.56	
12500					7.40	51.1	0.56	
16000					8.90	62.8	0.52	
20000					10.60	76.1	0.52	
25000					12.50	90	0.48	
31500					14.80	108	0.44	
40000					17.70	126.9	0.44	
50000	66				20.90	150.3	0.40	
63000					24.70	178.2	0.36	

Qualification Certificate



ISO 19001



ISO 45001

Qualification Certificate



实验室名称: 国家电器产品质量监督检验中心
Lab Name: China National Center for Quality Supervision and Test of Electrical Apparatus Products

No. ZJ0007612-05

型式试验报告 Type Test Report

委托单位: 中电电气(江苏)变压器制造有限公司
C114051
产品名称: 电力变压器
Name of Product:
产品型号: SZ22-63000/110
Product Type:
检测类别: 委托试验
Test Category:

本实验室对委托单位的试验(检测)结果负责, 未经本实验室同意, 不得将试验结果外传。
The laboratory is responsible for the inspection (Test) results. The report shall not be reprinted except in full, written approval of the laboratory.

国家电器产品质量监督检验中心 检 验 报 告				DQJC	
No. 2020090101		送 样 单 号		送 样 单 号	
委托方	中电电气(上海)有限公司	样品	型式试验		
生产单位	中电电气(上海)有限公司	类别			
生产标准	中电电气(上海)有限公司	标准名称	GB 1983-2011 电力变压器		
产品	高压变压器	产品型号	SC11-M-63000/110		
生产地址	浦东新区川沙新镇川沙路1000号	检验项目	型式试验		
检验日期	2020年10月10日	检验结果	合格		
检验项目	例行试验	GB 1983-2011-10.1			
	型式试验	GB 1983-2011-10.2			
	型式试验	GB 1983-2011-10.3			
	型式试验	GB 1983-2011-10.4			
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	型式试验	GB 1983-2011-10.7			
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	型式试验	GB 1983-2011-10.9			
	型式试验	GB 1983-2011-10.10			
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电 器 部 门	
电 器 部 门 检 测 报 告	
1. 样品名称	
额定电压: 63000V 额定容量: 10000kVA 额定电压: 110kV/100kV 额定容量: 10000kVA 额定电压: 110kV/100kV 额定容量: 10000kVA	
2. 样品来源	
生产厂家: 110kV/100kV (2019) 110kV/100kV 生产厂家: 110kV/100kV 生产厂家: 110kV/100kV 生产厂家: 110kV/100kV 生产厂家: 110kV/100kV	
3. 样品规格	
额定电压: 63000V 额定容量: 10000kVA 额定电压: 110kV/100kV 额定容量: 10000kVA 额定电压: 110kV/100kV 额定容量: 10000kVA	
4. 样品规格	
额定电压: 63000V (2019) 110kV/100kV (2019	



ISO 14001

TYPE TEST REPORT of 63000/110 TRANSFORMER

Product Family



01	02	03
04	05	06
07	08	09

1. Amorphous Metal Transformer
2. VPI Transformer
3. Cast Resin Transformer
4. 220kV Power Transformer
5. 220kV Traction Transformer
6. 110kV Traction Transformer
7. 110kV Power Transformer
8. 35kV Power Transformer
9. 110kV Mobile Transformer

Product Family



01	02	03
04	05	06
07	08	09

1. Mining Flame-proof Substation
2. Rectifier Transformer
3. Harmonic Mitigating Transformer
4. Ocean Platform Transformer
5. Marine Transformer
6. AFWF Transformer
7. Integrated PV Step-up Transformer
8. Substation
9. Substation



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Offenders will be held liable for the payment of damages. All rights reserved in the case of registration of a patent, utility model or registered design.

The product may have been modified after this document went to press.

We expressly reserve the right to make changes to the technical data, the design or the scope of delivery.

The information provided and the arrangements agreed during processing of the relevant quotations and orders are strictly binding.

The original operating instructions were drawn up in German.



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1 General

1.1 Safety instructions

All personnel involved in installation, commissioning, operation, maintenance or repair of the equipment must:

- be suitably professionally qualified and
- strictly observe these Operating Instructions.

Improper operation or misuse can lead to

- serious or fatal injury
- damage to the equipment and other property of the user
- a reduction in the efficiency of the equipment.

Three kinds of safety notices are used in these operating instructions to highlight important information.

⚠ WARNING	
	indicates potential death or injury. Failure to observe this notice may result in serious injury or death.
⚠ ATTENTION	
	indicates potential damage to the equipment and other property of the user. Potential death or injury can also not be ruled out.
NOTE	
indicates important information on a particular topic.	



1.2 Appropriate use

 ATTENTION	
	Use the on-load tap-changer only with the transformer specified in the order. Installation, electrical connection and commissioning of the on-load tap-changer must be carried out exclusively by trained, suitably qualified personnel and under strict observation of these operating instructions. The operator must ensure that the on-load tap-changer is used as intended. For safety reasons, any unauthorized work such as installation, alteration, electrical connection, commissioning or modification to the on-load tap-changer equipment is forbidden without first consulting MR! The trouble-free operation of the drive, the on-load tap-changer and the transformer may be endangered.

 ATTENTION	
	All relevant fire protection regulations must be strictly observed.

2 Design/Types

The on-load tap-changer consists of the diverter switch with the tap selector attached underneath **Figure 1**.

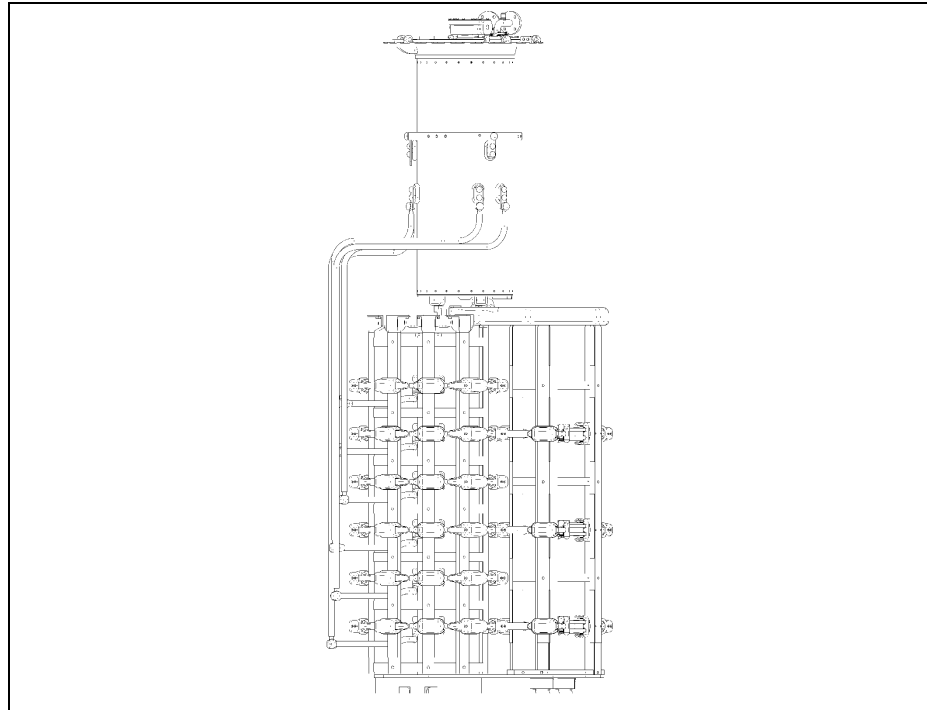


Figure 1 Three-phase on-load tap-changer

The diverter switch is installed in its own oil compartment.

The on-load tap-changer is secured to the transformer cover by the on-load tap-changer head.

The change-over selector of all type R OLTCs is laterally attached to the tap selector.

The E series tap selector is very different from those of the C and D series (see operating instructions no. 119).

On-load tap-changer models with change-over selector are available with up to a maximum of 27 operating positions.

The design of the on-load tap-changer and the designation of its main parts are shown in the installation drawing 897873 in the appendix.

These Operating Instructions apply to all standard models of the on-load tap-changer variants specified below.



Three-phase on-load tap-changer:

R III 1200-E (**Figure 1**)

Single-phase on-load tap-changer:

R I 1201-E, R I 2002/2402-E, R I 3003-E

Single-phase on-load tap-changers are also available as sets of on-load tap-changers

3 x R I 1201-E, 3 x R I 2002/2402-E or

3 x R I 3003-E

with a shared motor-drive unit.



3 Shipment

On-load tap-changer and motor-drive unit are shipped in the adjustment position. The on-load tap-changer is packed in two parts – diverter switch and tap selector – and is well protected against moisture. Both parts are locked in the adjustment position.

The on-load tap-changer equipment is shipped as follows:

Diverter switch oil compartment with on-load tap-changer head and fitted diverter switch insert (max. approx. 210 kg), **Figure 2**.

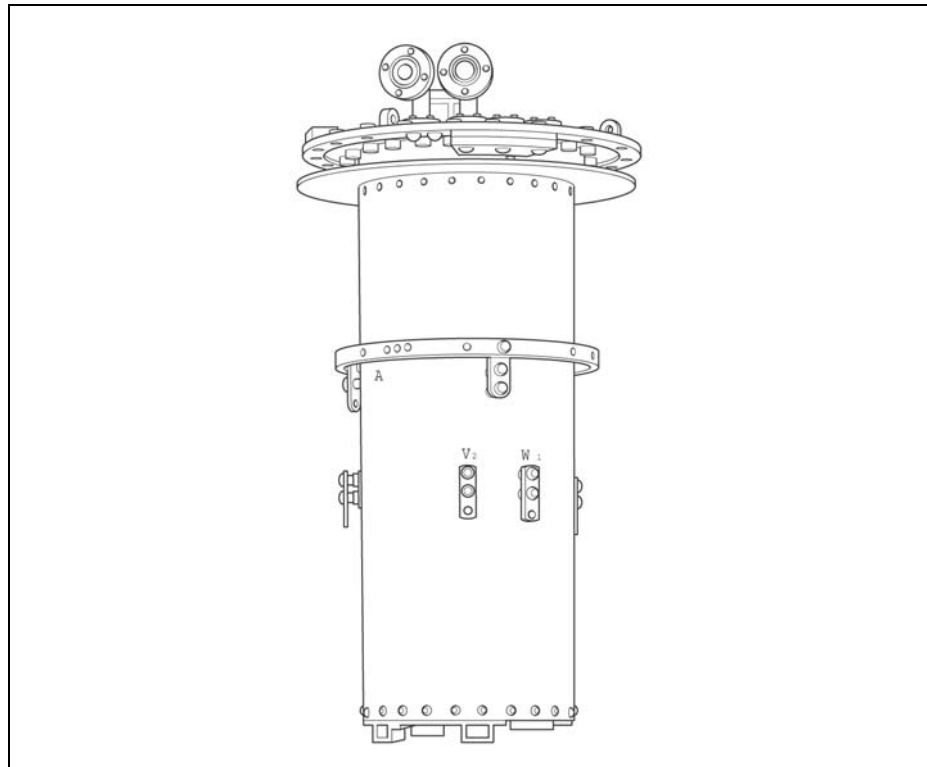


Figure 2 Diverter switch oil compartment

Tap selector (max. weight approx. 500 kg), **Figure 3.**

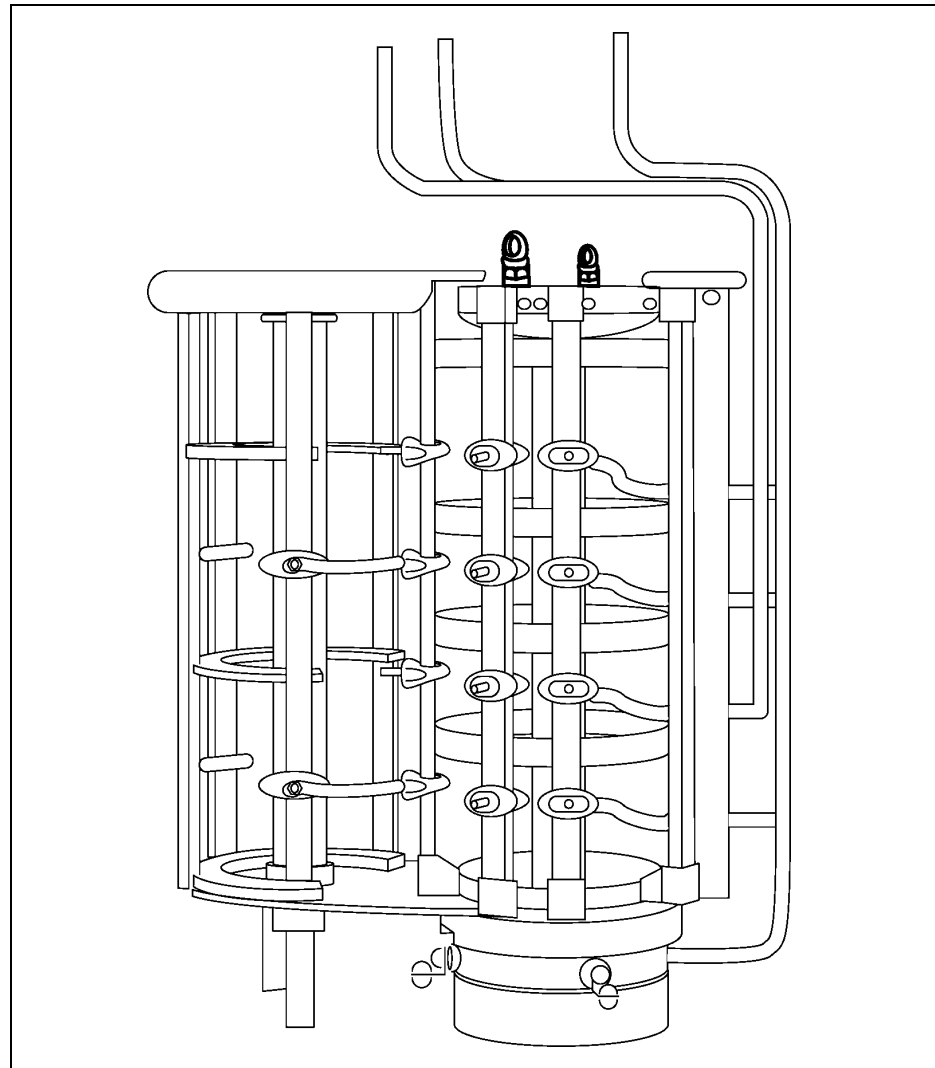


Figure 3 Tap selector



ED-S (approx. 80 kg), **Figure 4.**

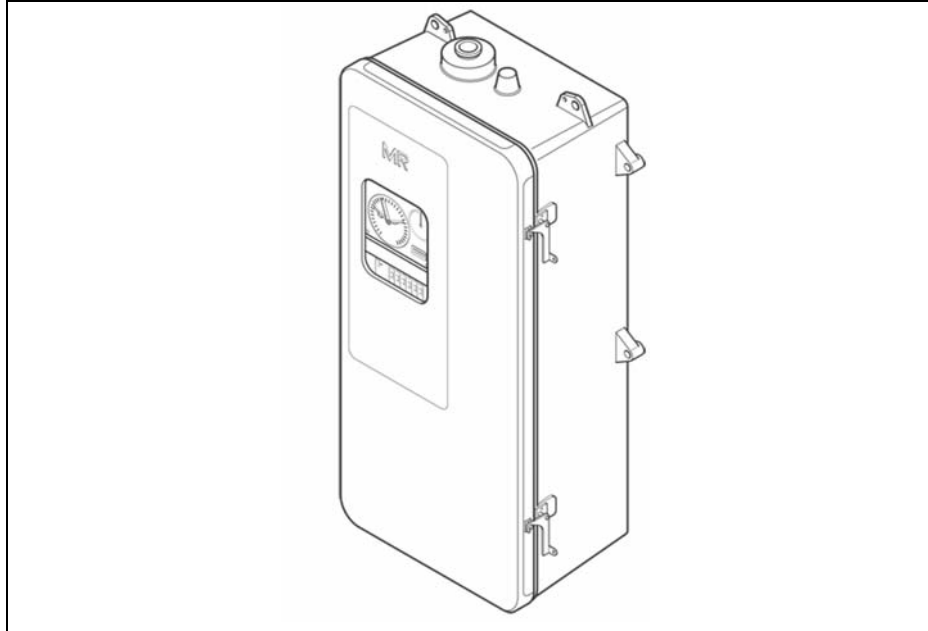


Figure 4 ED-S

Drive shaft with coupling parts and bevel gear (max. weight approx. 20 kg), **Figure 5.**

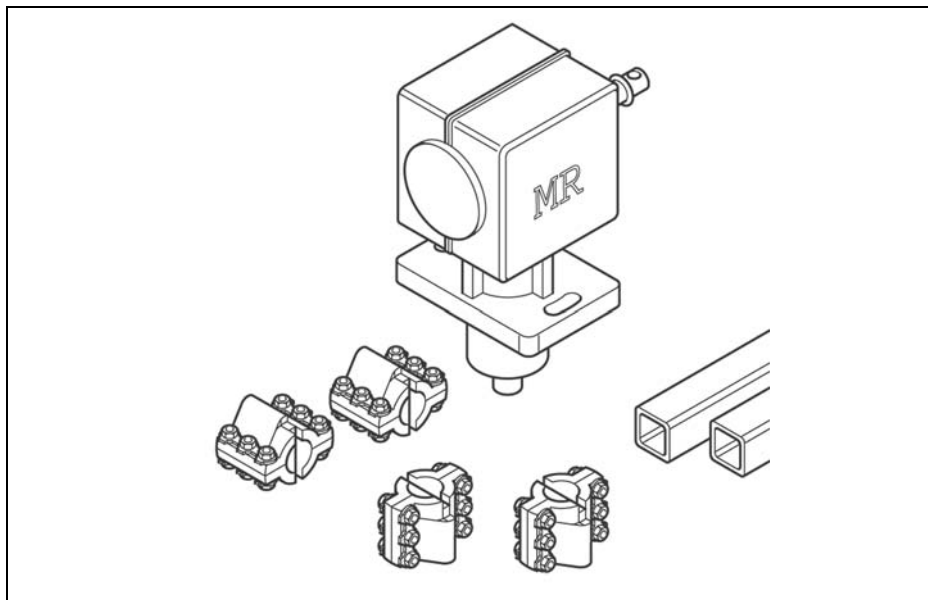


Figure 5 Drive shaft

Protective relay RS 2001 (3.5 kg), **Figure 6.**

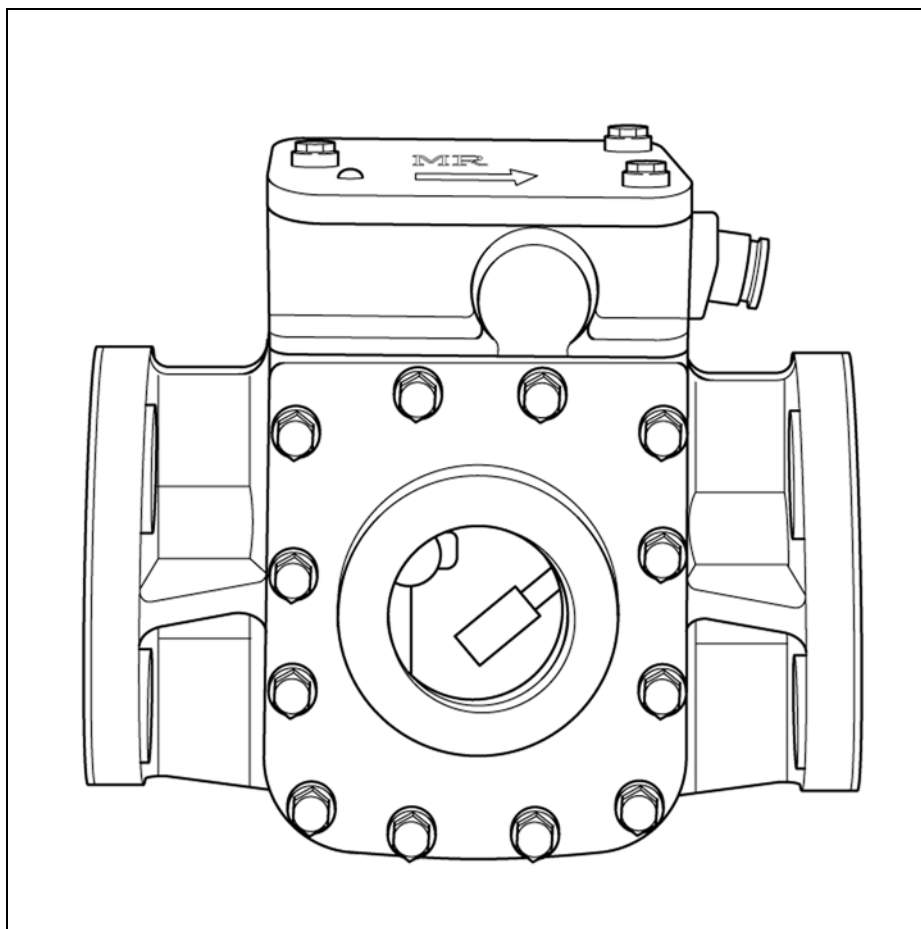


Figure 6 Protective relay RS 2001

The shipment is to be fully checked for completeness on the basis of the shipping documents. The parts must be stored in a dry place until installation.

All on-load tap-changer parts must remain in their airtight, protective wrapping and may only be removed shortly before installation.



In general, drive shafts, bevel gear and protective relay are packed with the on-load tap-changer.

4 Installation of the on-load tap-changer for cover mounting

4.1 Mounting flange

A mounting flange is required for fitting the on-load tap-changer head on the transformer cover. This mounting flange is to be designed according to the sealing surface of the on-load tap-changer head (see **Figure 7** and appendix, drawing 896705).

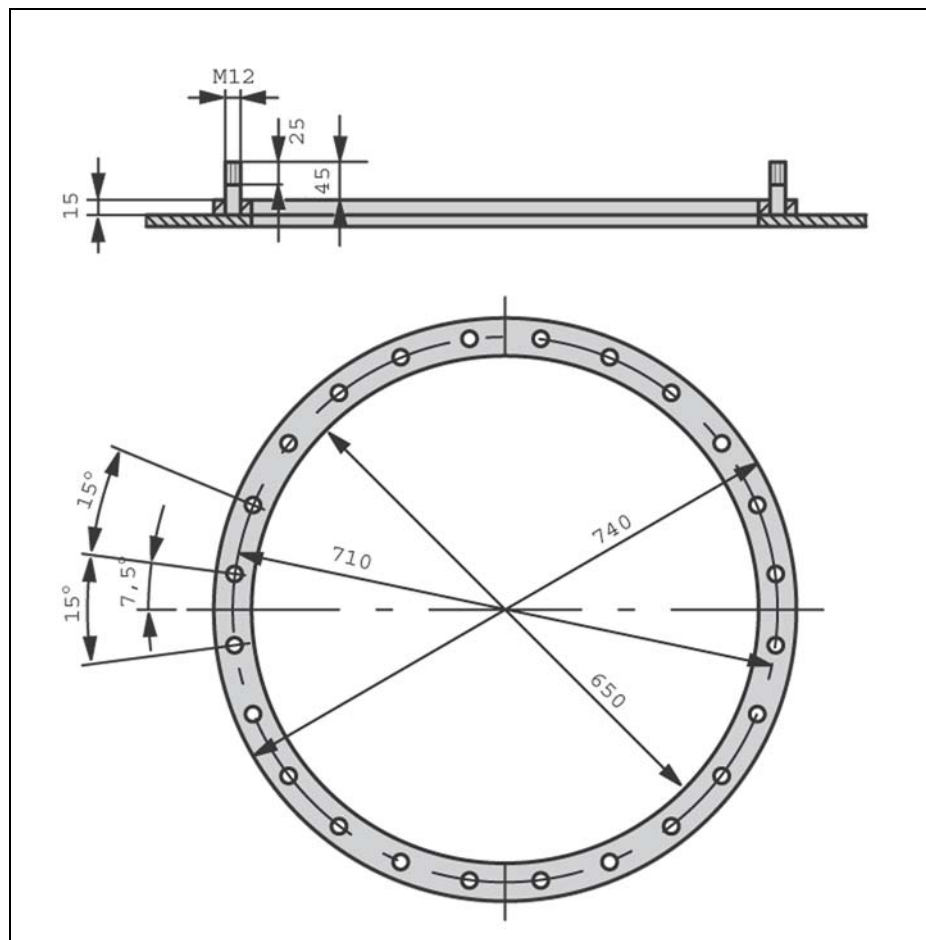


Figure 7 Mounting flange

We recommend using a tracing template to position the stud bolts (M12, max. length 45 mm). If requested, the tracing template will be supplied with the first installation of a type R on-load tap-changer free of charge (see **Figure 8** and appendix, drawing 890183).

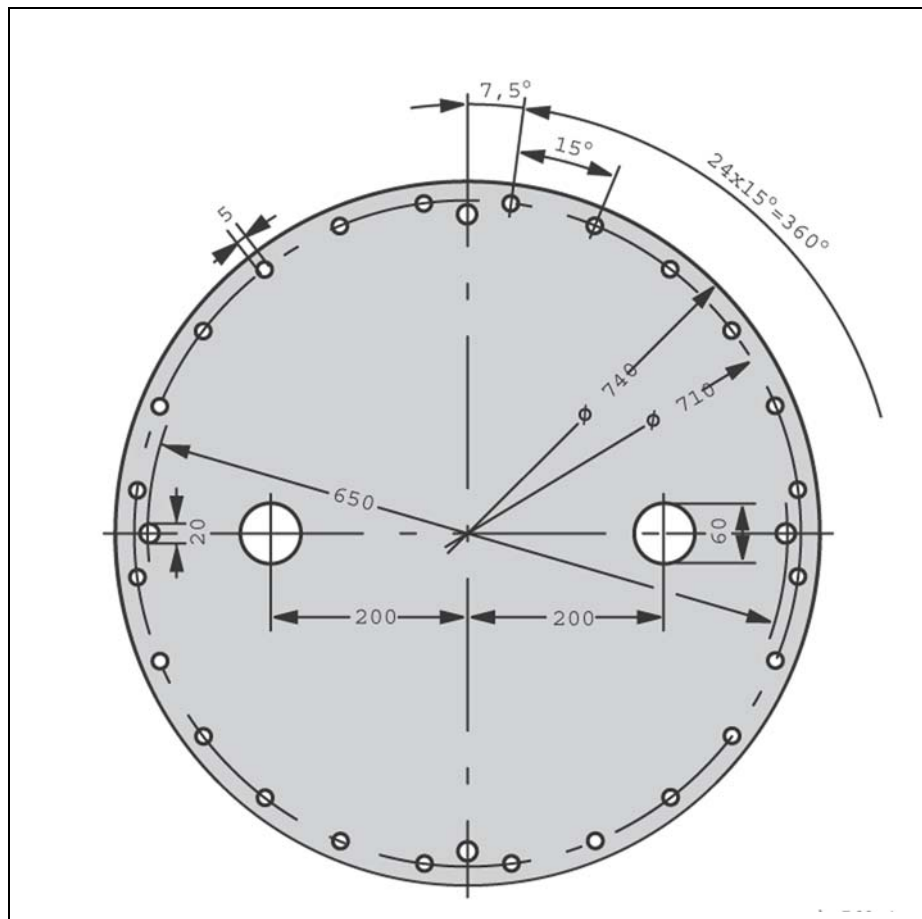


Figure 8 Tracing template

4.2 Attaching the on-load tap-changer to the transformer cover

The diverter switch oil compartment is lowered through the cover aperture (=mounting flange) of the transformer and bolted by the on-load tap-changer head to the mounting flange. The tap selector is then secured to the diverter switch oil compartment, **Chapter 4.3**.

Proceed as follows:

1. Place the diverter switch oil compartment on a level surface.
2. Clean sealing faces on mounting flange and on-load tap-changer head.
3. Place an oil-resistant gasket on the mounting flange.
4. Lift the diverter switch oil compartment by hooking up the on-load tap-changer head and carefully lower the oil compartment into the opening of the mounting flange.

Pay attention to the screening rings (with $U_m \geq 170$ kV only).

5. Check the mounting position of the on-load tap-changer head.
6. Fasten the on-load tap-changer head to the mounting flange.

ATTENTION



Now remove the blocking plate with stud bolt from the coupling of the diverter switch oil compartment bottom, **Figure 9**.

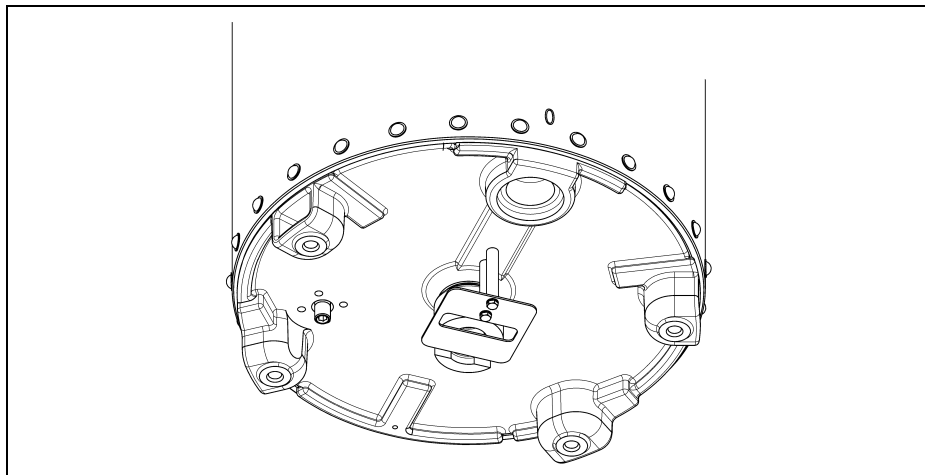


Figure 9 Blocking plate

4.3 Assembly of the diverter switch oil compartment and tap selector

The tap selector is raised from below to the diverter switch oil compartment and connected to it. Thus the mechanical coupling for the tap selector drive is established. Finally, connect the tap selector connecting leads to the diverter switch oil compartment.



4 Installation of the on-load tap-changer for cover mounting

Proceed as follows:

1. Put the tap selector down on a level surface. Get ready 4 lock nuts M12 with washers.

ATTENTION



Now remove the blocking strip from the tap selector coupling, **Figure 10**.

The coupling part must not be turned again afterwards.

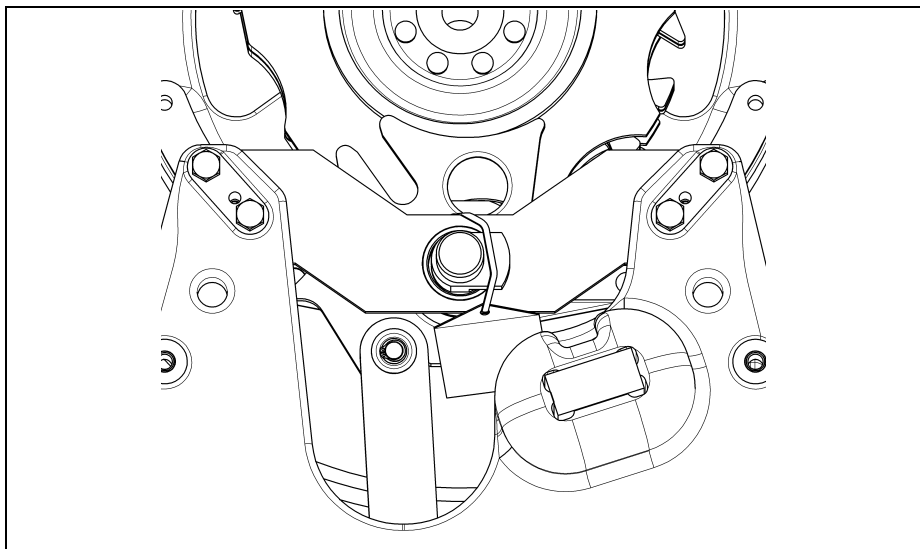


Figure 10 Tap selector coupling blocking strip

2. Place the tap selector on the lifting device.
3. Lift tap selector under diverter switch oil compartment. Take care that the tap selector connecting leads clear the diverter switch oil compartment and remain undamaged.
4. Match the position of the two coupling parts and the attachment points of tap selector suspension and oil compartment base.
5. Raise the tap selector to its final height.
6. Bolt the tap selector suspension to the oil compartment base:



4 lock nuts M12/wrench 19, washers, max. tightening torque 65 Nm
Figure 12.

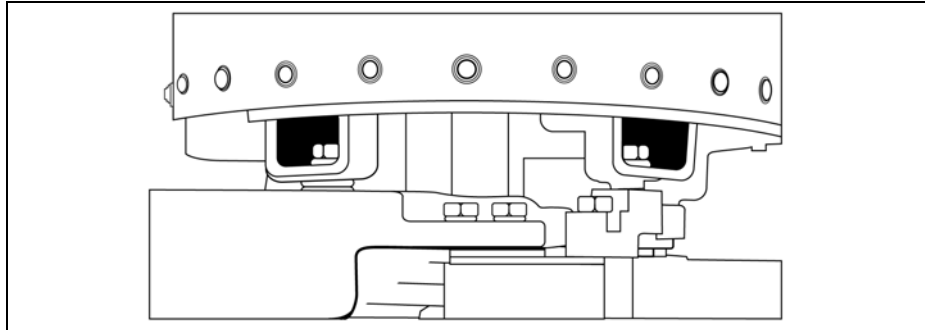


Figure 11 Bolting tap selector suspension

Connect tap selector connecting leads to the diverter switch oil compartment:

ATTENTION



All connections must be carried out carefully. The tightening torques indicated must be applied. Be sure of totally secure bolt connections and screening of the terminal locations using the screening caps supplied with the equipment, **Figure 12.**

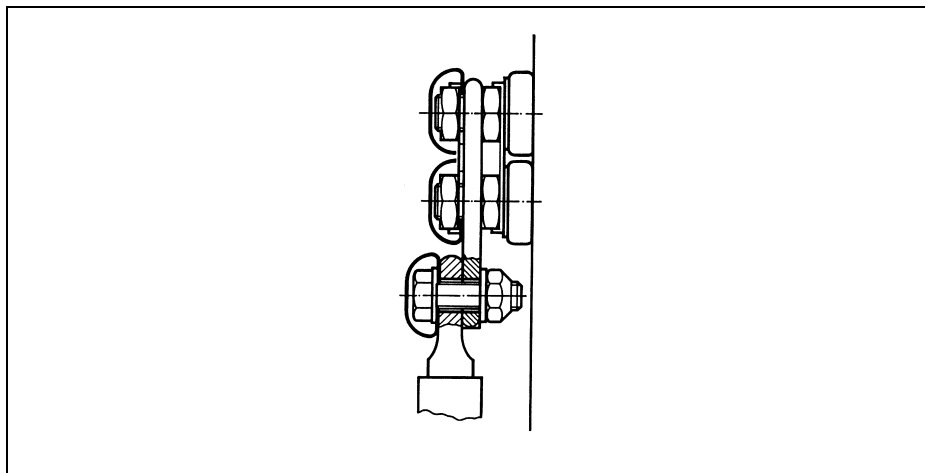


Figure 12 Bolt connections and screening of the terminal locations

On-load tap-changers R III 1200-E and R I 3003-E

Secure 6 lines to oil compartment connection terminals:

Each one attached by 1 bolt M12 (wrench 19) locknut and screening cap, tightening torque 80 Nm, **Figure 13.**



4 Installation of the on-load tap-changer for cover mounting

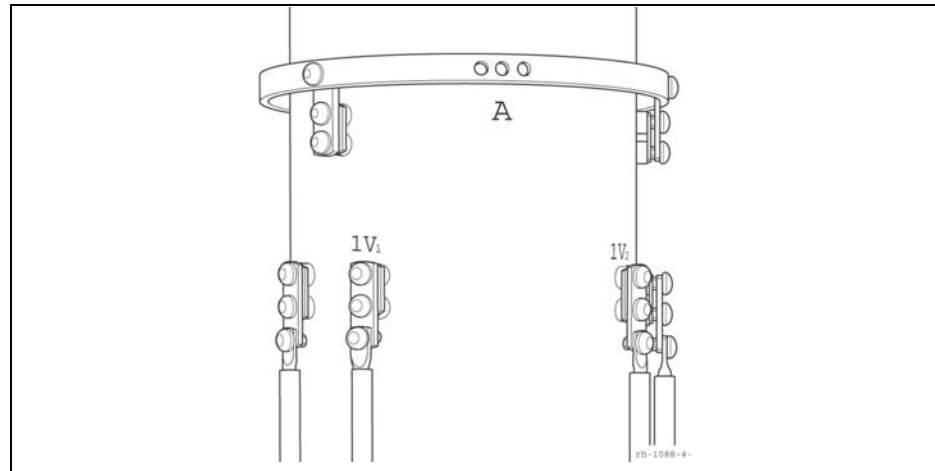


Figure 13 Connection terminals for oil compartment, on-load tap-changers R III 1200-E and R I 3003-E



On-load tap-changer R I 2002/2402-E

Secure 4 lines to oil compartment connection terminals:

Each one attached by 1 bolt M12 (wrench 19) locknut and screening cap, tightening torque 80 Nm, **Figure 14**.

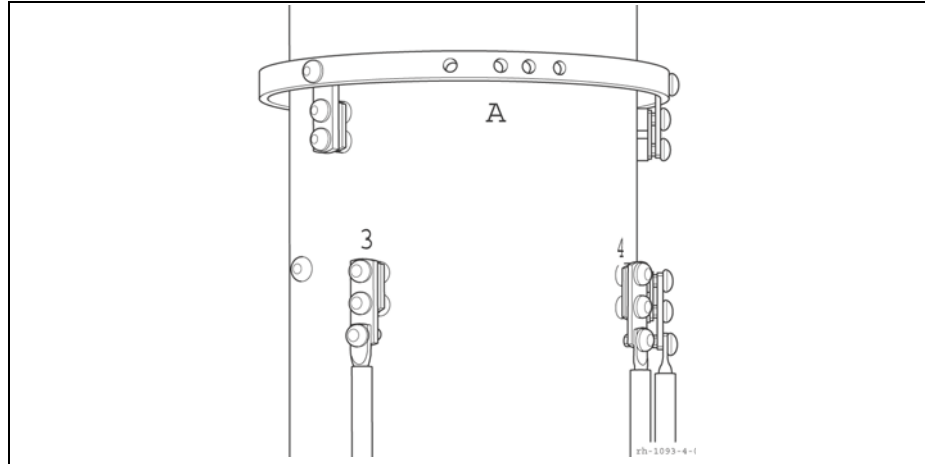


Figure 14 Connection terminals for on-load tap-changer oil compartment, on-load tap-changer R I 2002/2402-E



5 Installation of the on-load tap-changer into the bell-type tank

To install the on-load tap-changer into a transformer with a bell-type tank the on-load tap-changer has to be mounted onto a supporting structure. For this purpose, the on-load tap-changer is equipped with a supporting flange at the diverter switch oil compartment (special design, see appendix, drawing 896762).

First lift the on-load tap-changer into the supporting structure and connect it to the tap winding. The on-load tap-changer must be attached to the supporting structure in such a way that it cannot be displaced. The supporting flange has drilled holes so that it can easily be affixed to the supporting structure. We recommend placing temporary spacers between the supporting structure and supporting flange and removing them before the bell-type tank is mounted.

After mounting the bell-type tank raise the on-load tap-changer (diverter switch insert removed) by means of the lifting traverse (see appendix, drawing 890 180) and attach both the on-load tap-changer and the on-load tap-changer head to the bell-type tank. To attach the on-load tap-changer head to the bell-type tank we recommend the use of a mounting flange as described in **Chapter 4.1**.

5.1 Assembly of the diverter switch oil compartment and tap selector, connecting tap selector connecting leads

The diverter switch oil compartment and tap selector should be assembled and the connecting tap selector connecting leads connected in accordance with **Chapter 4.3**.

5.2 Installation of the on-load tap-changer on the supporting structure

Lift the assembled on-load tap-changer (according to **Chapter 4.1**) into the supporting structure. Check the mounting position of the on-load tap-changer and fix it securely.

NOTE

The on-load tap-changer must be suspended fully vertically in the supporting structure. The on-load tap-changer must be mounted so that it need not be lifted by more than 5 to 20 mm to reach its final position after the bell-type tank is set up.



5 Installation of the on-load tap-changer into the bell-type tank

It is of advantage to install spacer blocks between supporting structure and supporting flange of the on-load tap-changer in such a way that the on-load tap-changer is in its envisaged final position after the bell-type tank is set up. By this measure the leads to be connected to the on-load tap-changer can be correctly dimensioned in length. Remove the spacer blocks after the connection of the leads.

Connect the tap winding and the on-load tap-changer take-off leads according to **Chapter 6**.

ATTENTION



Make sure that the connected leads do not exert any force on the on-load tap-changer. In addition, there must be sufficient clearance so that the on-load tap-changer can be raised to its final mounting position after the bell-type tank is attached.

The drying process and transformer ratio test are to be performed in accordance with **Chapter 7** and **8**.

5.3 Preparation

Before positioning the bell-type tank, the on-load tap-changer head must be separated from the on-load tap-changer.

1. For this purpose, open the on-load tap-changer head cover (24 screws M10, wrench 17, with spring washers).
2. Pay attention to the cover gasket (round rubber gasket, **Figure 15**).

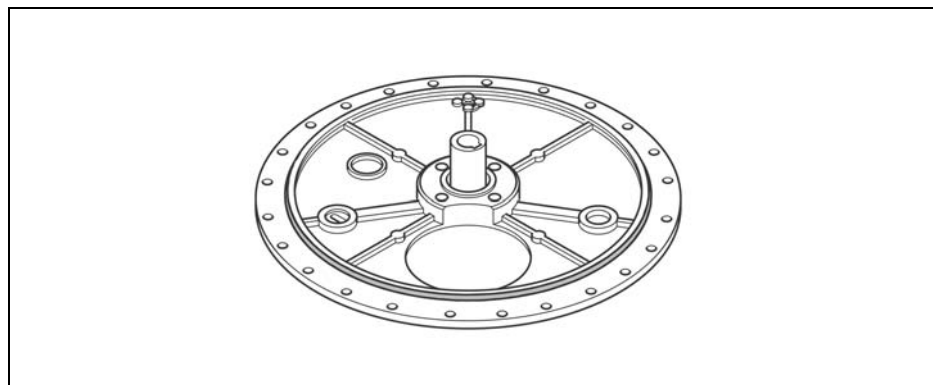


Figure 15 On-load tap-changer head cover gasket

3. Remove the tap position indicator disc (pull off the spring clip from the shaft end, **Figure 16**).

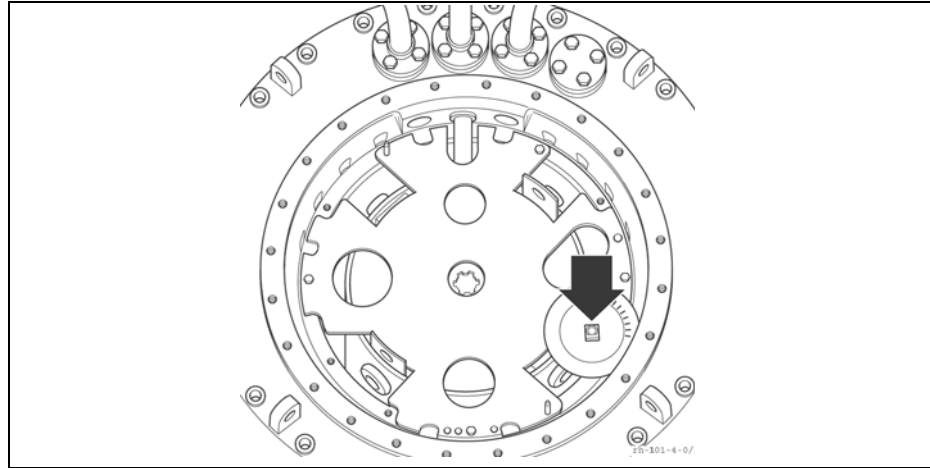


Figure 16 Tap position indicator disc

4. Take note of the red-marked area which is in the region of the on-load tap-changer head and not covered by the base plate of the diverter switch insert, **Figure 17**.

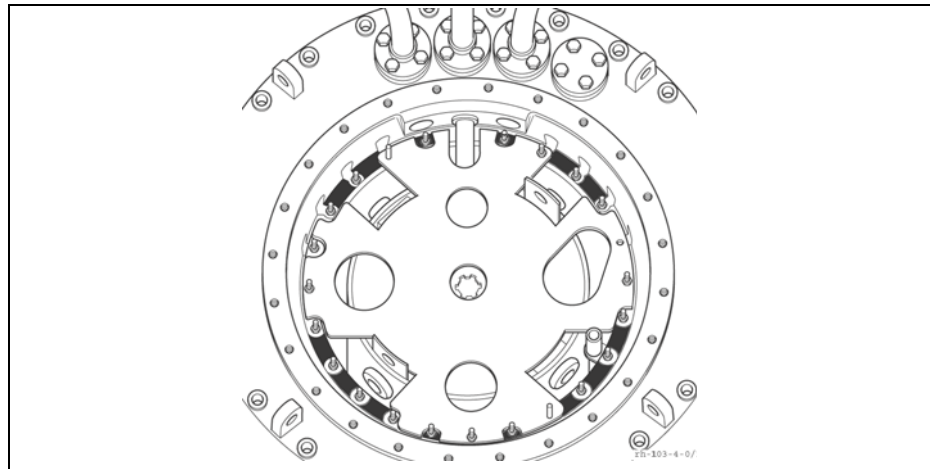


Figure 17 Marked area



5 Installation of the on-load tap-changer into the bell-type tank

5. Remove the fixing nuts of the base plate (4 nuts M8, wrench 13, spring washers, **Figure 18**).

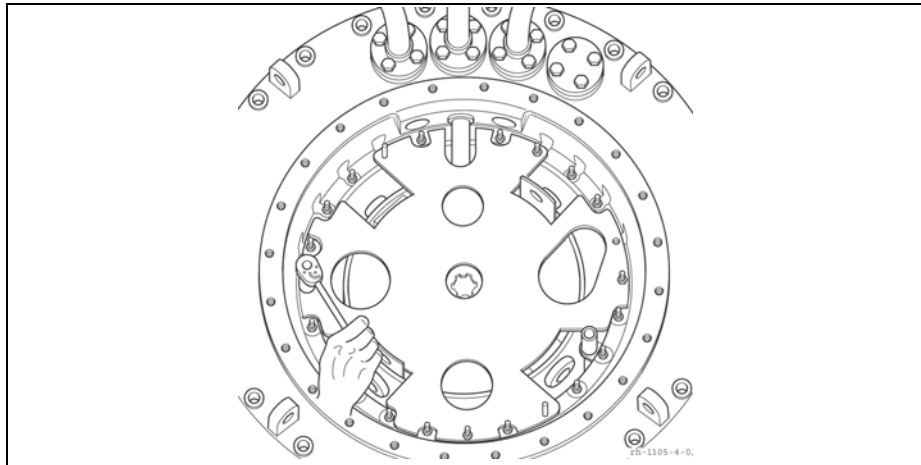


Figure 18 Base plate fixing nuts

6. Lift the diverter switch insert carefully and vertically out of the diverter switch oil compartment, **Figure 20**.

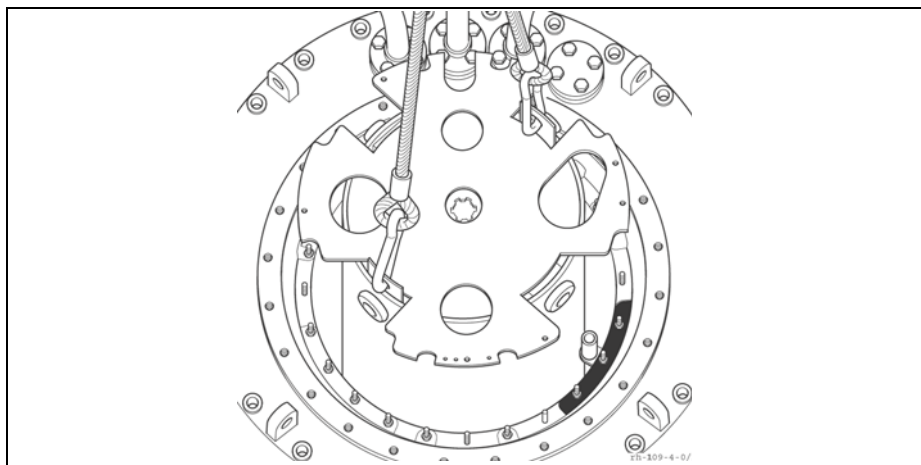


Figure 19 Lifting diverter switch insert



7. Remove the suction pipe. The connecting piece in the on-load tap-changer head must be withdrawn by pulling in and off, **Figure 20**. Note the connecting piece's o-rings.

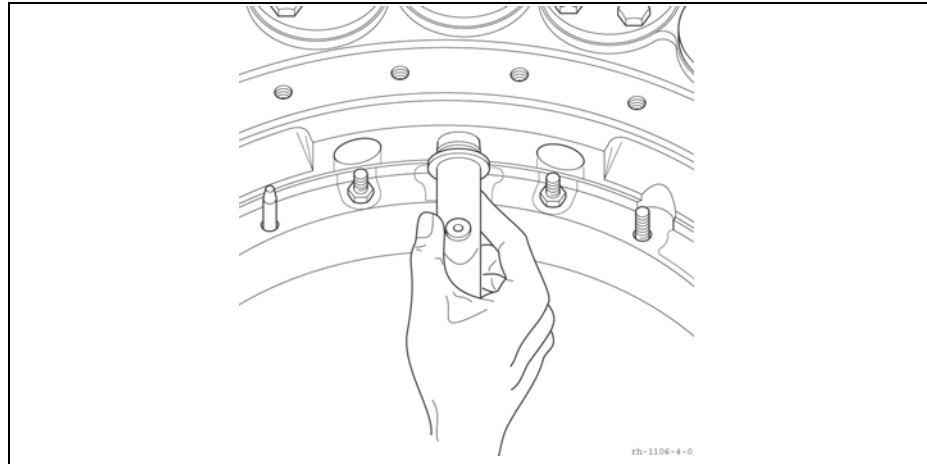


Figure 20 Removing suction pipe

8. Unscrew the remaining screw connections in the on-load tap-changer head (17 nuts M8/wrench 13, spring washers), **Figure 21**.

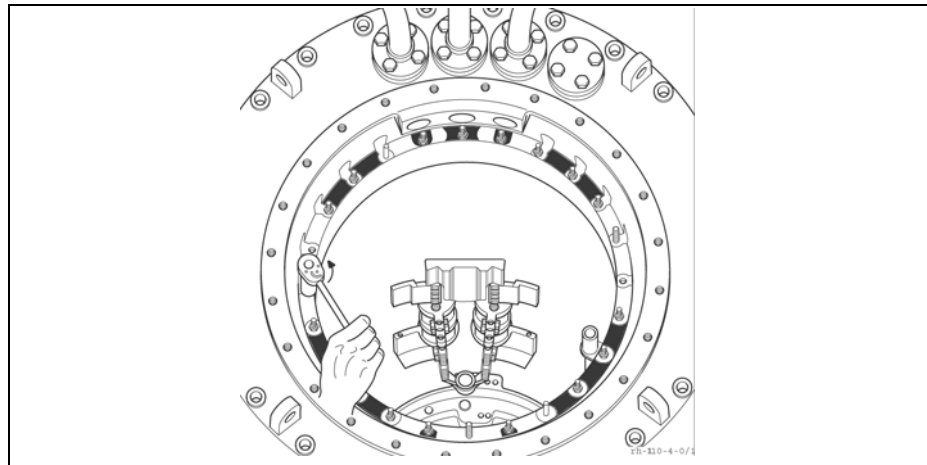


Figure 21 Loosening screw connections

9. Lift off the on-load tap-changer head from the supporting flange. Pay attention to the sealing.

5.4 Attaching the bell-type tank

1. Before positioning the bell-type tank clean the sealing surface of the supporting flange. Put the gasket on the supporting flange. Remove the spacer blocks, **Chapter 5.2**.
2. Lift the bell-type tank over the active part of the transformer and set up the bell-type tank.
3. Before mounting the on-load tap-changer head clean the sealing surfaces (bottom surface of the head, mounting flange). Place an oil-resistant gasket on the mounting flange.
4. Position the on-load tap-changer head onto the mounting flange. Pay attention to the two adjusting bolts (**Figure 22**) and the marks on the supporting flange and on-load tap-changer head (**Figure 23**), which ensure assembly in the correct position. Depending on the specified height, a distance of 5-20 mm must be left between on-load tap-changer head and supporting flange.

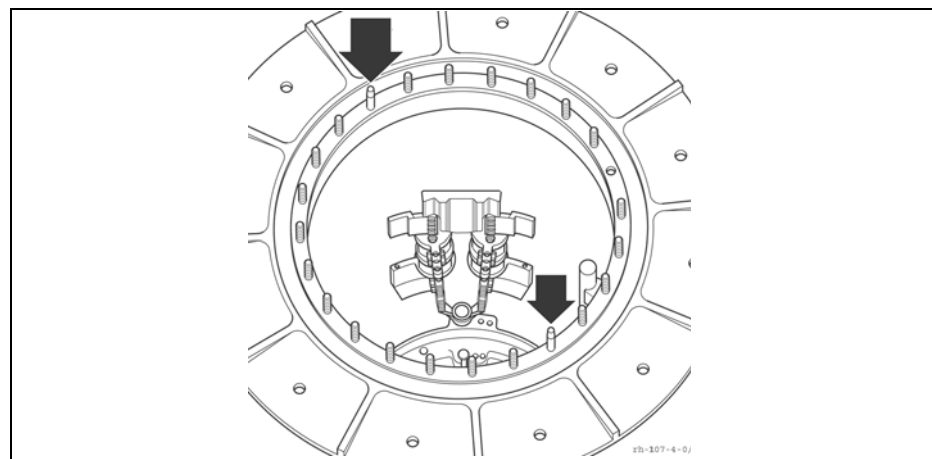


Figure 22 Adjusting bolts

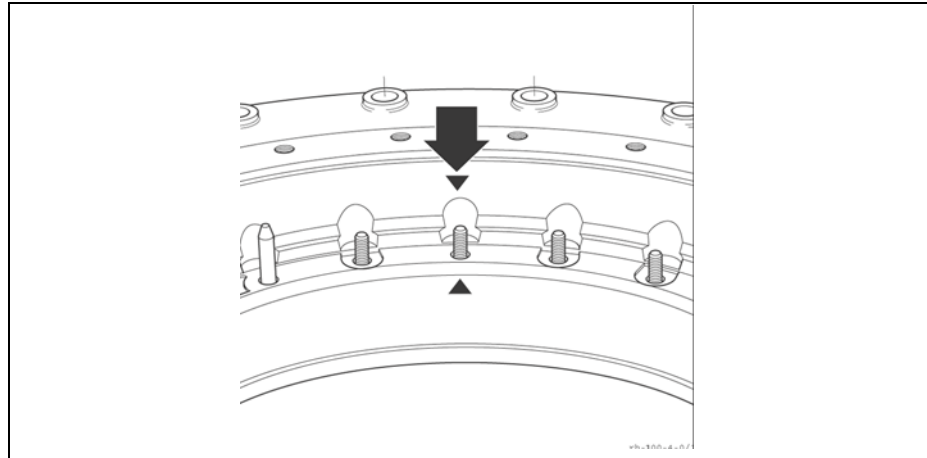


Figure 23 Markings

5. Lift the on-load tap-changer slightly by means of the lifting traverse (**Figure 24** and appendix, drawing 890180). Make sure that all supporting flange stud bolts go easily through the fixing holes of the on-load tap-changer head.

ATTENTION



Under all circumstances, avoid dropping parts into the diverter switch oil compartment. Otherwise there is a risk of the diverter switch blocking, thereby causing severe damage to the on-load tap-changer and the transformer.

Therefore check the quantities of small parts when disassembling and reassembling to ensure they are identical.

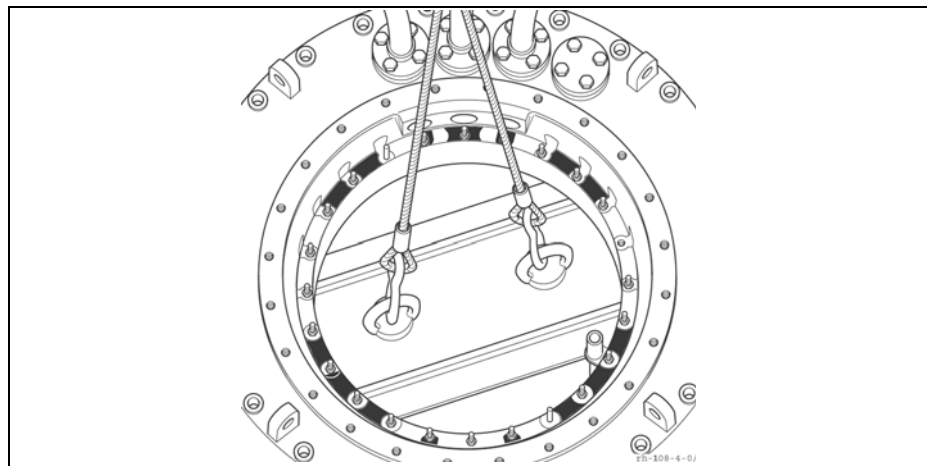


Figure 24 Raising on-load tap-changer



5 Installation of the on-load tap-changer into the bell-type tank

6. Fasten the on-load tap-changer head by screwing the nuts to all studs in the red marked region not covered by the diverter switch insert base plate (**Figure 25, Chapter 5.3**).

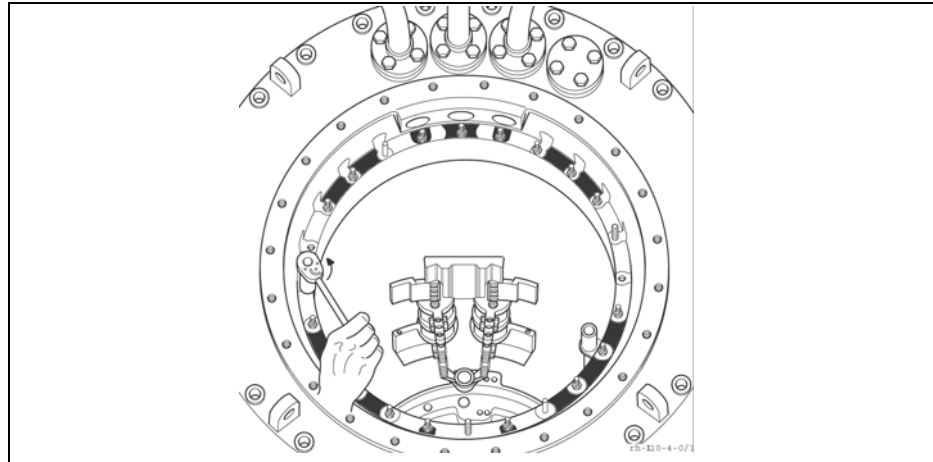


Figure 25 Securing on-load tap-changer head

Use 17 nuts M8 (wrench 13, max. tightening torque 14 Nm, securing by locking washers). Fasten the on-load tap-changer head to the mounting flange.

7. Remount the suction pipe. Make sure that the O-rings are correctly seated. The O-rings should be slightly greased before being mounted.
8. Put the diverter switch insert back in. Make sure that the base plate is in its proper position within the on-load tap-changer head (the red marked areas must be left free).

Attach the base plate:

5 M8 nuts (wrench 13, max. tightening torque 14 Nm, secure by locking washers).

9. Attach the tap position indicator disc:
Push the spring clip onto the shaft end.

The mounting of the position indicator dial is possible only in the correct position by means of its coupling pin, **Figure 26**.

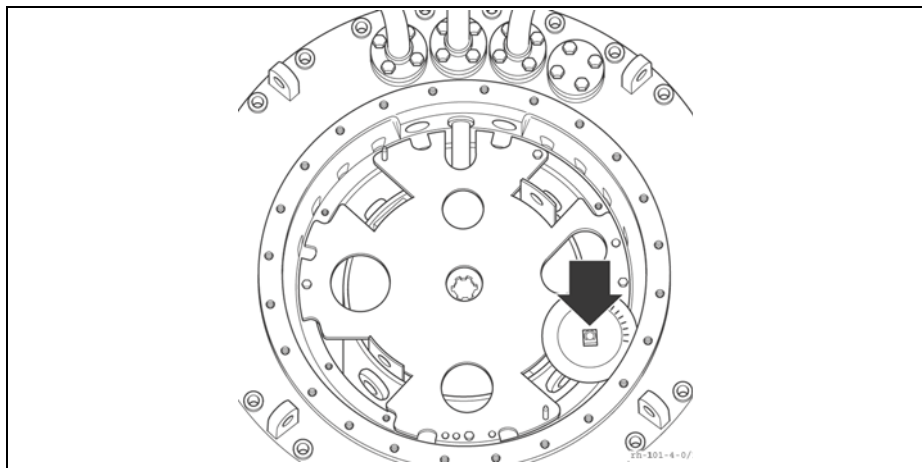


Figure 26 Tap position indicator disc

10. Close the on-load tap-changer head with the cover. Pay attention to the round rubber gasket in the cover. Evenly screw down the on-load tap-changer cover with 24 screws M10/wrench 17, max. tightening torque 34 Nm, **Figure 27**.

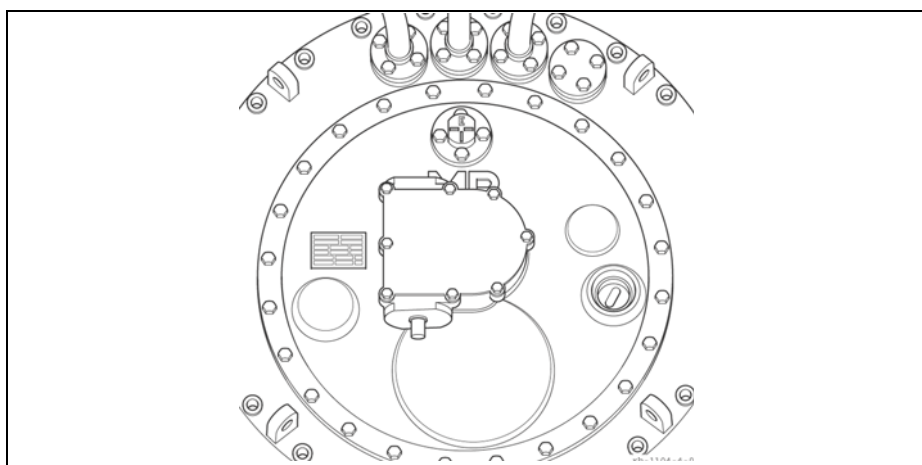


Figure 27 Closing on-load tap-changer head



6 Connection of the tap winding and on-load tap-changer take-off lead

The connection of the tap winding and the on-load tap-changer take-off leads has to be carried out according to the detailed connection diagram included in the delivery.

ATTENTION



All connections must be made carefully and locked safely. The tap selector take-off leads must be assembled in such a way as to allow all leads to be connected to the tap selector without tension. If necessary, the connection ends of the tap selector take-off leads must be shaped in the form of expansion loops.

In order to avoid overvoltage on terminals connected in parallel, tap selector connection terminals with the same designation must be linked together when using R I 2002-E and R I 3003-E single-phase on-load tap-changers with several tap selector planes connected in parallel.

If requested, bridges for the parallel connection of tap selector planes according to drawing 898713 can be supplied (see appendix).

In the case of on-load tap-changer R I 2402, the parallel connection of tap selector planes by means of parallel bridges is not applicable as an enforced current splitting is provided by two isolated winding branches on each tap selector connection terminals.



6.1 Connection of the tap selector take-off leads

The tap selector's connection terminals are marked on the tap selector bars, **Figure 28**. The connection is made on the thread stud of the tap selector connection terminal using a cable shoe and M20/wrench 30 lock nut, tightening torque 80 Nm.

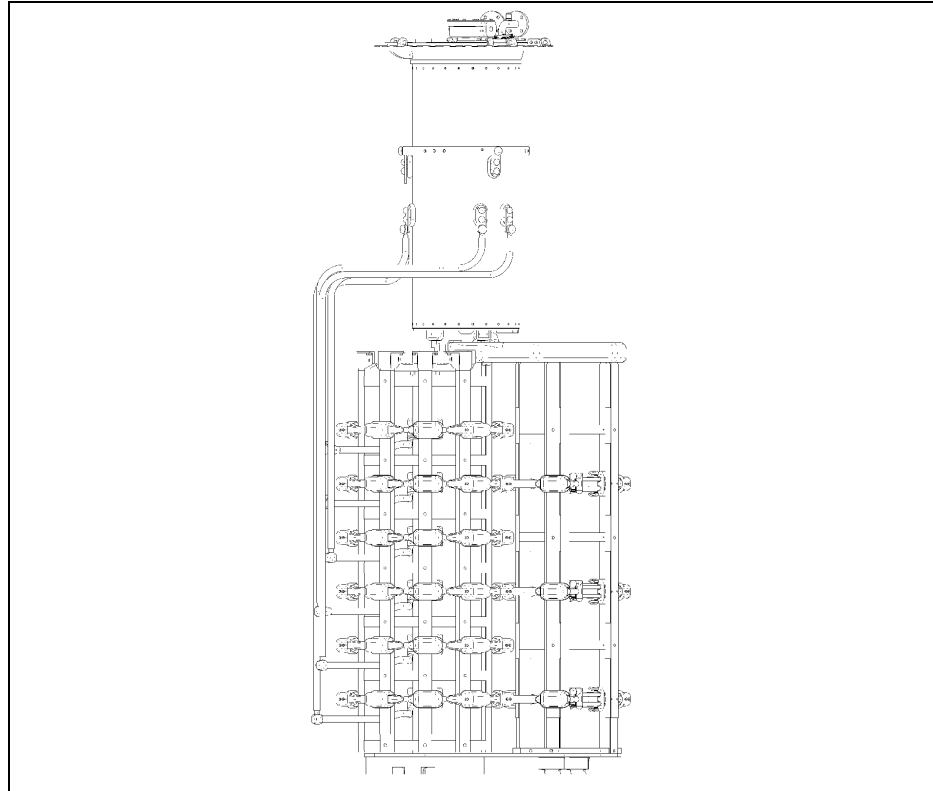


Figure 28 Tap selector connection terminals

Every connection point must be covered by a cover cap. For lateral connection (**Figure 29**), the screening caps are fitted with a straight cable shoe or for face-end connection (**Figure 30**) with an angled cable shoe (see drawing 897 868 in appendix).

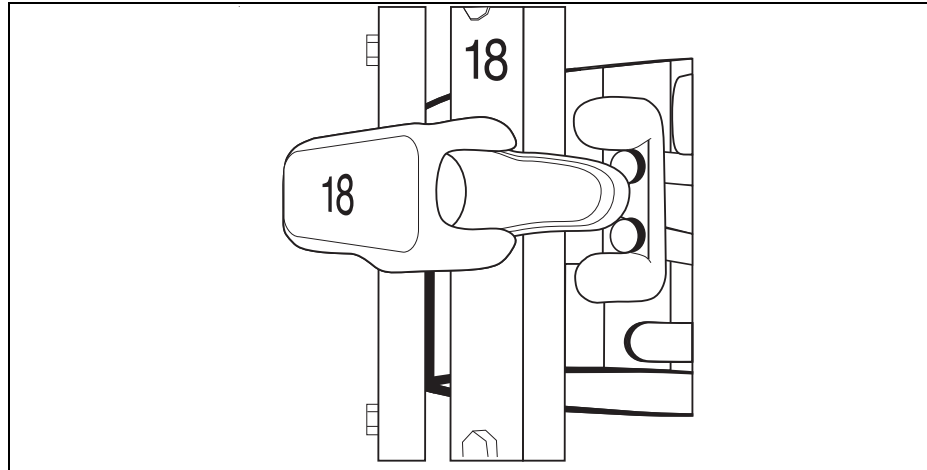


Figure 29 Screening caps for lateral connection

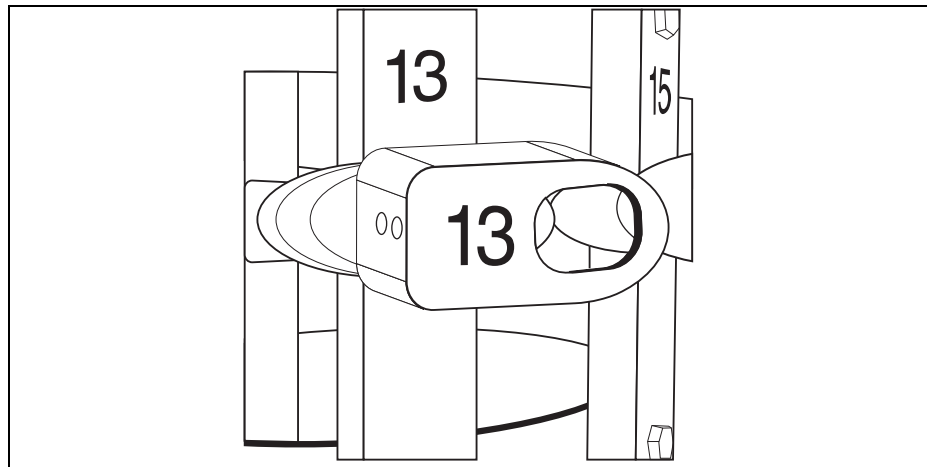


Figure 30 Screening caps for face-end connection

The screening caps are each fitted using a steel bracket and 2 screws M5x12, max tightening torque 5.5 Nm and secured by a center mark on the circumference of the screw head.

Note: The distance between the screening caps and adjacent tap selector take-off leads must be at least 25 mm.



6.2 Parallel jumpers for R I 2002-E and R I 3003-E

Bridges for connecting the connection terminals of the tap selector and change-over selector in parallel can be supplied on request.

6.3 Connection of on-load tap-changer take-off lead

The on-load tap-changer take-off lead should be connected with the connecting ring of the diverter switch oil compartment, **Figure 31**.

The screw connection has to be secured.

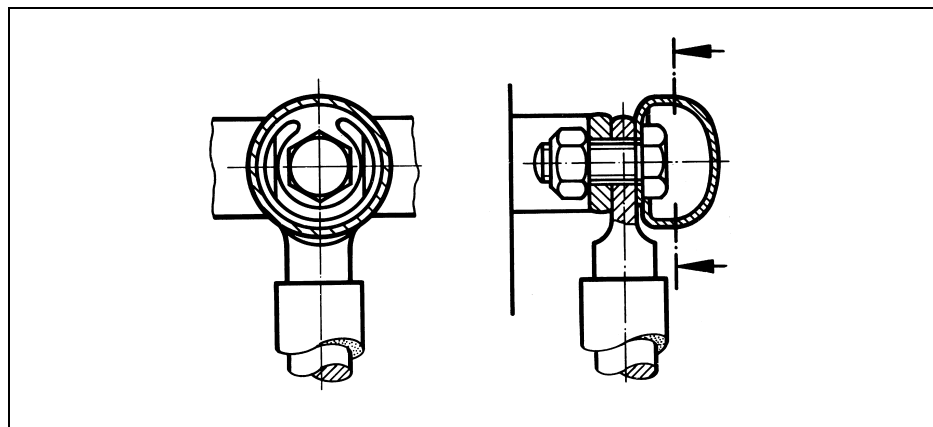


Figure 31 Diverter switch oil compartment connecting ring

On-load tap-changer R III 1200-E (star point connection)

One through-hole each for M12 bolts is provided on different points of the connection ring displaced by 120° **Figure 32**.

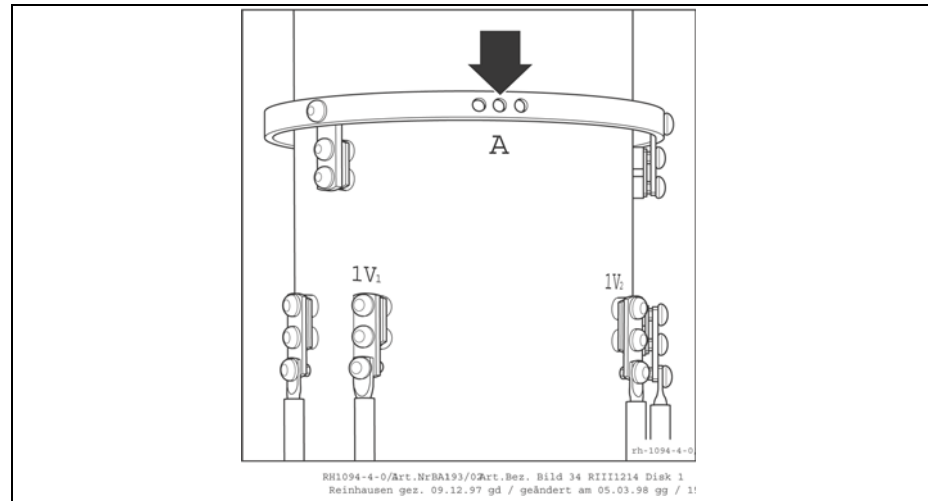


Figure 32 Connecting ring through-hole 1200-E

On-load tap-changers R I 2002-E/2402-E and R I 3003-E

Three or four through-holes each for M12 bolts are provided on different points of the connection ring displaced by 120° **Figure 33**.

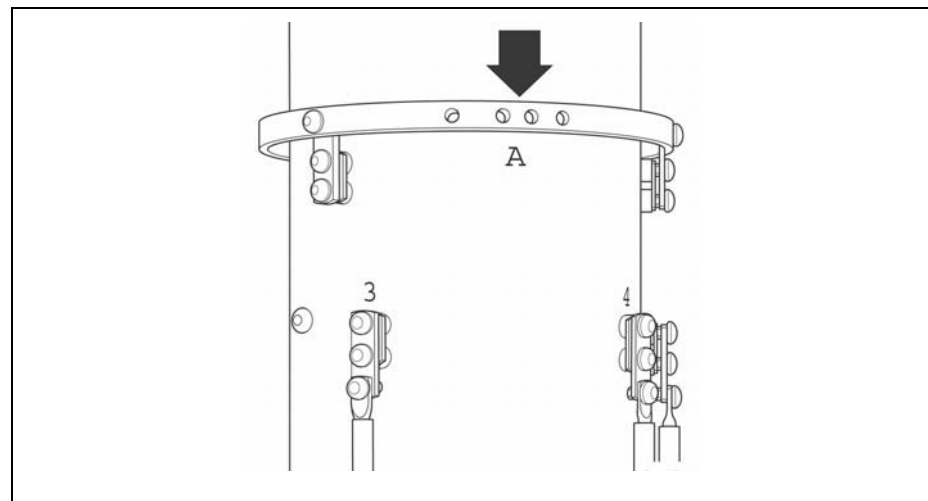


Figure 33 Connecting ring through-hole 2002-E and 3003-E



7 Transformer ratio test

We recommend performing a transformer ratio test with low alternating voltage before drying the transformer.

To operate the drive shaft of the on-load tap-changer head a short tube of 25 mm nominal width with a screwed-in coupling bolt of 12 mm diameter together with a hand wheel or a hand crank may be used.

If using the 3 x R I 2002-E...3003-E on-load tap-changer set, all 3 on-load tap-changer heads must be connected to one another using the horizontal drive shaft part, **Chapter 10**.

If using the ED motor-drive unit, 16.5 revolutions are needed per step on the on-load tap-changer drive shaft. Operation of the diverter switch is clearly audible.

When operating the change-over selector a higher torque is required.

The end positions, which are indicated in the connection diagram supplied with the delivery, must never be overrun. Therefore always check the attained operating position through the inspection window in the on-load tap-changer cover, **Figure 34**.

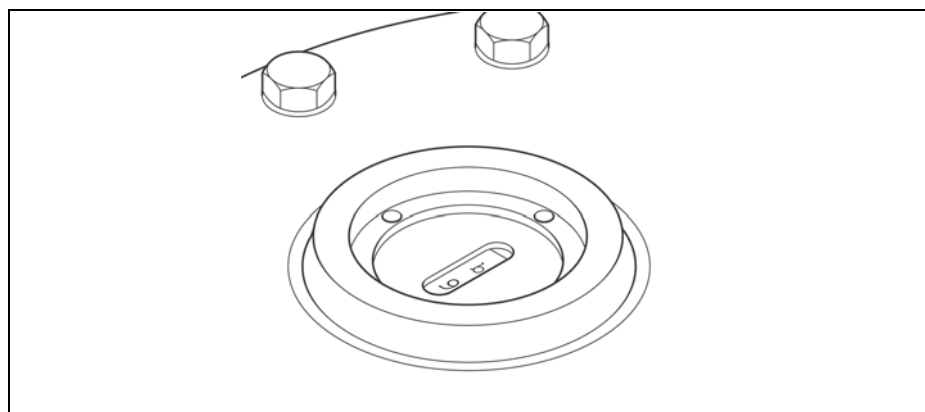


Figure 34 On-load tap-changer cover inspection window

Keep the number of tap-change operations without oil to a minimum. After the transformer ratio test, the on-load tap-changer has to be moved back to the adjustment position (see the detailed connection diagram delivered with the equipment).

NOTE

When vapor-phase drying the transformer in its own tank, open the kerosene drain screw, **Chapter 8.1.2**.



8 Drying process and oil filling

8.1 Drying process

As a precondition of MR's guarantee of the dielectric properties of the on-load tap-changer, a minimum drying treatment must be carried out according to the following instructions (alternatively **Chapter 8.1.1** or **8.1.2**).

8.1.1 Vacuum-drying

8.1.1.1 Vacuum-drying in the autoclave

NOTE
Before drying the transformer in the autoclave, the on-load tap-changer cover must be removed and stored outside the autoclave.

- Heating up:

Heat the on-load tap-changer in air at atmospheric pressure, increasing the temperature by approx. 10 °C/h up to a final temperature of not more than 110 °C.

- Pre-drying:

Pre-dry the on-load tap-changer in circulating air at a max. temperature of 110 °C applied to the on-load tap-changer for a duration of 20 hours.

- Drying:

Vacuum drying at a temperature of 110 °C max. applied to the on-load tap-changer and a residual pressure of at most 10^{-3} bar for a duration of at least 50 hours.

8.1.1.2 Drying in the transformer tank

NOTE
If the transformer is to be dried in its own tank, the interior of the on-load tap-changer must be connected to vacuum by a connecting pipe, as the on-load tap-changer cover remains closed during the entire drying process.

The on-load tap-changer cover is vacuum-proof.

To ensure sufficient drying of the interior of the oil compartment and the incorporated diverter switch insert, a short by-pass tube of 25 mm nominal width must be connected between the transformer tank and a pipe connection at the on-load tap-changer head that leads directly into the interior.

The connection line must be installed on the on-load tap-changer head between the connections E2 and Q or E2 and R (for location of the connections on on-load tap-changer head, see **Chapter 9** and appendix, drawing 893 899).

Procedure, temperature, duration and pressure of the drying process are described in **Chapter 8.1.1.1**.

8.1.2 Vapor-phase drying

NOTE

In order to drain off the kerosene condensate in the oil compartment, the kerosene drain screw in the oil compartment base must be opened before the drying process commences, **Figure 35**.

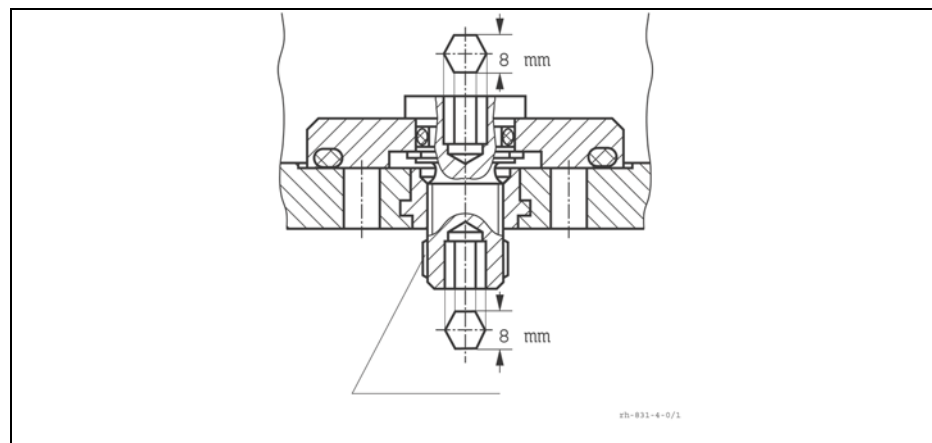


Figure 35 Kerosene drain screw

The kerosene drain screw has a hexagonal recess and is easily accessible between oil compartment base and tap selector gear and can be unscrewed from outside.

The thread of the kerosene drain screw features a plastic coating and requires a higher turning torque.

NOTE

Turn the kerosene drain screw only to the point of increased force.



When vapor-phase drying the transformer in its own tank (see **Chapter 8.1.2.2**) **the kerosene drain screw, in general, is not accessible from outside and can only be opened from the inside.** In this case, the diverter switch insert must be removed, the kerosene drain screw screwed on with an extended socket wrench (see appendix, drawing 890 182) and the diverter switch insert refitted.

	! ATTENTION
	The kerosene drain screw must be closed again after the drying process to ensure that no oil from the diverter switch oil compartment can flow into the transformer oil tank!

8.1.2.1 Vapor-phase drying in the vacuum autoclave

NOTE
Before drying the transformer in the autoclave, the on-load tap-changer cover must be removed and stored outside the autoclave.

- Heating up:

Supply kerosene vapor at a temperature of approx. 90°C. Keep this temperature constant for approx. 3-4 hours.

- Drying:

Increase the kerosene vapor temperature applied to the on-load tap-changer by approx. 10 °C/h to the desired final temperature which should not exceed 125 °C. The duration of the drying process depends on the transformer.

8.1.2.2 Vapor-phase drying in the transformer tank

If the transformer is to be dried in its own tank, the on-load tap-changer cover remains closed during the entire drying process.

The on-load tap-changer cover is vacuum-proof. To ensure sufficient drying of the interior of the diverter switch oil compartment and of the diverter switch insert, it is necessary to connect a common tube of at least 50 mm nominal width between the kerosene vapor lead and at least two pipe connections of the on-load tap-changer head leading into the diverter switch compartment.

For this purpose use pipe connections R and Q for on-load tap-changer type R (for position of pipe connections at the on-load tap-changer head see **Chapter 9** and appendix, drawing 893 899).

Procedure, temperature and duration of the drying process are described in **Chapter 8.1.2.1**.



8.1.2.3 Operating the on-load tap-changer

⚠ ATTENTION	
	Do not operate the on-load tap-changer after drying without oil wetting, otherwise bearings and gaskets will be damaged.

The on-load tap-changer must not be operated before the diverter switch oil compartment has been filled with oil and the tap selector has been completely immersed in transformer oil.

8.2 Filling with oil

⚠ ATTENTION	
	The oil compartment and the associated oil conservator must be filled only with new mineral insulating oil for transformers according to IEC 296. The use of other oil puts at risk the trouble-free operation of on-load tap-changer and transformer.

Close the on-load tap-changer head with the cover. Tighten all 24 cover bolts M10, wrench 17 equally (max. tightening torque 34 Nm).

On-load tap-changer and transformer are simultaneously filled with new transformer oil under vacuum.

When filling with oil, pipe connection S or R on the on-load tap-changer head is to be used. For evacuating purposes, a by-pass tube between connections E2 and Q is to be installed in order to simultaneously apply vacuum to the transformer and the oil compartment.



9 Pipe connections

The on-load tap-changer head is provided with 3 pipe connections for different purposes. After loosening the pressure ring (4 M10/wrench 17 screws), all pipe connections can be freely swiveled (**Figure 36** and appendix, 893 899).

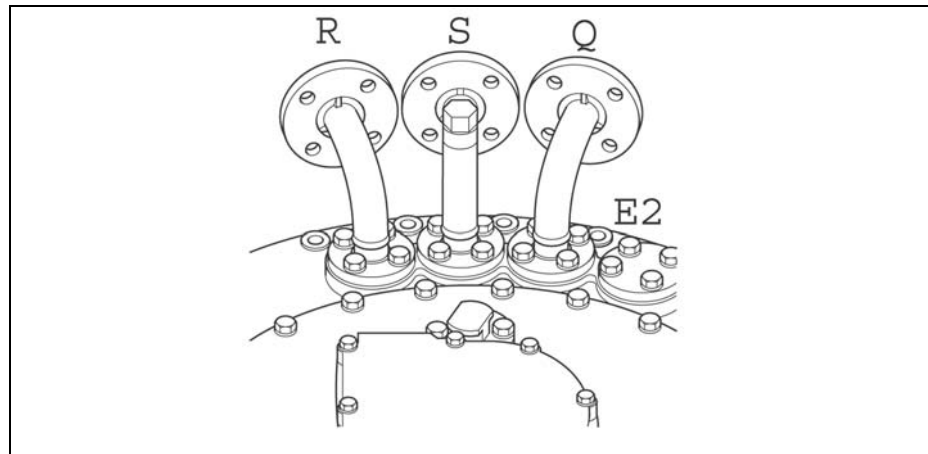


Figure 36 Pipe connections

9.1 Pipe connection R for protective relay RS 2001

Install the protective relay RS 2001 (see appendix, dimension drawing 892608) according to our Operating Instructions No. 59.

NOTE

The stamped serial number must match the serial number of the on-load tap-changer.

The protective relay must be installed as close as possible to the on-load tap-changer head in a horizontal position.

The directional arrow on the protective relay must point towards the oil conservator in the mounted state.

The pipe leading to the oil conservator must have an inclination of at least 2 %.



9.2 Pipe connection S for suction pipe

If no feed pipe of a stationary oil filter unit is connected here, a pipe must be connected which ends with a drain valve at the side of the transformer tank at operating height.

9.3 Pipe connection Q (special version, only needed with oil filter unit)

This pipe connection is used to connect the oil return for a stationary oil filter unit. If no oil filter unit is connected, a blank cover is mounted instead of the pipe connection.

9.4 E2 connection

This connection is sealed using a blank cover. It runs into the transformer's oil tank directly under the on-load tap-changer head and can if necessary be connected to a collecting pipe for the Buchholz relay.



10 Mounting the motor-drive unit, bevel gear and drive shaft

10.1 Mounting the motor-drive unit (see appendix, dimension drawing 895660, 893381)

Detailed installation instructions can be found in our Operating Instructions no. 138 for the ED motor-drive unit.

NOTE

The serial number of the motor-drive unit must match the serial number of the on-load tap-changer (nameplate).

Motor-drive unit and on-load tap-changer must be in the same operating position.

The adjustment position is indicated in the connection of the on-load tap-changer included in delivery.

The motor-drive unit must be mounted at the intended position on the transformer tank in a vertical position and protected against transformer vibrations.

10.2 Mounting the bevel gear

The bevel gear is to be attached to a support on the transformer cover by 2 bolts (through-holes 18 mm diameter, see appendix, drawing 892916).

NOTE

The stamped serial number must match the serial number of the on-load tap-changer.

The horizontal drive shaft must align with the shaft end of the on-load tap-changer head.

After loosening the pressure ring (6 bolts M8, wrench 13) the upper gear unit can be freely swiveled, **Figure 37**. When having adjusted the upper gear unit, tighten the pressure ring (max. tightening torque 15 Nm). **The bolts should be secured.**

The above notes also apply analogously to the special models of bevel gears and to the intermediate bearings of the vertical or horizontal drive shaft.



10 Mounting the motor-drive unit, bevel gear and drive shaft

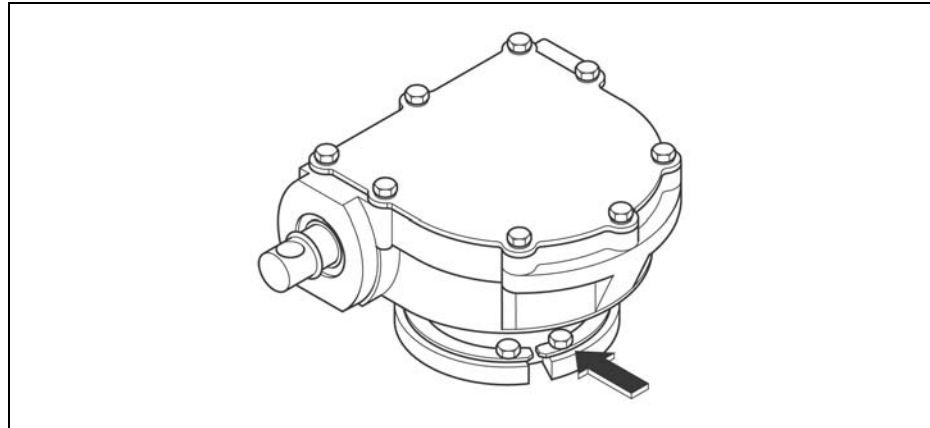


Figure 37 Upper gear unit

10.3 Mounting the drive shaft (square tube)

The drive shaft must be mounted according to our Operating Instructions No. 42.

The drive shaft is the mechanical connection between the motor-drive unit and the on-load tap-changer head.

The bevel gear changes the direction from vertical to horizontal. Accordingly, the vertical drive shaft has to be mounted between motor-drive unit and bevel gear and the horizontal drive shaft has to be mounted between bevel gear and on-load tap-changer head.

The drive shaft itself consists of a square tube and is to be coupled by two coupling brackets and one coupling bolt at both ends to the drive or driven shaft end of the device to be connected.

NOTE
When mounting the drive shaft make sure that the shaft ends to be connected are aligned exactly.

Square tubes, coupling brackets, coupling bolts, screws, nuts and lock tabs are made of corrosion-resistant steel. We recommend, however, to apply the same outside coating to these parts as to the transformer tank.

The square tubes and the guard plate, which serves as a foot step protection for the horizontal drive shaft over the transformer cover, are delivered longer than necessary (various standard lengths). They must be cut to the right lengths when they are mounted on the transformer.

The lag of the motor-drive unit must then be balanced with the diverter switch operation of the on-load tap-changer (as described in our operating instructions no. 138 for ED).



On-load tap-changer 3 x R I 2002-E...3003-E

The following procedure is recommended for the R III1200 on-load tap-changer.

Due to the special arrangement of three column constructions, the on-load tap-changer heads must be coupled together above the transformer cover.

Turning the upper gear unit will initiate a tap-change operation, so ensure that the diverter switches are returned exactly to the adjustment position once the gear units have been adjusted.

For this purpose proceed as follows:

1. Check that the operating positions of all on-load tap-changers are identical (inspection window in the on-load tap-changer head). Each of the single-phase on-load tap-changers must be in the adjustment position.
2. Turn the upper gear unit of the on-load tap-changer heads into the desired mounting position and fix them there (screw-tighten and secure pressure rings).

Take note of the arrow on the drive shaft flange below the punched serial number. The direction of the arrow indicates the direction of rotation when turning the hand crank of the motor-drive unit clockwise and must be the same on all gear units.

3. Operate the on-load tap-changer poles separately by one step by rotating the shaft ends **counter-clockwise** until the diverter switch operates once.

Check coincidence of the operating positions of all on-load tap-changer heads.

4. Mount the **horizontal** drive shaft between the on-load tap-changer heads.
5. Return the whole on-load tap-changer set, that is all on-load tap-changer poles together, into the adjustment position. The adjustment position must be reached by turning the drive shaft **in clockwise** direction.

Check simultaneous operation of all diverter switches. Check coincidence of the operating positions of all on-load tap-changer heads.

6. Mount the **vertical** drive shaft.



ATTENTION



The supervisory circuit must be installed according to the connection diagram of the relevant motor-drive unit. Incorrect installation will cause damage of both on-load tap-changer and transformer in case of malfunction.



11 Commissioning the on-load tap-changer at the transformer manufacturer's site

11.1 Tap change operation tests

Before applying voltage to the transformer, test tap-change operations must be carried out to check the mechanical functions of on-load tap-changer and motor-drive unit.

These tap-change operations are to be performed over the entire operating range.

Make sure that in each operating position the tap position indicators of motor-drive unit and on-load tap-changer (inspection window in the on-load tap-changer head) read the same position.

 ATTENTION	
	Non-conformance of the tap position indicator of the on-load tap-changer and motor-drive unit indicates a coupling error. Misalignment of coupling between on-load tap-changer and motor-drive unit leads to severe damage of on-load tap-changer and transformer, if operation is continued. Do not put the transformer into operation.

Check, in both end positions, the automatic switching off and the function of the electrical and mechanical end position limitation (see Operating Instructions no. 138 for the motor-drive unit ED).

11.2 Complete oil filling

Bleed and completely fill the on-load tap-changer with transformer oil via the oil conservator.

Bleed:

- the oil tank of the on-load tap-changer head via the air-vent valve in the on-load tap-changer cover (E1):



11 Commissioning the on-load tap-changer at the transformer

Open the screw cap M30/wrench 36, lift the valve tappet by means of a screwdriver, **Figure 38**.

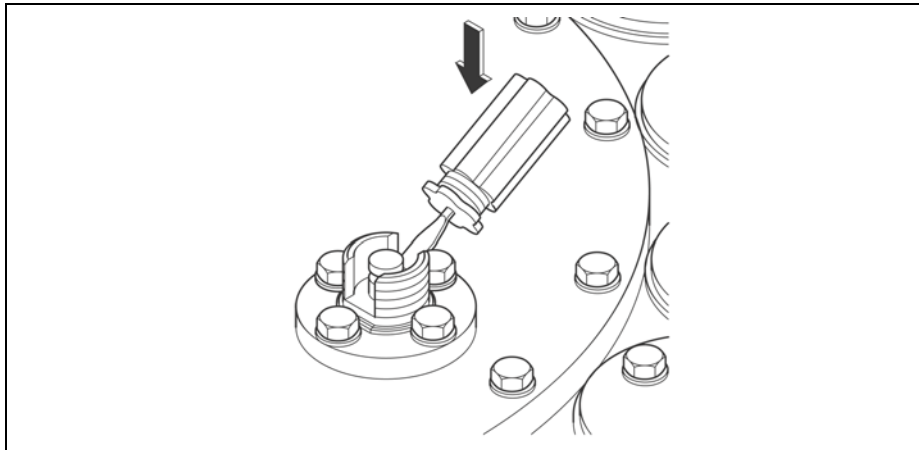


Figure 38 Opening screw cap

- Push suction pipe (S) through bleeder screw on connecting elbow: screw cap M16/wrench 22, max. tightening torque 9 Nm, bleeder screw M6 with slotted head, max. tightening torque 2 Nm, **Figure 39**.

ATTENTION



Make sure that the suction pipe has been bled correctly. The insulation capability of the on-load tap-changer to ground is otherwise significantly impaired.

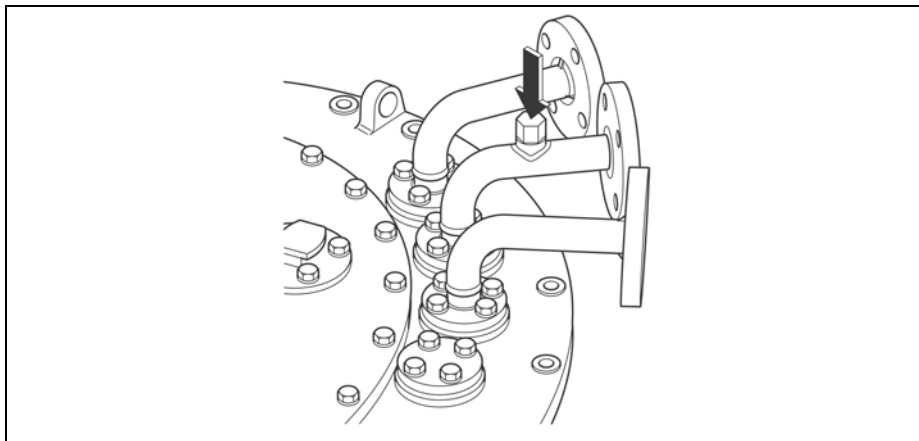


Figure 39 Connecting elbow vent screw



11.3 Ground connections

Connect the ground screws of the on-load tap-changer head (2 screws M12 with nuts, wrench 19, max. tightening torque 60 Nm, **Figure 40**) to the transformer cover.

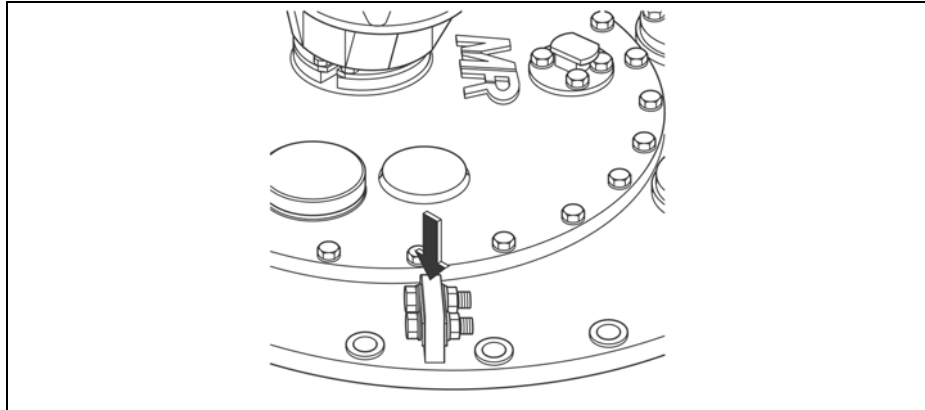


Figure 40 On-load tap-changer head grounding screws

Connect grounding screw M12/wrench 19 (max. tightening torque 60 Nm) of motor-drive unit protective housing with transformer tank.

11.4 Electrical tests on the transformer

Following the work described above, the electrical tests required for the commissioning of the transformer can now be performed.



12 Transportation to the operating site

If the motor-drive unit has to be dismounted for the transport of the transformer to the operating site, operate the motor-drive unit into the adjustment position and then uncouple it.

⚠ ATTENTION	
	Do not operate the motor-drive unit while the on-load tap-changer is not coupled.

It is reassembled as described under **Chapter 10.1** and **10.3**.

NOTE	
If the transformer is filled with oil but stored or transported without oil conservator, a connecting lead must be installed between the interior of the diverter switch oil compartment and the transformer oil tank to equalize the pressure caused by the expansion of the oil.	

The connecting lead must run between connections E2 and Q on the on-load tap-changer head. For a short operating period of 2-4 weeks without an oil conservator, lowering the oil level in the on-load tap-changer head by around 5 liters is sufficient.

If the transformer is to be completely emptied, drain also the switching oil of the on-load tap-changer completely.

The interior of the diverter switch oil compartment is to be conserved in the same way as the transformer (e.g. by filling with N₂).

For longer immobilization periods, the motor-drive unit heating must be connected and operated.



13 Commissioning at the operating site

Before putting the transformer into service operational tests of on-load tap-changer and motor-drive unit have to be performed according to **Chapter 11.1**. The function of the protective relay must also be checked at this point.

NOTE

The protective relay must be inserted into the tripping circuit of the circuit-breakers so that the transformer is immediately shut down by the circuit-breakers when the protective relay is tripped (see operating instructions no. 59 for RS 2001 the protective relay).

A test trip of the connected circuit breakers should be made by pressing the test button "OFF" of the protective relay.

Make sure that closing of the circuit breakers is only possible again after the protective relay has been brought to the "IN SERVICE" position by pressing the other test button.

ATTENTION



Check that all stop valves between oil conservator and on-load tap-changer are open.

After energizing the transformer, tap-change operations under load can be performed. The switching gas accumulating under the on-load tap-changer cover will cause small amounts of oil to be displaced or will escape through the oil conservator.



14 Supervision during service, failures

Monitoring the on-load tap-changer and motor-drive unit is limited to occasional visual checks of on-load tap-changer head, protective relay and motor-drive unit.

Pay particular attention to the following:

- sealing points of the on-load tap-changer head, protective relay and connected pipes are to be oil-proof,
- gaskets of the protective housing of the motor-drive unit,
- correct functioning of the installed electrical heater in the protective housing of the motor-drive unit
- the condition of the control devices in the motor-drive unit.

WARNING



If the protective relay is triggered, the on-load tap-changer and transformer must be thoroughly checked. To do this, remove the diverter switch insert and check as described in the inspection instructions. Proceed in detail according to Operating Instructions No. 59 for the protective relay RS 2001.

Do not use the equipment again until you are sure there is no damage to the on-load tap-changer or transformer.

Energizing the transformer without prior checking is not permitted as serious damage to the on-load tap-changer and the transformer can occur.

For more serious problems with the on-load tap-changer and motor-drive unit, which cannot be easily corrected on site, or if the protective relay has been tripped, please inform your authorized MR representative, the transformer manufacturer or contact us directly at:

Maschinenfabrik Reinhausen GmbH
Technischer Service
Postfach 12 03 60
D-93025 Regensburg
Tel.: (+49) 9 41 / 40 90-0
Fax: (+49) 9 41 / 40 90-501
Telex: 65881



15 Inspections

NOTE
The tap-changing equipment must be inspected at regular intervals to maintain a high level of operational safety.

The inspection can be carried out by qualified and MR-trained personnel usually within one day, provided it is well prepared and organized.

We generally recommend to have inspection carried out by our Technical Service.

This guarantees a professional performance of the inspection and ensures the updating of specific components to the latest operational state.

If the inspection is not to be carried out by MR personnel, we recommend that you ask for a quotation of the spare parts required for the inspection (please quote the on-load tap-changer serial number and the number of switching operations).

The numbers of tap-change operations determining the inspection intervals indicated in Table II and Table III are figures based on experience with use of usual oil qualities.

The tap selector in the on-load tap-changer does not require any maintenance. In special cases, however, for example in industrial transformers where high numbers of tap-change operations are to be expected, our technical service department must be contacted after about 1,000,000 tap-change operations.

The diverter switch insert in the on-load tap-changer must be replaced after 800,000 tap-change operations at the latest. The protective relay must be connected. The protective relay must be connected.

If the number of tap-change operations per year is 15,000 or higher, we recommend the use of our stationary oil filter unit type OF100 with a paper filter insert (see Operating Instructions BA018). Use of the oil filter unit OF 100 with combined filter is prescribed for all type R on-load tap-changers where $U_m = 300$ kV (insulated to ground) and there is a linked operating voltage on the on-load tap-changer of 245...260 kV. Use of the oil filter unit OF 100 with combined filter is generally prescribed for all type R on-load tap-changers where $U_m = 362$ kV (insulated to ground).

Filtering of the switching oil allows the inspection intervals to be extended.

The insulating oils in the transformer are to be monitored by the operator according to the appropriate rules and regulations.

If inspections are not carried out by MR personnel, we request a report to supplement our inspection files.

**⚠ ATTENTION**

Disregard of the inspection intervals puts at a risk the trouble-free operation of on-load tap-changer and transformer.

Standard values for oil testing according to CIGRE report 12-13 (1982) apply to transformer oil at service temperature:

On-load tap-changer	Water content ¹	Dielectric strength ²
Star-point on-load tap-changer	< 40 ppm	> 30 kV/2.5 mm
Single-phase on-load tap-changer	< 30 ppm	> 40 kV/2.5 mm

Table 1 Approximate values for monitoring the on-load tap-changer oil
¹ measured according to Karl-Fischer method based on IEC Publication 814
² measured according to DIN VDE 0370 Part 1

On-load tap-changer	Transformer Rated current	Number of tap-change operations	
		without MR oil filter unit	with MR oil filter unit
R III 1200-E	up to 600 A	80000	100000
	up to 1200 A	60000	100000
R I 2002-E	up to 2000 A	40000	80000
R I 2402-E	up to 2400	40000	80000
R I 3003-E	up to 3000	40000	80000

Table 2 Inspection intervals for type R on-load tap-changers in star point application, single-phase on-load tap-changers where $U_m < 245$ kV and in autotransformers or for regulation at line end of winding of the transformer.

Initial inspection and further inspections: After every 7 years or the number of tap-changer operations given in table II, depending on what is reached first.

On-load tap-changer	Transformer Rated current	Number of tap-change operations	
		without MR oil filter unit	with MR oil filter unit
R II 1201-E	up to 600 A	40000	50000
	up to 1200 A	30000	50000
R I 2002-E	up to 2000 A	20000	40000
R I 2402-E	up to 2400	20000	40000

Table 3 Inspection intervals for type R on-load tap-changers in star point application, single-phase on-load tap-changers where $U_m < 245$ kV and in autotransformers or for regulation at line end of winding of the transformer.



On-load tap-changer	Transformer	Number of tap-change operations	
	Rated current	without MR oil filter unit	with MR oil filter unit
R I 3003-E	up to 3000	20000	40000

Table 3 Inspection intervals for type R on-load tap-changers in star point application, single-phase on-load tap-changers where $U_m < 245$ kV and in autotransformers or for regulation at line end of winding of the transformer.

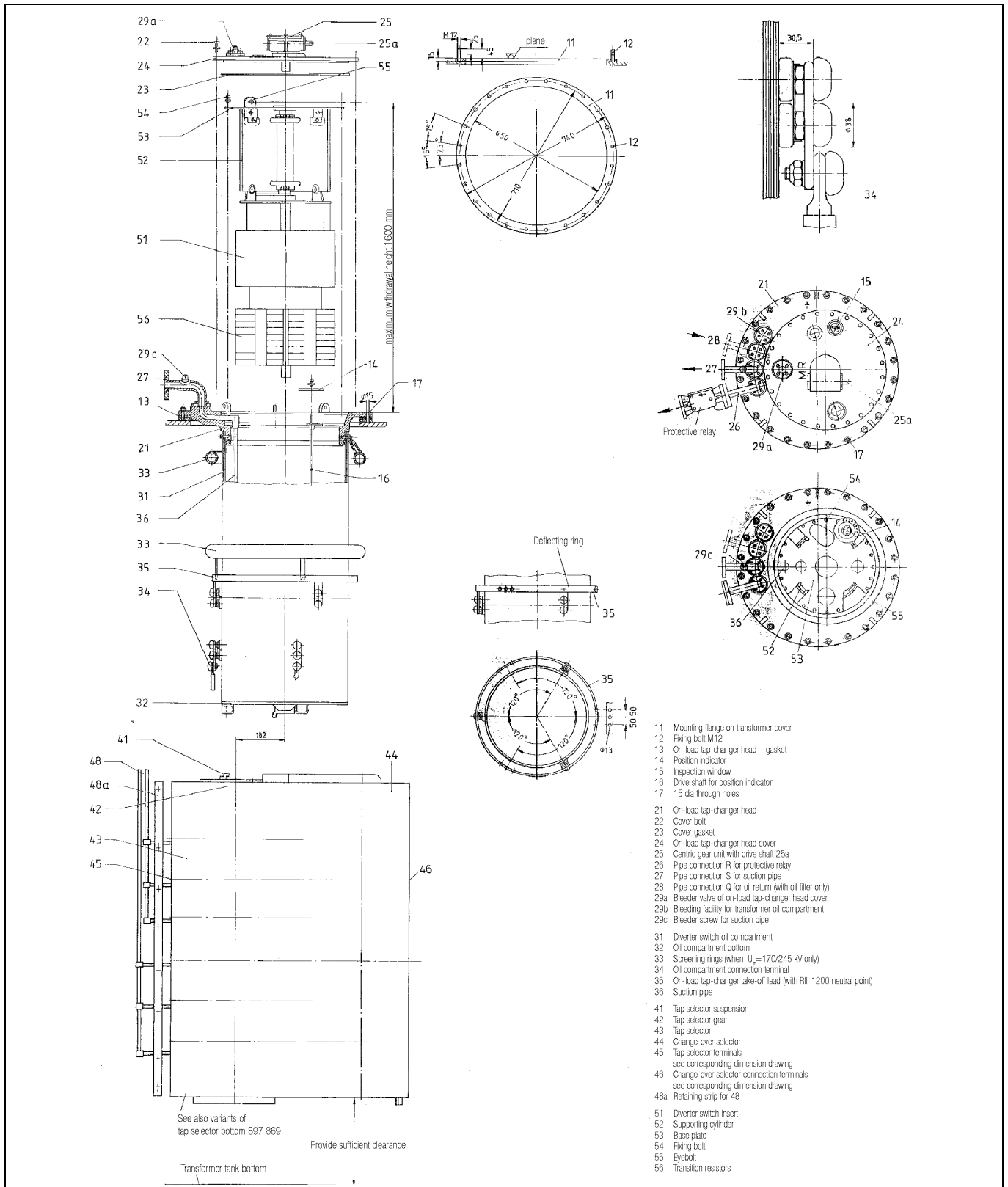
First inspection: after 2 years or 20,000 tap-change operations, depending on what is reached first.

Further inspections: Without MR filter unit after every 4 years, with MR filter unit (combined filter) after every 6 years or the number of operations indicated in table III – whatever is reached first.



16 Appendix

Installation drawing	8978730
Tap and change-over selector connection terminals	8978680
On-load tap-changer head	8938998
Template for on-load tap-changer head	8901836
Supporting flange for bell-type tank installation	8967623
Lifting traverse	8901803
Socket wrench for kerosene drain plug	8901827
Protective relay RS 2001, dimensional drawing	8926085
Motor-drive unit MA 7, dimensional drawing	895660A
CD 6500 bevel gear, dimension drawing	8929166



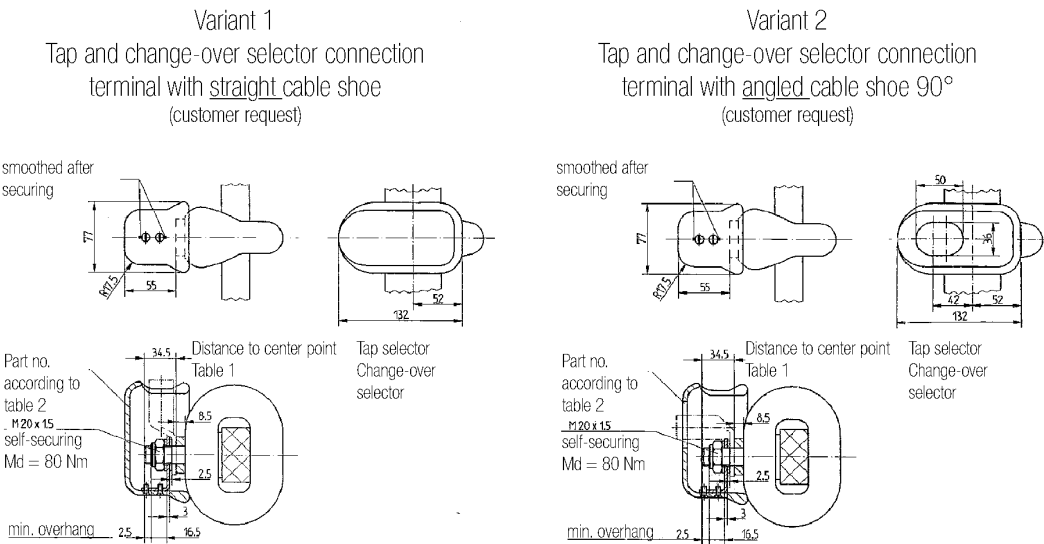
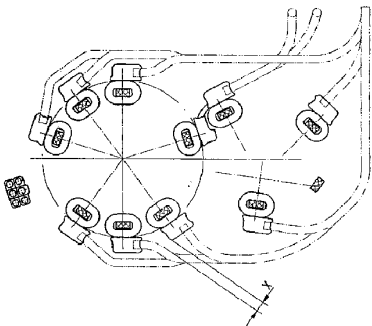


Table 1: Distance to center point for tap selector/change-over selector (connection points)

Contact designation	
Fine tap selector contact	352
"0" contact change-over selector	176
"+" and "-" contact change-over selector	383

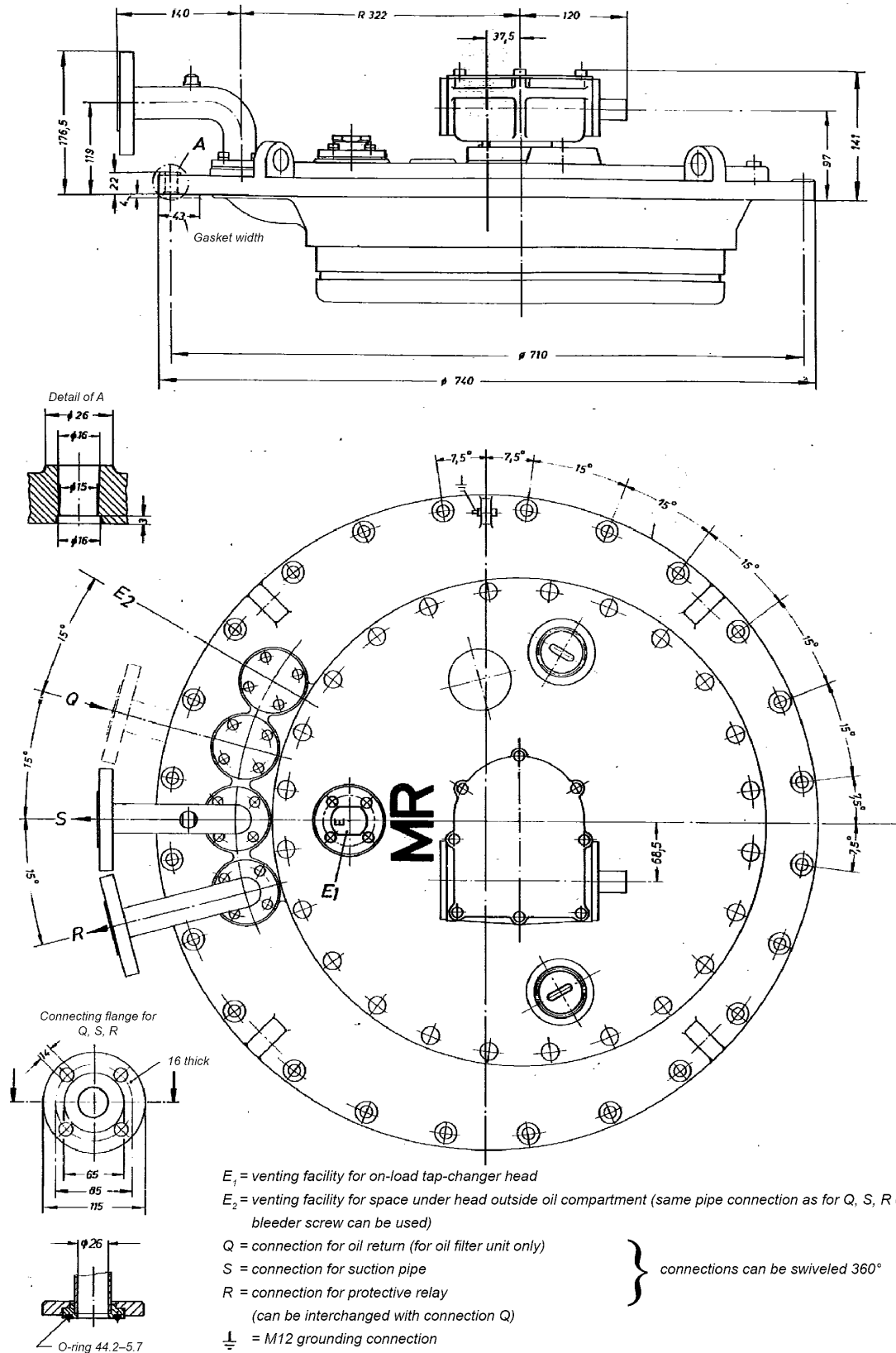


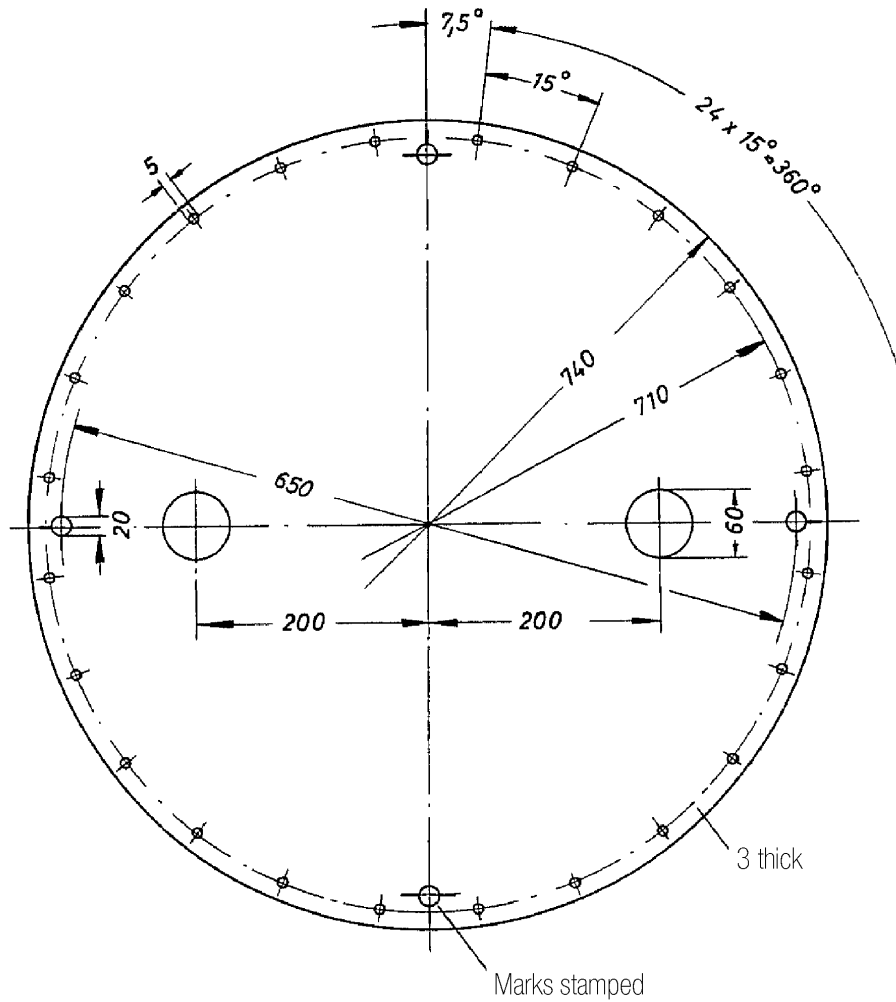
x min. between screening cap and neighboring feed = 25 mm
(rated lightning impulse withstand voltage 300 kV 2.3/50 and line Ø18/Ø28)

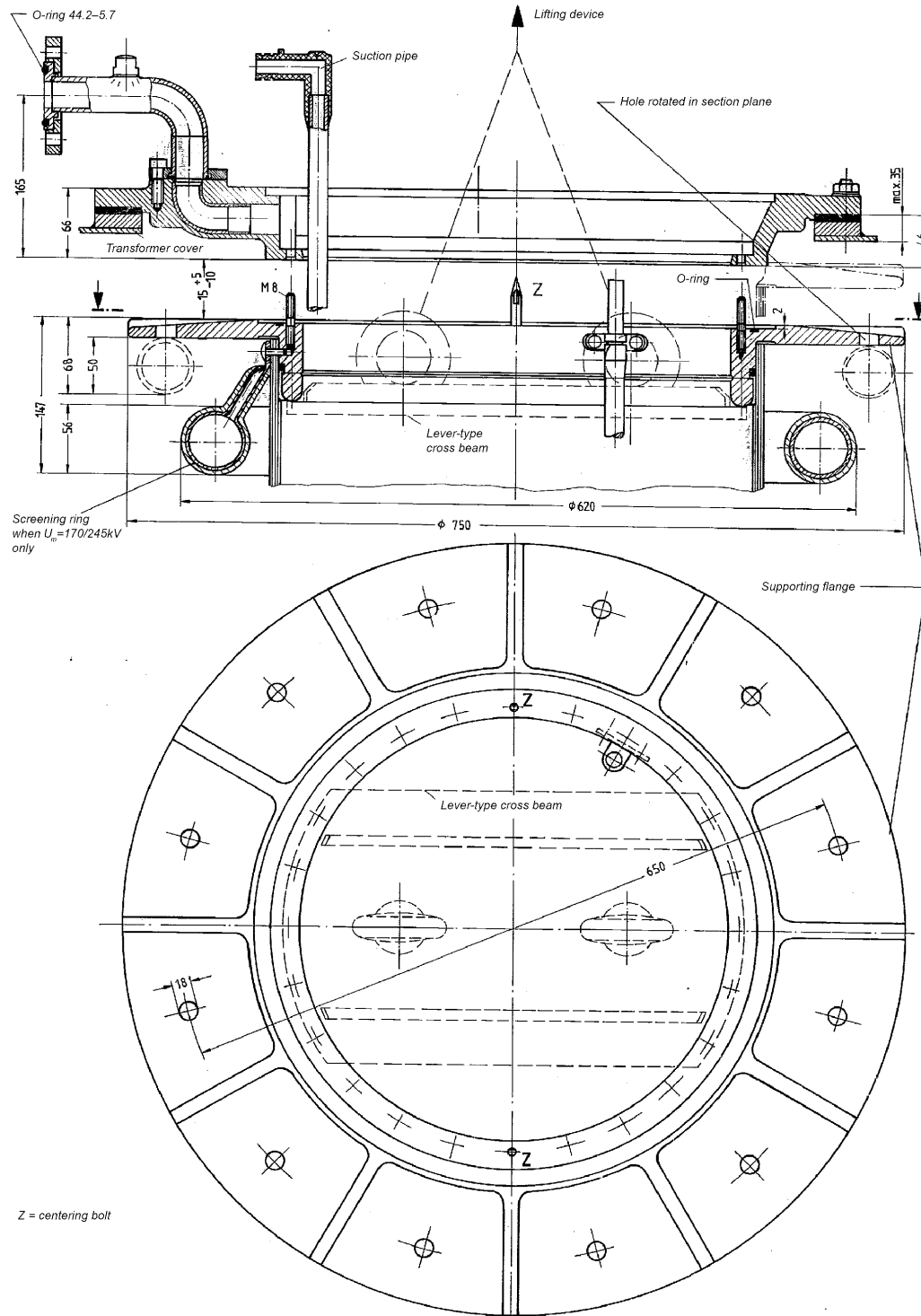
Table 1: Connection variants which can be produced with part numbers of the screening caps needed.

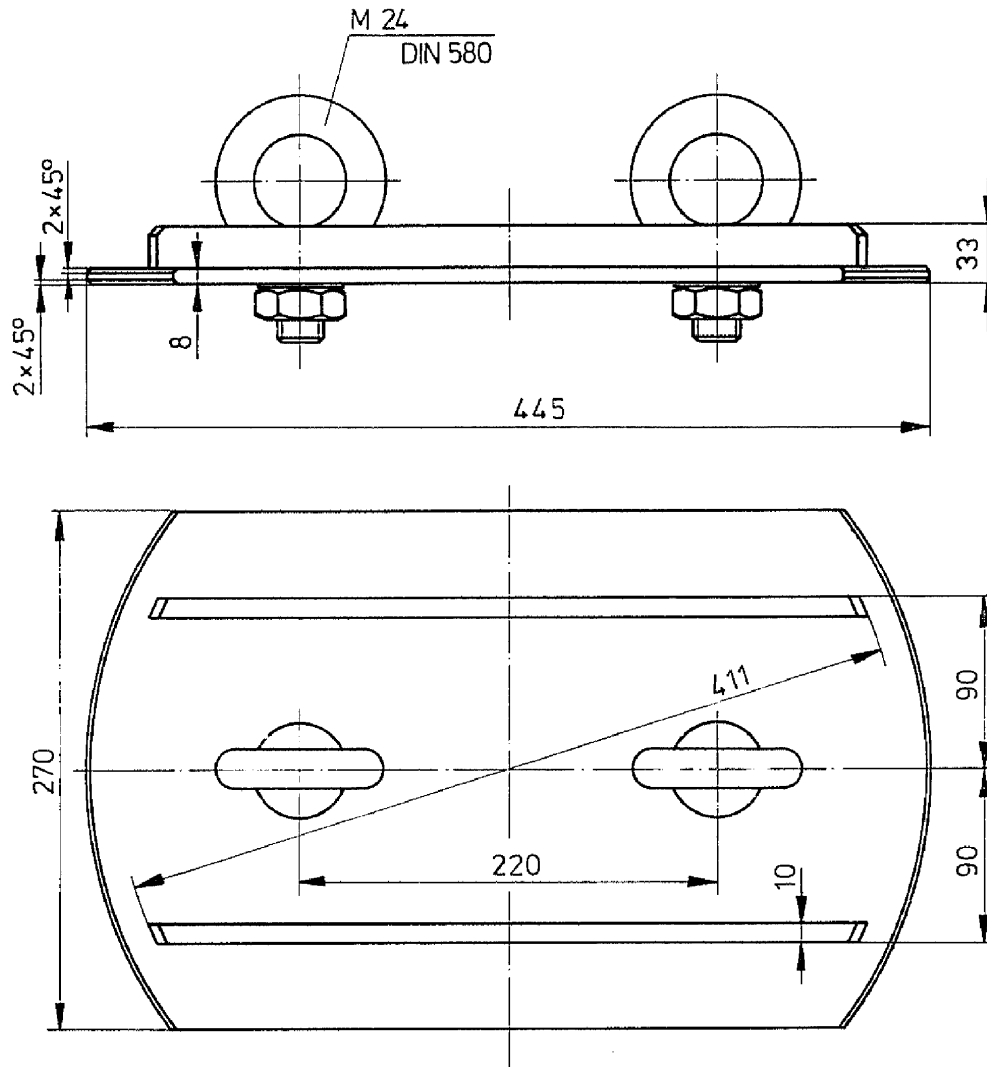
		CONTACT DESIGNATION					
		1 to n - 2	n - 1	n and/or K	0	+	-
TYPE OF ON-LOAD TAP-CHANGER	with coarse change-over selector	Var. 1 055 640: Var. 2 082 751:	Var. 1 055 640:	no customer connection	Var. 1 055 040: Var. 2 082 751:	Var. 1 055 743: Var. 2 084 414:	Var. 1 055 640: Var. 2 082 751:
	with reversing change-over selector	Var. 1 055 640: Var. 2 082 751:	Var. 1 055 640:	no customer connection	Var. 1 055 743: Var. 2 084 414:	Var. 1 055 640: Var. 2 022 751:	Var. 1 055 640: Var. 2 082 751:
	without change-over selector	Var. 1 055 640: Var. 2 032 751:	Var. 1 055 640: Var. 2 082 731:	Var. 1 035 640: Var. 2 282 751:			

The above variants apply for one tap selector connecting lead per contact.
Two tap selector connecting leads per contact on request.

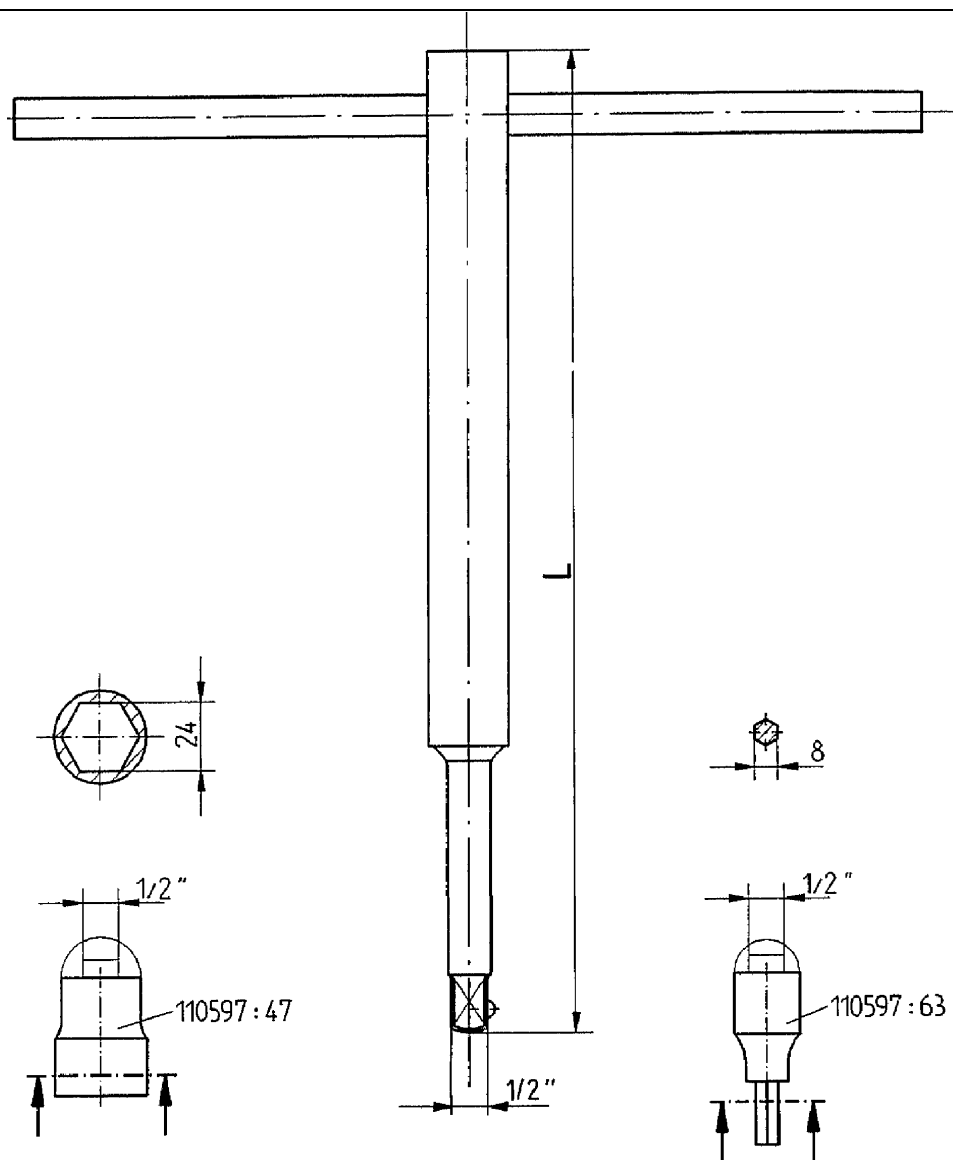








Steel plate
St 37-2 DIN 17100



Socket wrench

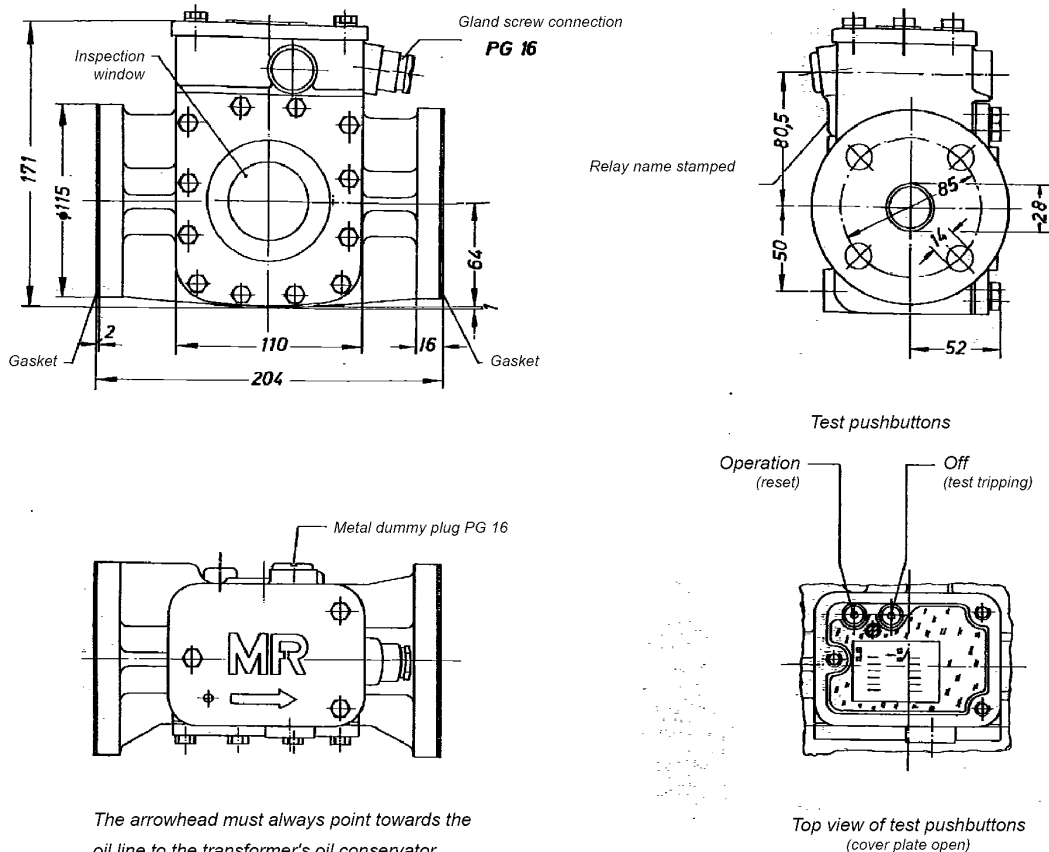
Part no. 014820:
L = 1350 mm

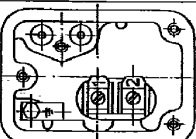
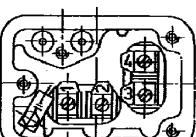
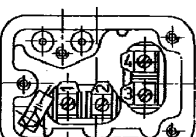
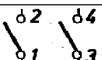
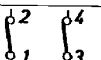
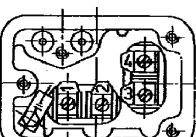
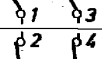
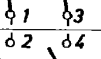
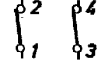
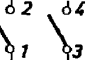
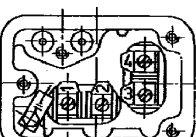
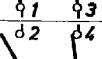
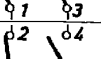
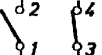
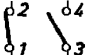
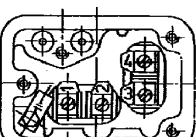
Part no. 017660:
L = 1860 mm

Can be used for on-load
tap-changer

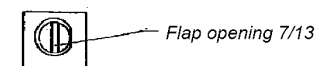
Type M (apart from
M Δ)
Type MS

Type M III 350/500/600 Δ
Type T
Type R
Type G



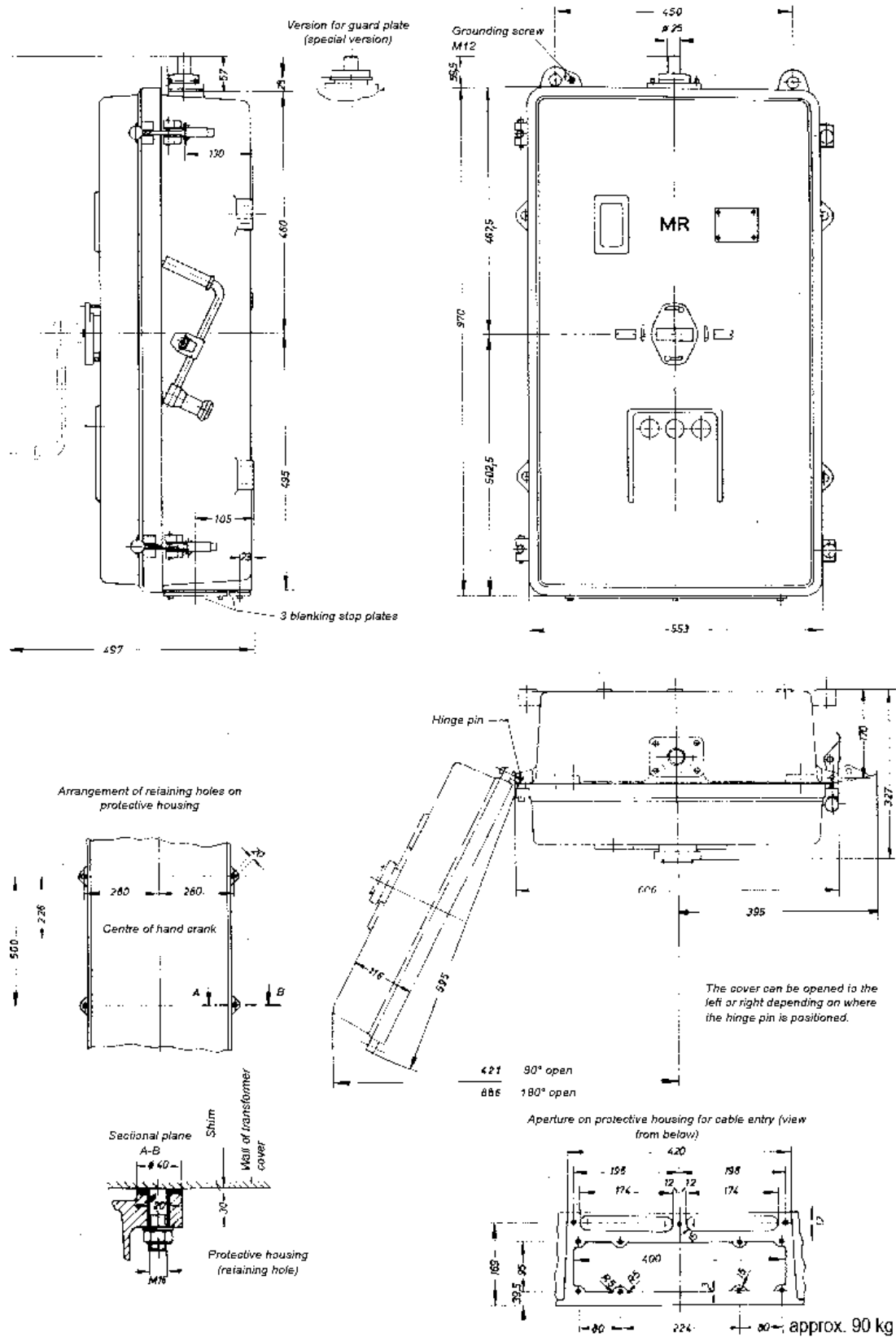
List of variants												
Relay designations	Flap openings	Magnetic switch	Contact positions		Arrangement of terminals	Model						
			Operation	Off								
7-s	7	A				Normal version						
13-s	13											
7-o	7	B						Special version for additional charge				
13-o	13											
7-w	7	C				Special version for additional charge						
13-w	13											
7-2s	7	2A								Special version for additional charge		
13-2s	13											
7-2o	7	2B										Special version for additional charge
13-2o	13											
7-1s1o	7	1A, 1B						Special version for additional charge				
13-1s1o	13											

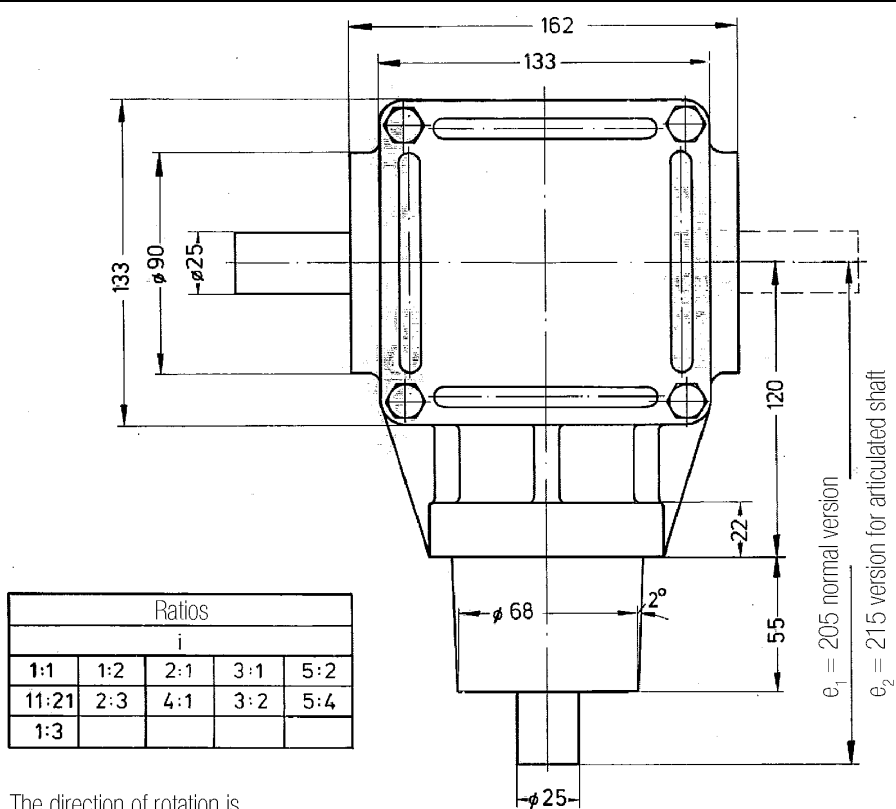
s – normally open contact, o – normally closed contact, w – changeover contact



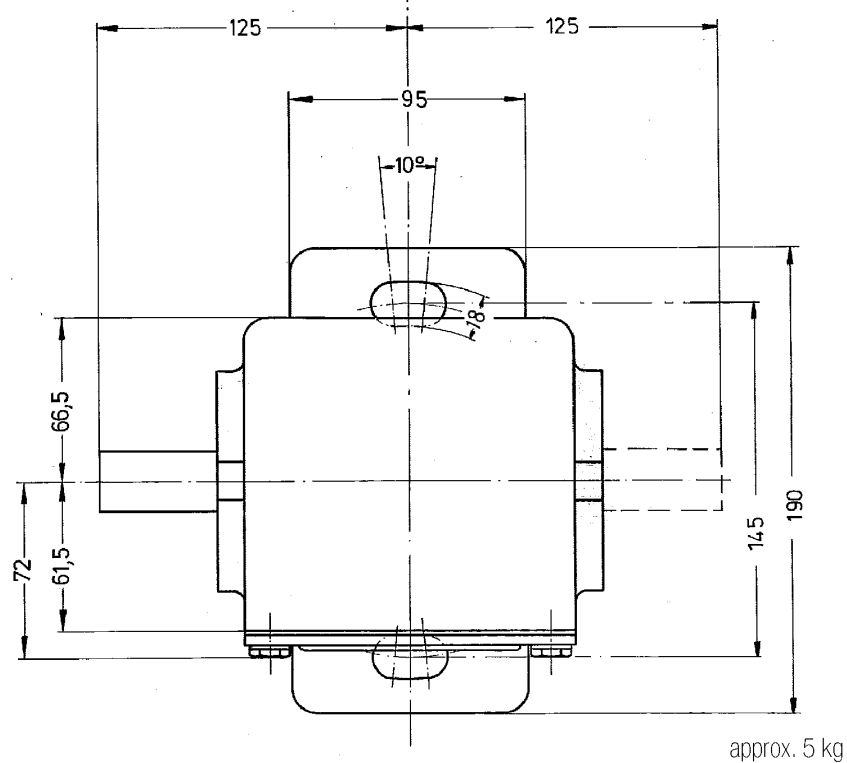
The protective relay must be connected such that the transformer is immediately shut down by the relevant circuit-breakers when the relay is activated.

approx. 3.5 kg





The direction of rotation is defined during ordering.



approx. 5 kg

