MORE ADVANCED THAN YOU IMAGINE

Power Transformer

LS IS

LSIS - The Specialist of Power Solutions

LSIS has contributed greatly to the infrastructure of the electricity and automotive industries -the foundations of the Korea's economy- on numerous construction sites and building structures over 30 years.
We are presently moving up to a whole new level in order to become a world-class company with a passion, and accumulations of countless technology and experience.

Ready for Surprise?

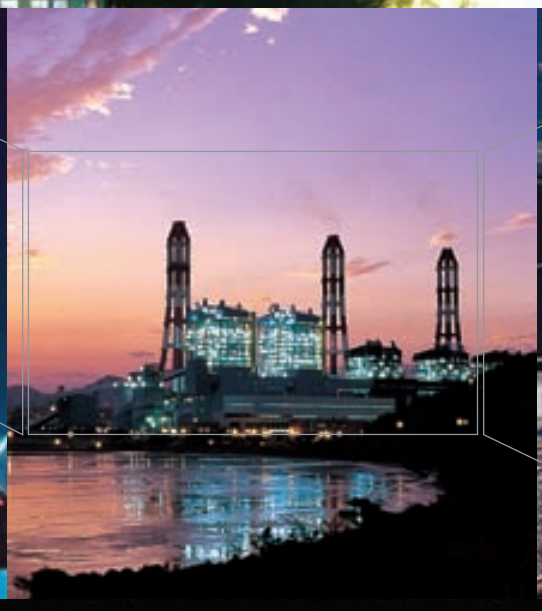
A Power Transformer produced by Korea's no.1 Electricity/Electronics Company!
This Power Transformer is a product from technological advancement and experience gathered many years, and it boasts the high level of quality.

LS Power Transformer

- **Total Solution Provider**
- **Tailored Design**
- **Perfect Performance**

We're Leading Innovation and Creating Tomorrow!

Contents



LSIS is a NEW & LARGE supplier in the Power Transformer Market. That's why LSIS continues to work longer and harder for you.

As the leading company in Korea's power solutions industry, LSIS is playing a central role in the national power supply network, based on its reliability and technology. LS's experience of transformer manufacturing and production technologies of over 20 years has enabled us to proudly present the Power Transformer. Now, LSIS is going to instill confidence in our customers once again.

Not only 'Latest', but also 'Newest' Technology!

LSIS' Power Transformer does not merely possess the latest technologies, but is the state-of-the-art product equipped with the newest technologies. On top of all the merits that are part of existing systems, the Power Transformer provides a Total Solution with a Network Control System for the benefit of the private consumer as well as commercial power plants.

Trust LS Transformer-Perfect performance

Safety and reliability are of the utmost importance in the power transformer. That is why you need to choose a reliable company. LSIS's Power Transformer will ensure optimum reliability through stable performance in any given condition.

Over 30 years of experience for electrical solution. (Since 1974)

LSIS has been walking a single path in the field of industrial electricity / electronics for the past 30 years, and has achieved technological innovations and improved competitiveness through continuous R&D and investments.

Strict test make reliable & safe products.

LSIS' conviction, that rigorous testing is the only way to ensure perfectly operational products at industrial sites was also applied to the Power Transformer. If you are concerned with reduced competitiveness caused by maintenance problems and defects, hesitate no more and choose LSIS.

Professional staffs make your project succeed.

LSIS, Korea's top engineers will lead you to perfect success on your business with highly trained skills and careful management.

The newest facilities and equipments make faultless products.

LSIS has constructed an ultramodern factory in an effort to satisfy the diverse demands of its customers. Our clean facilities enable the production of zero-defect products, within which even a single speck of dust is not allowed.

LS always think about efficiency & environment.

LSIS takes into consideration the global environment that is in harmony with future-oriented technologies. We aim to not only provide economic advantages for our customers through increased energy efficiency, but also to fulfill our social responsibilities through the development of environment-friendly products.

LS Power Transformer

The power transformer is a static inductive device that can step the voltage up and down to transfer electrical power efficiently.

Winding types and methods that offer the least loss were selected using magnetic field analysis, and also used in the LSIS's Power Transformer to ensure high levels of efficiency. Moreover, by selecting the optimal insulating structure through the electric field analysis of insulation between turns, sections, windings and phases, the Power Transformer's electrical stability is achieved. LS fluent analysis technology has enabled the realization of an optimal cooling system, and 3D structure strength analysis has enabled a structural design that can withstand internal mechanical power short-circuits caused by system faults, seismic conditions according to external impacts, and the impact of transportation.

LSIS' Power Transformer factory is equipped with the latest core processor machines, the latest winding machines, high-capacity vacuum heat drying equipment, state-of-the-art cleaning facilities, and has the best test room.

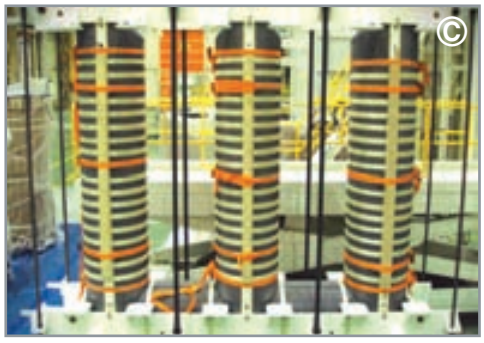
Internal construction

Core

Non-aging grain oriented silicon steel sheets with high permeability and low hysteresis loss are used in the construction of cores. They are thinly stratified to reduce Eddy loss, and the joints are arranged with the form of step-lap types to reduce loss and noise.

The thin silicone steel sheets produced by the core's manufacturing equipment are stacked to form magnetic circuits that can generate a magnetic flux. The stacking process cannot be carried out in an upright position due to the thin and large structure of the silicone steel sheets, and is therefore carried out horizontally on a stand. Upon the completion of the stacking process, the top and bottom are supported by a frame Tie-Plates and Glass Resin Tape are wound securely around the core, and then standing upright.

Ⓐ Core Stacking Process (done horizontally)
Ⓑ Cutting & Punching using a Core Processing Device
Ⓒ Standing uplight after Core Staking



Coil & Winding

Coil & Winding prevent insulation damage caused by the contraction and expansion that takes place during temperature changes, and the agitation and bending caused by abnormal severe conditions. It also ensures the circulation of the insulation fluid, and is produced in a manner suitable for reducing the occurrence of Hot Spots. Appropriate insulation barriers are used between the windings and the cores, and between high and low voltage windings. It is also produced in a way that is suitable for suppressing electrification effects. The End Coil is equipped with a supplementary, protective device that can withstand abnormal track conditions.


Ⓓ


Ⓔ


Ⓓ

The windings are produced by winding pure copper coils of at least 99.9% pure copper around the circular winding machine. The winding machines are separated into vertical and horizontal-types. The vertical type is used for high-voltage, low-current conditions with a small number of conductors and implements a complex winding method. The horizontal type is used for winding methods of a low-voltage, high-current type with a large number of conductors. Winding processes are carried out inside a dustproof room in order to protect it from harmful particles.

Ⓓ Horizontal Winding Method - for low voltage, high current winding
Ⓔ Vertical Winding Method - for high voltage, low current winding

Process

1 Winding

Process for manufacturing winding which flows current by winding the rectangular shaped copper wire (purty over 99.999%) to the cylinder shaped winding machine.

2 Core Cutting & Punching

The cores are produced by automatically cutting and punching roll-type silicon steel sheets into designed sizes using the program.

3 Core Stacking & Assembling

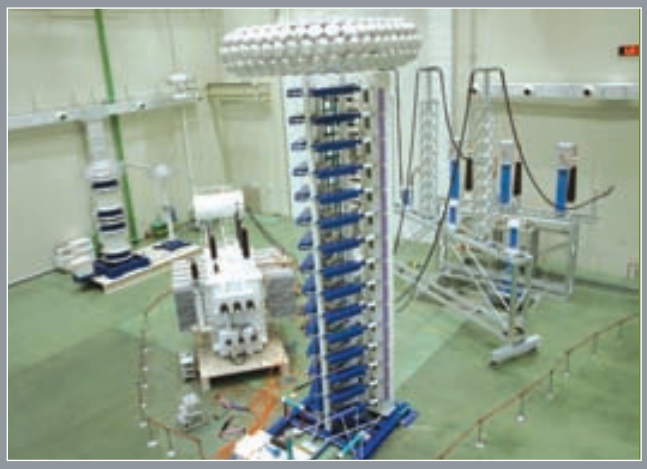
The cut silicon steel sheets are stacked to form magnetic circuits that are capable of generating an electric magnetic flux.

4 Assembling for Main Body

Core and winding are conbined together electro-magnetically.

5 Final Assembling

Once the main device is inserted into the tank and the vacuum is achieved, the formation of the electrical circuit is completed by filling the insulation fluid and installing the various supplementary equipment types on the outside of the tank.



6 Final Testing

Upon completion of the final assembly, the transformer's electrical characteristics and electrical insulation performance is checked through final testing to guarantee its utmost quality.

Design Technologies

Magnetic Field Analysis

- Loss and Characteristics Calculation
- Magnetic Shield Plate Design
- CTC Optimal Arrangement

Insulation Analysis

- Insulation Safety Margin Assessment
- Electric Field Analysis Technology
- Potential Distribution Calculation in Transient State

Cooling System Analysis

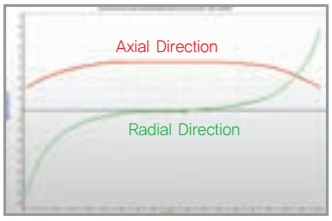
- Temperature Calculation
- Cooling Efficiency Structure Design
- Cooling System Performance Improvement

Mechanical Structure Analysis

- Stability Calculation in case of Short Circuits
- Support Beam Reinforcement Technology
- Structure Optimization Technology

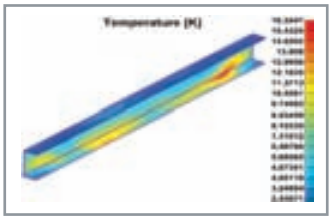
Magnetic Field Analysis

Magnetic fields can be calculated using the 3D Magnetic field analysis, as well as stray losses in structures inside the magnetic fields such as Tank and Frame, and Hot Spot temperatures.



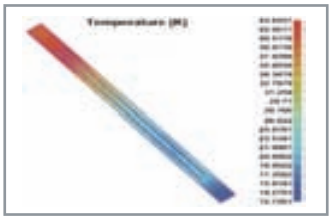
Magnetic Intensity

A magnetic field analysis program is used to minimize Eddy current losses that occur in conductors due to magnetic flux. At the ends of the windings, the horizontal component of magnetic flux is high, and in the central parts of the winding, the vertical component of magnetic flux is high. Conductor sizes are differentiated accordingly to minimize Eddy current losses.



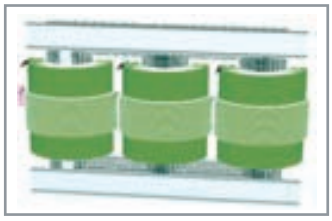
Frame Temp. Rise

At the design stage, the distribution of leakage magnetic flux in the core-supporting frame is analyzed using 3D modeling. The analyzed results are used to calculate local losses, and for making adjustments to materials, structures and dimensions so as to minimize losses and temperature rise.



Tie Plate Temp. Rise

At the design stage, the distribution of leakage magnetic flux in the leg core-supporting tie plate is analyzed using 3D modeling. The analysis results are used to calculate local losses, and for making adjustments to materials, structures and dimensions to minimize losses and temperature rise.



3-D Magnetic Field Analysis for C&C

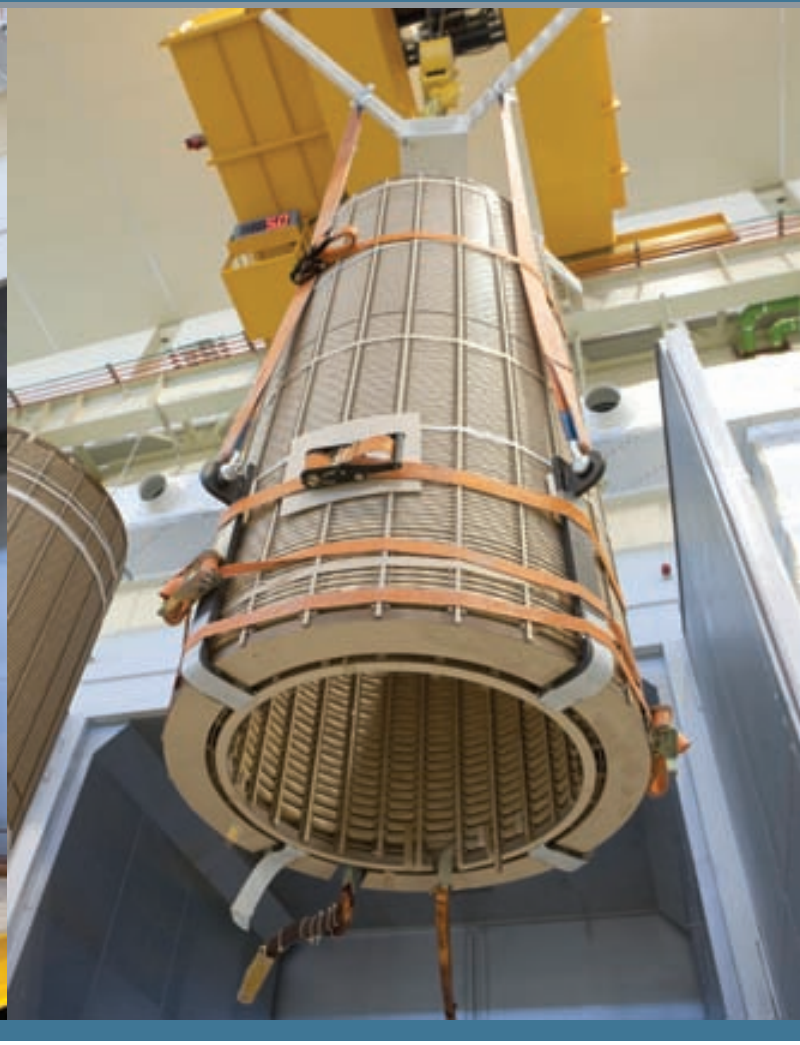
Losses that occur in structures such as the frame or the tank caused by leakage magnetic flux are estimated using the 3D magnetic field analysis program. Adjustments based on the analysis results are made to the frame's structure and dimensions, and magnetic covers such as magnetic shunts are attached to the interior walls in order to minimize losses and temperature rise.

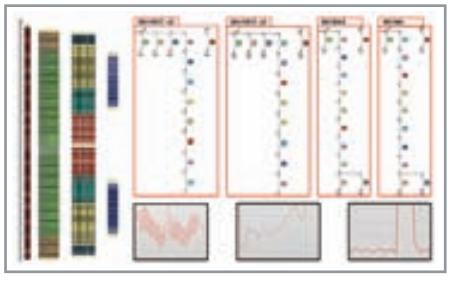
CTC Wire

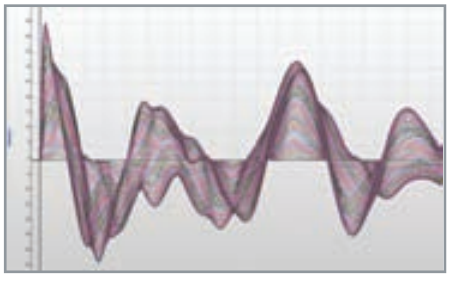
For windings that pass through large currents, small cables are divided into multiple strands in order to reduce the surface area where magnetic flux in orthogonal position, and a CTC (Continuously Transposed Conductor) is applied to reduce Eddy current losses. The CTC not only reduces Eddy current losses, but because the small cables are transposed continuously, loss minimization is achieved through reducing circulating current losses.

Insulation Analysis

The transient analysis program is used to analyze transienst state when applying impulse voltages, and insulation strength between turns, sections and windings. An electric field analysis program is used to analyze the insulation strength at the main gap in the center of the windings and at the end of the windings.

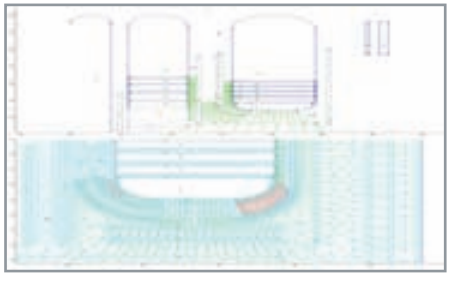


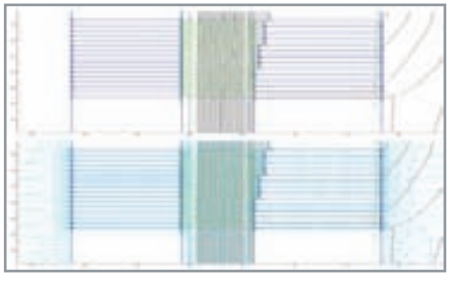




Transient Stage Voltage Oscillation

Using the results from an transient voltage analysis program, the insulation strength between specific sections, electrodes and nodes are examined. By measuring the concentrated electrical field of the insulating materials at the middle and end of the widings, as to whether the insulating structure meets the permitted insulating standards. The results are used in deciding the size and number of the insulating barrier's oil gaps, and in deciding whether angle rings to be inserted. At the ends, where electric fields are concentrated, a static shield ring is inserted to relieve the electrical fields. The series capacitance is increased to improve excessive voltage characteristics, resulting in a safe and compact insulating structure.



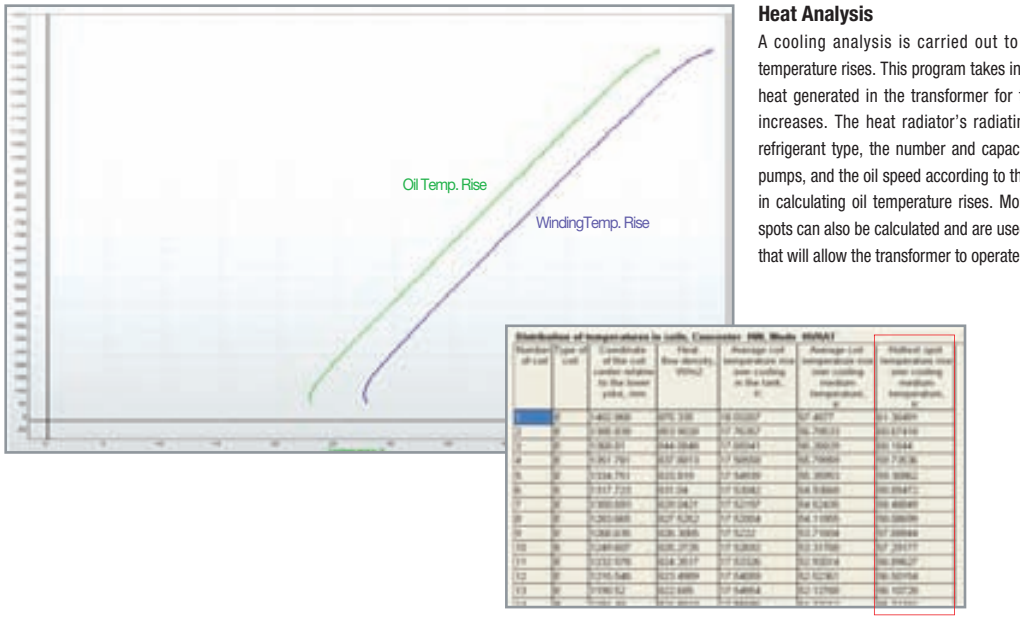


Electric Field Analysis

In order to guarantee the transformer's electrical safety margin, an electric field analysis is carried out. The LSIS' design program can replicate the many possible conditions that may arise if the winding is subjected to basic lightning impulses, chopped wave impulses, and switching impulses. The winding's inductance, resistance and capacitance, together with the electric field of the nodes that are distributed along the windings, can be tested using such conditions. The results of the analysis were used in designing an electrically safe device by inserting contra shields at the winding's ends to relieve electric field, and by using interleaved windings.

Cooling System Analysis

The cores and the windings are designed for optimal cooling efficiency. They are equipped with large heat-radiating surface areas. Others are equipped with fans and pumps for forced cooling. A program that is capable of applying various parameters, such as radiator surface areas, refrigerant types, size and number of fans and pumps, is used for verification.

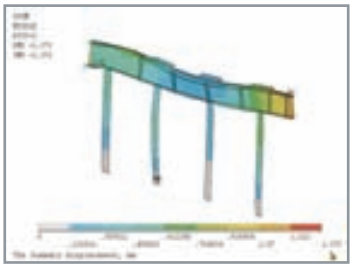


Heat Analysis

A cooling analysis is carried out to guarantee the customer's required temperature rises. This program takes into consideration all the different kinds of heat generated in the transformer for the purpose of calculating temperature increases. The heat radiator's radiating surface area, the radiator number, refrigerant type, the number and capacity of fans, the number and capacity of pumps, and the oil speed according to the respective oil pipes, are all considered in calculating oil temperature rises. Moreover, temperature rises in the hottest spots can also be calculated and are used in designing an optimal cooling system that will allow the transformer to operate safely under conditions .

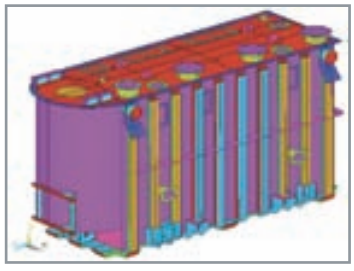
Mechanical Structure Analysis

The transformer's tank is designed to withstand the impacts and vibrations that occur during its delivery and handling. It is also designed to withstand internal pressures that may arise due to electrical faults. The ANSYS strength analysis program is used to analysis the various strengths of different parts. The internal assembly components can withstand mechanical stress during short-circuits and faults, and are firmly and safely attached to the tank to withstand a variety of impacts or vibrations while in transportation.



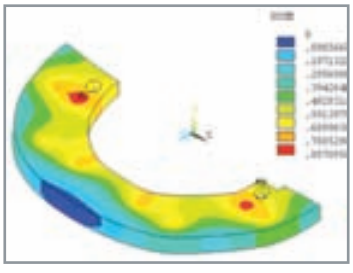
Frame Strength Analysis

The frame's ability to withstand stress such as short-circuits is analysed using 3D modeling. The results are used in determining the frame's structure, dimensions and materials to ensure its endurance even in the harshest of conditions. The frame is also designed to withstand impacts during transportation, which ensures the frame's mechanical safety against bending and deformation.



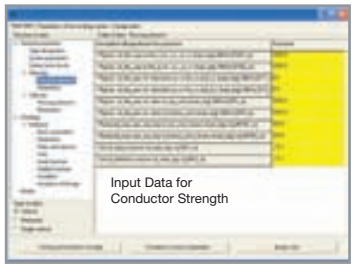
Pressure Test Analysis

A program is used to analyse the transformer tank's ability to withstand abnormal internal pressure caused by faults. The tank's mechanical safety is ensured through adding supporting materials to areas that are weak against abnormal internal pressure.



Pressure Ring Strength

The pressure ring's ability to withstand stress such as short-circuits is analysed using 3D modeling. The results are used in determining the pressure ring's structure, dimensions and materials to ensure its endurance in the harshest of conditions. The pressure ring is also designed to withstand transportation impacts, which ensures the ring's mechanical safety against bending and deformation.



Short Circuit Strength Calculation

A faults mode calculating program is used to calculate the mechanical stress applied to the windings due to faults in the system such as 1-line faults, 2-line faults, 3-phase faults. This mechanical stress is divided into hoop force, bucking force, axial force and tilting force, depending on the many conditions, and the winding's mechanical safety is ensured by choosing the optimal conductors to endure such mechanical forces.

Test

We possess reliable world-class testing and measuring equipment, and a system that provides our customers with products of the highest quality. Characteristic test, insulation test and temperature rise test that meets international standards such as IEC, ANSI/IEEE, NEMA, KS, and ES.

Testing Equipments

Impulse Test	3000kV 300kJ
AC Withstand Voltage Test	600kV 3000kVA
P.D Meaeurement	ERA/RIV 20kHz-20MHz
M.G set	6.6kV 2400kVA
Loss Meaeurement	200kV 4000A
Resistance Meaeurement	100A 1$\mu\Omega$ ~ 500Ω
Condenser Bank	130kV 144MVAR

Routine tests

a) Measurement of winding resistance
b) Measurement of voltage ratio and check of phase displacement
c) Measurement of short-circuit impedance and load loss
d) Measurement of no-load loss and current
e) Dielectric routine tests

Type tests

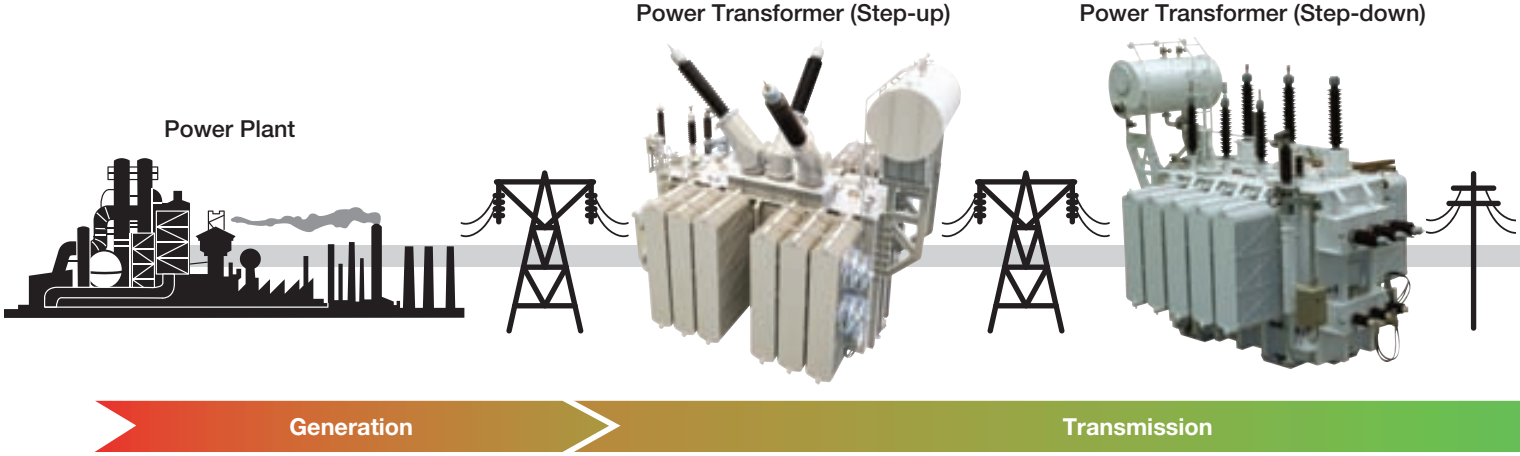
a) Temperature-rise test
b) Dielectric type tests
c) Tests on on-load tap-changers

Special tests

a) Dielectric special tests
b) Determination of capacitances windings-to-earth, and between windings
c) Determination of transient voltage transfer characteristics
d) Measurement of zero-sequence impedance(s)
e) Determination of sound levels
f) Measurement of the harmonics of the no-load current
g) Measurement of the power taken by the fan and oil pump motors
h) Measurement of insulation resistance

Technical Data

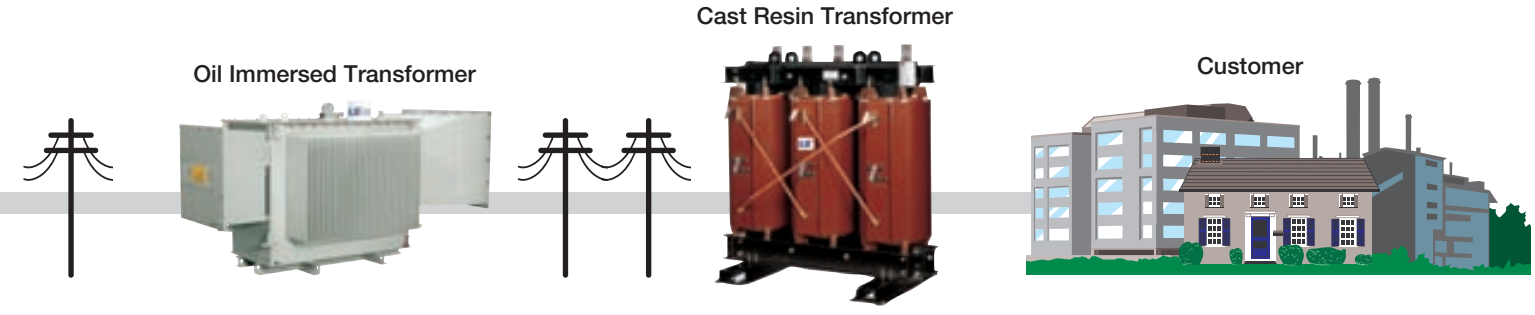
LSIS' Power Transformer is produced on a clean, zero-defect production line, and comes in capacities up to 550kV, 800MVA.
LSIS also produces and delivers various electrical supply transformers for nuclear fusion, nuclear energy, rectifiers, and more.



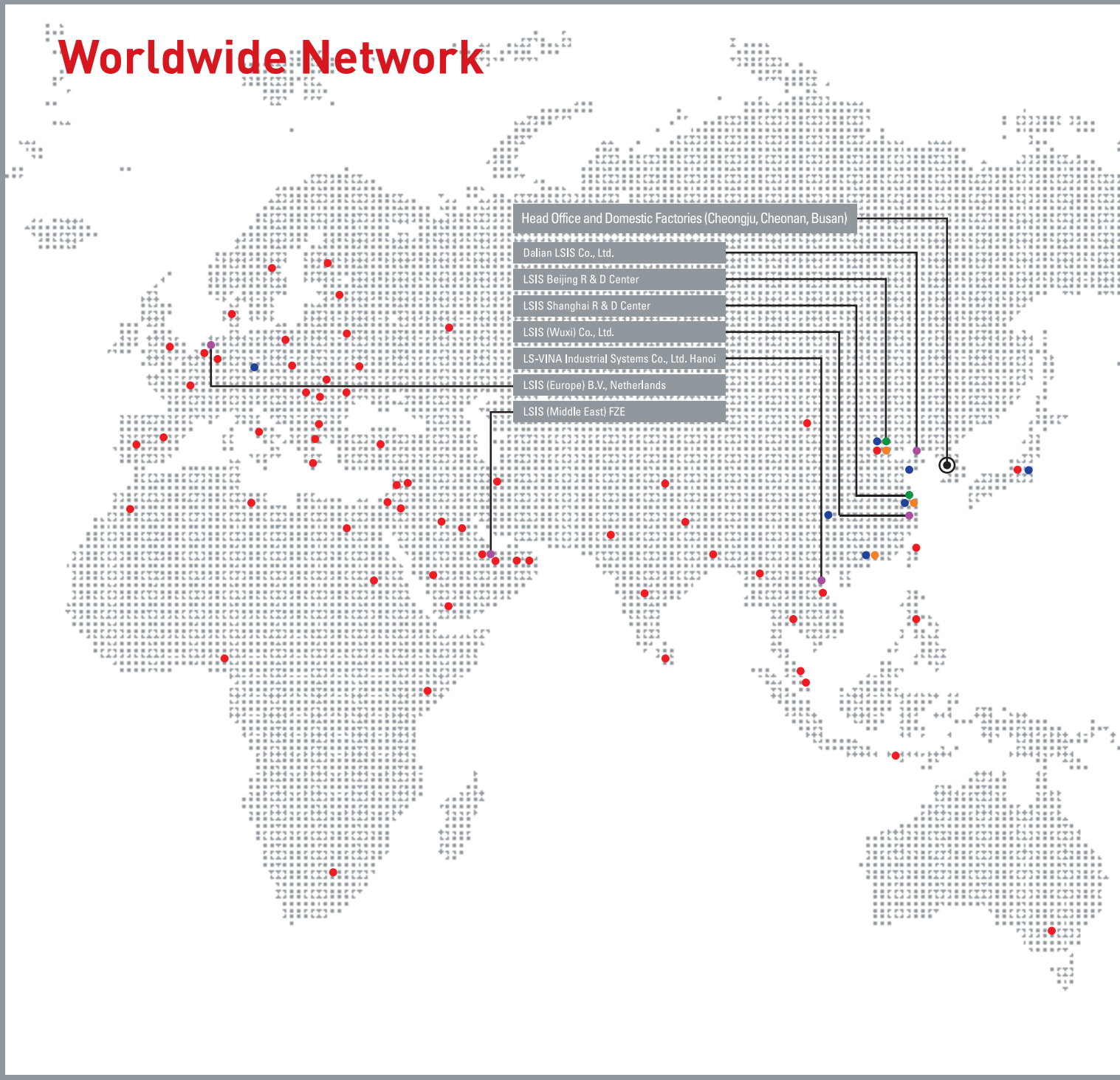
Power Transformer up to 550kV/800MVA

Applicable Specification

Applicable Standard		IEC 60076 / ANSI (IEEE) C57
Installation Location		Outdoor / Indoor
Frequency [Hz]		50 / 60
Themal Class [℃]		105(A)
Winding Temp. Rise [K]		65
Oil Temp. Rise [K]		60
Cooling Method	Internal	ON / OF / OD
	External	AN / AF / WF
Max. Voltage (kV)		Up to 550
Capacity (MVA)		Up to 800 for Three Phase Up to 300 for Single Phase



Worldwide Network



Quality Assurance

Flexible and quick delivery is possible through our computerized management using an ERP System and the rigorous ISO 9001 quality control. Moreover, we have obtained the ISO 14001 environmental management system certification for our environmen friendly production and after-sales service.

Quality Management

The LSIS runs a development library that carries out verifications in various sites of conditions. and comparison tests with other companies' products. This is achieving a growing customer satisfaction level through producing high-quality products. Such quality management has earned LSIS' many certifications and awards, and has become the basis for a realization of products of a global standards.

Customer Technology Training Service

The LSIS offers the industry's first customer training program through the internal training institute. Factory automation and other Industrial electricity and electronic processes are taught through realistic practice apparatus. Technology advice and guidance are offered through this cutting-edge technological service.

Web-based Customer Service.

The LSIS offers globally web-based customer service, aimed at customer satisfaction through providing technological information, quick responses to enquiries, and precise service history. Moreover, by building a supply chain management system-an integrated management for purchasing, production and supply- we are leading the e-business in industrial electrical automation.

LSIS engages in business activities around the world.
The company has a global network that includes
four overseas corporations and seven overseas branches.
It also has 224 business partners in 77 countries.

Overseas Corporations	Dalian and Wuxi (China), Hanoi (Vietnam), Dubai (UAE), Europe B.V (Netherlands)
Overseas Branches	Shanghai, Beijing, Guangzhou, Chengdu, Qingdao (China), Tokyo (Japan), Germany
Global Service Centers	Shanghai, Beijing, Guangzhou (China)
Global R & D Centers	Shanghai, Beijing (China)
Presence Internationally	77 Countries

Power Testing & Technology Institute

We are the first domestic private enterprise with a short-circuit test equipment of 1,600MVA capacity, high-voltage test equipment, reliability test equipment and a KOLAS recognition, providing global-standard test assessment services. The institute enjoys a global public confidence, through strategic cooperation, and reciprocal recognition of test reports, with UL (American safety standards), CE (EU recognition logo), The Netherland's KEMA, Italy's CESI and other overseas accredited testing institutes.

This catalogue was produced using
environmentally-friendly paper
recommended by environmental organizations.

Green Innovators of Innovation

Safety Instructions

- For your safety, please read user's manual thoroughly before operating.
- Contact the nearest authorized service facility for examination, repair, or adjustment.
- Please contact qualified service technician when you need maintenance.
  Do not disassemble or repair by yourself!
- Any maintenance and inspection shall be performed by the personnel having expertise concerned.

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※ LSIS constantly endeavor to improve our products so that information in this catalog is subject to change without notice.

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