



Oil Immersed Transformers



www.hyosungpni.com

Global Top Energy, Machinery & Plant Solution Provider

HYOSUNG CORPORATION
Power & Industrial Systems Performance Group

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About HYOSUNG



Hyosung Power & Industrial Systems PG is a division under Hyosung which consists of seven performance groups (PGs). In addition to establishing itself as a world-class manufacturer of electrical equipments, green technology and industrial machineries, Hyosung is also the largest producer of tire cords and spandex in the global market and the second largest supplier of ATMs in the USA.

01 Our Business

Brief introduction of Hyosung Power & Industrial Systems

Hyosung Power & Industrial Systems Performance Group

Hyosung Power & Industrial Systems Performance Group, a comprehensive energy solution provider, boasts world-leading technology in the global power industry and has secured a competitive capability on par with that of top competitors in transformers, switchgears, motors, decelerators, industrial pumps, and wind energy business.

With globalization as one of our top priorities, we have achieved outstanding increase in sales over the past few years thanks to the enhancement in Hyosung's quality, technology, and brand recognition among overseas clients, which include North America, Europe, the Middle East, and Asia. We expect such robust performance, marked by an increasing number of orders from the overseas market, to continue in the future.

At the heart of our capability to grow as a comprehensive energy solution provider is our global organization structure. Hyosung Power & Industrial Systems Performance Group is divided into four business areas or performance units, depending on the types of flagship products: Power Systems Performance Unit, Industrial Machinery Performance Unit, Hyosung GoodSprings Performance Unit, and the Wind Energy Business Division.

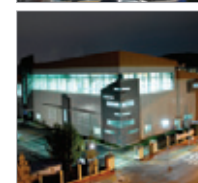
Power Systems Performance Unit

Hyosung's Power Systems Performance Unit provides a full spectrum of power generation, transmission, and distribution services, from design and engineering to the maintenance of equipment and has been building up on cutting-edge information technology resources and developing substation automation systems, such as power monitor and control systems, and early detection and prevention systems.

Such vast product assortment and technical know-how is based on our product development history. In 1992, Hyosung was the first in Korea, and the sixth in the world, to develop a 765kV ultra-high voltage (UHV) transformer, and, in 1999, was the first in the world to manufacture the 800kV gas insulated switchgear (GIS), which has put Hyosung on an equal technological ground as its top global competitors.

Having such world-class technology, we established Baoding Hyosung Tianwei Transformer Co., Ltd., a joint venture with the Baoding Tianwei Organization, to hold the largest share of the market in Baoding City, China. This venture was established in 2003, and by the end of 2004, we established a production plant producing 11,000 transformers per year. In 2006 we acquired one of the top five companies in quality terms as certified by the Chinese government, Nantong Hyosung Transformer Co., Ltd. in Jiangsu.

The Power systems Performance Unit is continuously striving to secure competitiveness in every aspect of quality, technology, sales, services, and management, in order to satisfy customer needs globally and become a top-tire company in the world by providing customers with the best quality products and services in the power systems sector.



Oil Immersed Transformers

CONTENTS

02 Our Business 03 Sustainability / R&D 04 General 05 Technology 06 Design Concept
07 Construction 08 Products & Details 14 Total Quality Assurance 15 Global Network

02 Sustainability

Our sustainability principles are the backbone of the way we design and manufacture products

Quality Assurance

Hyosung strives for excellence. We believe excellence can only be achieved through absolute quality and value for customers. In order to create quality products, we believe that all of the actions of every single employee must be focused in the highest level of quality. In order to achieve such levels, we have implemented a quality assurance policy and programs that make our philosophy into a reality. Our Quality Assurance Policy was founded based on the management policy of the president and meets the demands of ISO 9001. As a globally active company, we are committed to comprehensive and quality management through three quality strategies: quality management system, customer-focused management system, and concentration on core competencies.

The comprehensive quality management system ensures that we completely comply with all compliances and applicable legislation, codes, and standards in addition to implementing efficient operation of our management resources to eliminate unnecessary waste. Our customer-focused management system clarifies and simplifies our first priority which is customer satisfaction. All of our work is aimed to exceed customer needs and provide exceptional value through quality standards, flexibility, and innovation. Finally, we concentrate on our core competencies for strict quality control and continual improvement which provides quality products and cost-saving to our clients via advancement in technical capacity and technological innovation.

We implement our policy via a Quality Management Team manages research laboratories, including the Measurement Standard Laboratory, the Chemical Analysis Laboratory and the Material Analysis Laboratory to maintain a strict control over quality.



Environment Protection Policy

Hyosung understands the impact of Hyosung's activities in the environment and works to protect the environment from pollution, manages the environmental impacts of Hyosung's products and technologies, and prevents future pollution and harmful effects in the environment by investing in environmentally-friendly products and solutions.

Based on this eco-philosophy of shared responsibility, Hyosung has implemented a comprehensive environmental protection program that aims to minimize our impact on the environment and conserve resources. Our environmental policy fulfils all requirements of the ISO 14001.

03 R&D

Inspiring innovation, creation and expertise

Hyosung R&D Center identifies innovation, creation, and expertise as core value, and concentrates on world class R&D activities in the 21st century with a philosophy aspiring after customer satisfaction, quality priority, and performance orientation. Hyosung pursues to be the world's best company in the field of heavy electrical machinery, industrial & electrical electronics engineering, and energy system. Ever since establishment in 1978, R&D Center had led the development of domestic technology. Along with the Anyang and Changwon labs, the group has endeavored to produce core technology and world-class products in the areas of heavy electrical machinery, energy system, electrical electronics engineering, and industrial automation system.

Research Areas

Hyosung R&D Center engages in the activities in the field of energy system, solution & service, applied electrical and electronic technology, basic core technology, technology of improved reliability, core components, and new materials.

Energy System

- Renewable energy (wind system, wind turbine, wind PCS, solar system, PV PCS, fuel cell, co-generation)
- Electric Vehicle (EV charger, EV motor)

Solution & Service

- Power facility diagnosis algorithm and system
- Power facility lifecycle evaluation system
- Service solution for remote diagnosis for prevention

Applied Electrical & Electronic Technology

- Power conversion system
- Flexible AC transmission system and high voltage direct current
- Power quality solution

Basic Core Technology

- Fortified technology in structural dynamics, electromagnetics, heat transfer analysis, etc.
- Skills for system simulation, analysis and evaluation
- Business support technology

Technology with Improved Reliability

- Test data analysis and testing facility
- Analysis of lifecycle and cause of error
- Reliability assessment (environment-friendliness, durability, long-term degradation, and more)

Core Components and New Materials

- Organic and inorganic insulation materials
- Silicon forming technology
- Intelligent sensor (facility diagnosis, CT, PT, VT, LA, and more)

Oil Immersed Transformers



General

Based on know-how accumulated over several years, Hyosung's oil-immersed transformers have been supplied to various industries including semiconductor, steel work, and petrochemical. Further, as an outstanding and comprehensive solution provider, we respond to the demanding requirements of our customers by developing and manufacturing both eco-friendly and high-efficiency transformers. Hyosung exports its oil immersed transformers to more than 25 countries all over the world.

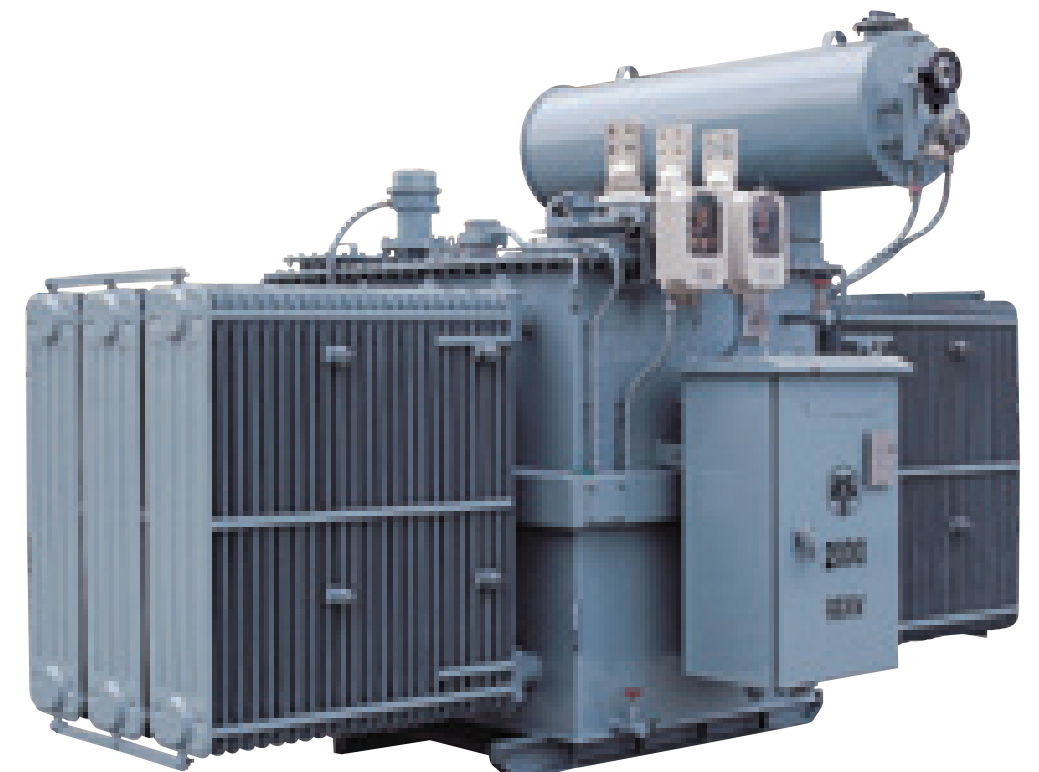
Technology

Hyosung is the leading supplier of the power transformer industry. Starting with the development of the 154kV high-voltage transformer in 1969, Hyosung introduced the 345kV and the 765kV transformers subsequently for the first time in the country, and only the sixth in the world.

Hyosung's oil immersed transformers are designed to withstand all environmental hazards. In the rated power range up to 60MVA and operating voltage up to 66kV, these transformers have off-load or on-load tap changers to adapt it to various network conditions. Hyosung manufactures transformers under IEC, JEC, ANSI, BS and every required national standard. We offer individual solutions for satisfying requirements related to types of operation, low noise and low losses, connection technology, type of cooling, transportation, installation and so on.

With Hyosung Oil Immersed Transformers, you obtain not only the transformer but also an Energy Partner for your business

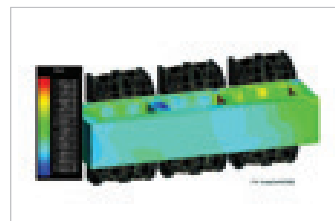
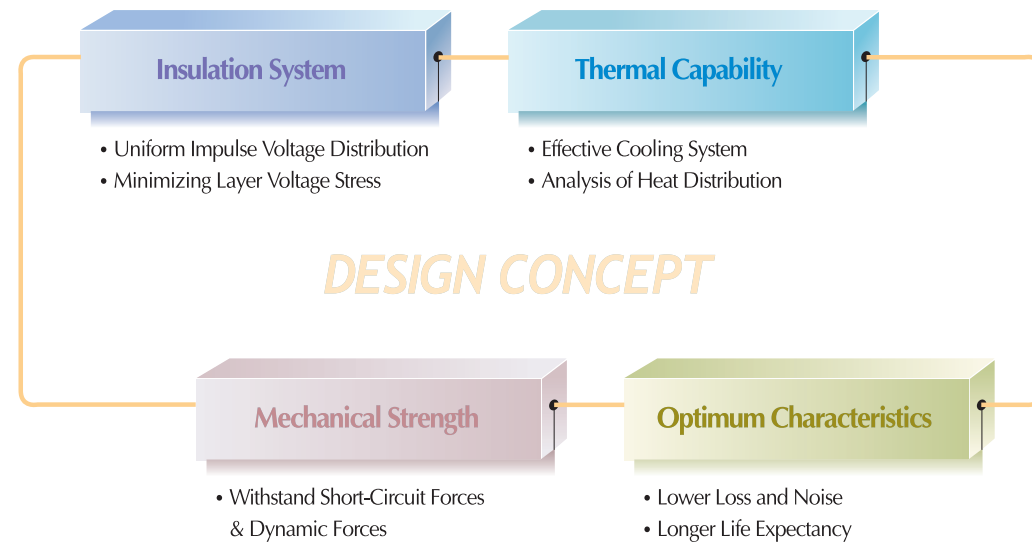
- Excellent short-circuit resistance
- Satisfies the various load conditions required by customers
- Low-loss step lap laminated core
- Uses latest insulation material with high short-circuit strength to realize high thermal capacity
- Cold steel sheet is used for radiating pipe to ensure a sufficient cooling effect and aesthetic exterior
- Compact, light, and low-noise transformer with standard efficiency and noise level which can be easily installed even in a small indoor or outdoor area



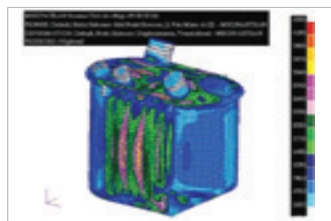
Design Concept

Minimize Losses
Minimize Hottest-Spot
Max. Withstand Short-Circuit

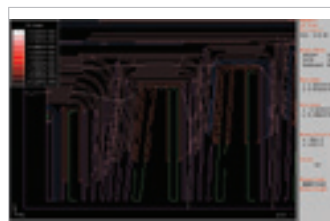
For highest customer value, Hyosung supplies world-class quality transformers at a reasonable price. High quality starts from the design process. For transformer design, accumulated experience level and computer technology are the two most important aspects in evaluating transformer engineering. Well-trained engineers with a high quality training program help to assure high quality design. With more than 40 years of engineering database network system and optimum design program experience, Hyosung guarantees customers a trustworthy transformer. Our computerized design system, including 3D analysis (Electric field, magnetic field and mechanical analysis) reinforces not only the insulation system but also the dielectric strength. With Hyosung's advanced design program, the actual finish product can be reviewed in advance. Dedicated and customer-centered engineers always provide defect-free and optimized products to customers.



Magnetic Field Analysis

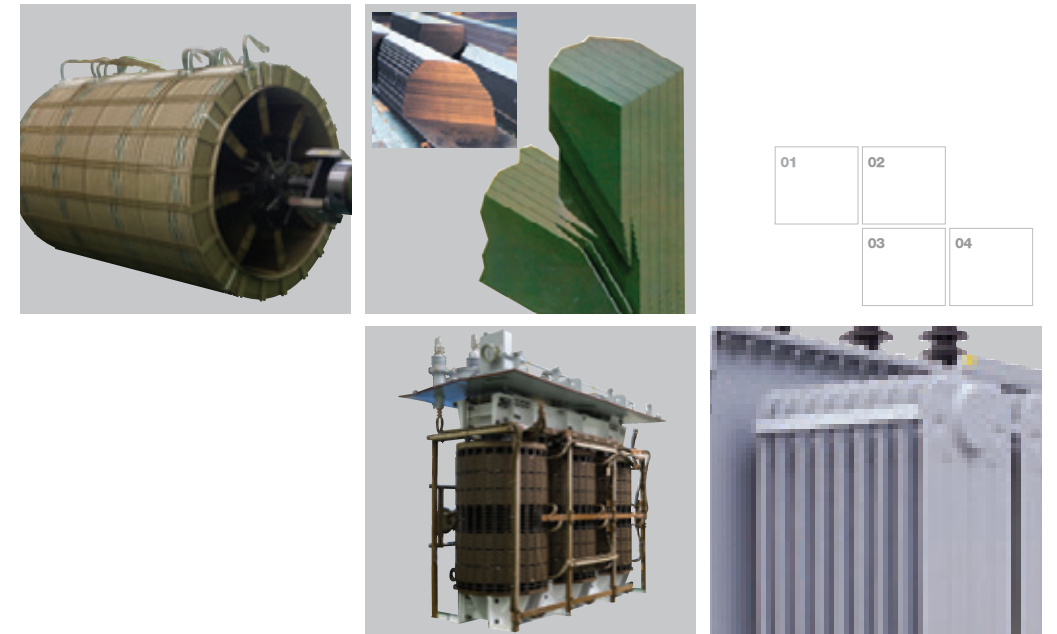


Mechanical Analysis



Dielectric Analysis

Construction



01 Windings

Windings are composed of two parts, namely, a conductor and insulation material. For the conductor, Hyosung uses high grade electrolytic copper or aluminium. Hyosung Oil Immersed Transformers obtain high thermal capacity with the use of Epoxy coated Insuldur Kraft Paper, which has higher short time overload capacity than any other Kraft paper type.

02 Core

Core design is essential because it determines the transformer's efficiency and noise level. For high dimensional accuracy, the core cutting processing of Hyosung is controlled by a computerized system. By Step-Lap core stacking, Hyosung Oil Immersed Transformers attain to optimal characteristics for each customer.

03 Winding Support System

Coils are sized and clamped by being pressed with a special hydraulic fixture after assembly with the core. With Axial and Radial direction, we reinforce the winding support system. This secure structure helps withstand harsh short circuit forces.

04 Radiator

The transformer will be furnished with panel or corrugated radiators assuring that the temperature rise of the windings or oil will not exceed their specified limit when the transformer continuously operates at the rated full load.

Products and Details



Hyosung Oil Immersed Transformers,
Your Reliable Energy Partner

Product Arrangement

Ratings

- Single or 3 - Phase Unit
- Rated Frequency : 50Hz or 60Hz
- Thermal Insulation Class : A
- Winding Conductor : Copper or Aluminum
- kVA Range : From 100kVA up to 60MVA
- High Voltage : 3.3kV - 66kV
(with taps, N.L.T.C. or O.L.T.C.)
- Low Voltage : 600V below
- Production Capacity : 12,000MVA/year
- ※Temperature Rise : 55°C, 55/65°C, 65°C(Optional :
special temp. Rise)
- ※Basic Insulation Level : 30kV BIL through 350kV BIL



Options and Accessories

- Oil temperature indicator
- Winding temperature indicator
- Oil level indicator
- Buchholz relay
- Pressure relief device
- Sudden pressure relay
- Thermometer pocket
- Skid base or bi-directional rollers
- Cooling fan and fan control panel
- Various oil preservation system
- ※Other accessories are available upon request

Transformer for Special Applications

- For Rectifiers
- For Harmonic Distortion
- For Arc Furnaces
- For Variable Speed Drives
- For Reactors
- For Inverter and Converters
- Earthing Transformers
- Excitation Transformers
- High Efficiency Transformers
- ※Hyosung provides customized solution for
individual customer's needs

Hyosung Offers

- Maintenance and Site testing
- Site assembling and Installation
- Commissioning
- Training
- Spare parts procurement
- Technical solutions
- Retrofit and Upgrading

For Petrochemical & Chemical Plants

Petrochemical and chemical plants are processing industries, and operate continuously 24/7. If one facility stops, everything else must be gradually stopped. Moreover once this happens, petrochemical and chemical raw materials become solid and transmute, it should be burned and purified before the facilities start to operate again, so the damage is huge. By thinking from the customer's point of view, Hyosung ensures the **Stability** of transformers. We have been actively engaged in large-scale petrochemical and chemical projects around the world.

Main Service Areas

- Naphtha Cracking Complexes
- Aromatics Complexes
- Fertilizer & Pesticide Complexes
- Chemical Plants
- Fine Chemical Plants



Products and Details



For Oil & Gas Plants

Different from the past, most oil and gas plants accept electric furnaces for the production process. These types of facilities use an immense amount of electricity. Because good quality of electricity is directly related to good quality of oil and gas, **Stability and Lasting Quality** are key factors for transformers. Hyosung has supplied high and secure stability transformers for field of oil and gas facilities, such as oil production, refinery and gas processing facilities.

Main Service Areas

- Oil and Gas Production Facilities
- Oil Refinery Facilities
- HOU (Heavy Oil Upgrading) Facilities
- FCC (Fluidized Catalytic Cracking) Facilities
- Gas Processing Facilities
- LNG Facilities



For Power Plants & Substations

Electricity is vital for most everyday activities. Power plants connect to a huge network of people, electric lines, and generating equipment. Because of this network, transformers in power plants and substations are very important.

Power plants need to generate high quality power, and very stable loads, so the top element of a transformer is **Efficiency**. With Hyosung transformer's top-class efficiency, Hyosung has supplied the product to various power plants, such as nuclear and thermal power plants and substations. With extensive experience records and accumulated experience, Hyosung offers high quality transformers to the power sectors.

Main Service Areas

- Combined Cycle Power Plants
- Thermal Power Plants
- Cogeneration Power Plants
- Diesel Engine Power Plants
- Geothermal Power Plants
- Hydro, Pumped Storage Power Plants
- Wind Power Plants
- Transmission, Substation & Distribution
- Nuclear Facilities



Products and Details



For Industrial Plants

If a semi-conductor factory stops for even a few seconds, the damage is enormous because it needs long time to adjust the optimal manufacturing condition. The secure electric supply is directly connected with customer's benefits in the industrial plant. Hyosung understands the importance of the transformer for industrial plants, we provide **Individual Solutions** for satisfying various kinds of requirements : types of operation, high efficiency, resistance against harmonic distortion, maintenance, installation and so on.

Main Service Areas

- Semiconductor & LCD related Plants
- Steel Mills & Metal Plants
- Automobile Plants
- Cement Plants
- Pulp / Paper Mills
- Material Recycling Plants

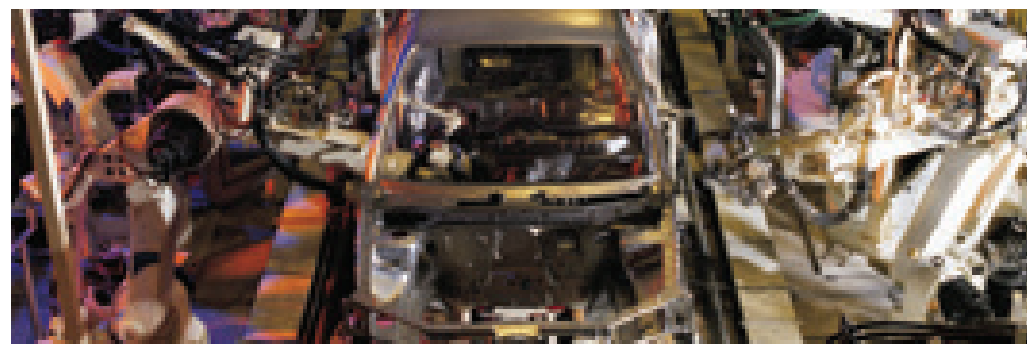
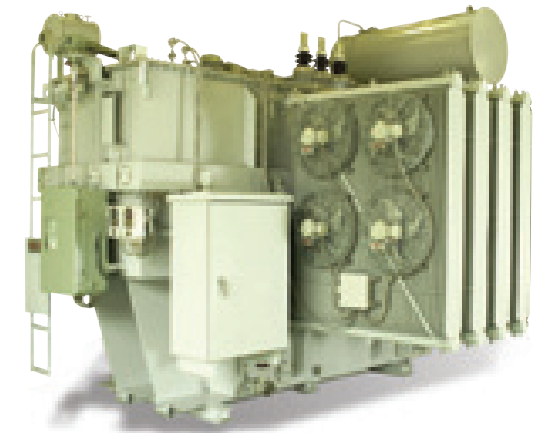


For Environmental Plants

In environmental plants, such as seawater desalination facilities and wastewater treatment facilities, the main equipment is a pump. Loads of such equipment are very unsteady, and undergo dramatical changes. Hyosung transformers are designed for environmental plants with **Mechanical Strength** to bear short-time overload.

Main Service Areas

- Seawater Desalination Facilities
- Flue Gas Desulphurization / Denitrification
- Wastewater Treatment Facilities
- Solid Waste Management Facilities



Total Quality Assurance

At Hyosung, our goal is not only to meet the needs of our customers today but also to provide them better life in the future.

Hyosung's total quality commitment to our customers is demonstrated by providing the highest quality product at the most competitive prices with on time delivery. We achieve these high quality levels through our integrated quality assurance program. Our products are used extensively both at home and abroad. This level of experience allows Hyosung's quality assurance and reliability to exceed those of our competitors. We share our customer's goals with high quality products. From design to assembly, testing and installation, our customers' requirements are our minimum standards.

All tests are based on International standards and our customers' requirements. Through additional testing, Hyosung seeks to exceed established testing criteria, thereby producing more reliable products.

Our special process operators and technicians are highly trained. Continued professional growth and advanced training is encouraged through internal training groups and outside courses.

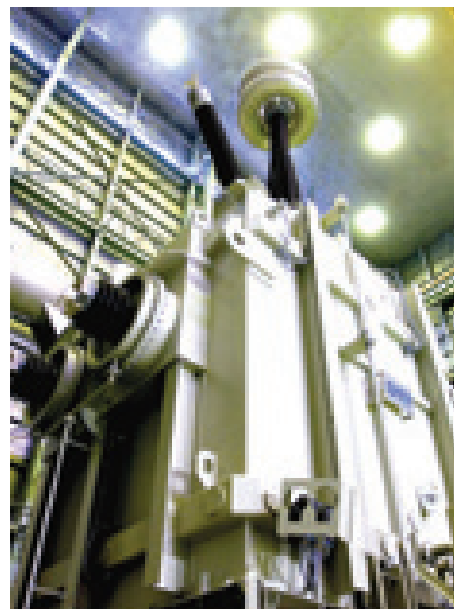
All our products have ISO 9001 and ISO 14001 certifications.

At Hyosung, we endeavor to maintain the highest quality.

Scope

In line with major international standards for quality assurance, the quality assurance program of our plants includes the following elements.

- Contract review
- Inspection/test control
- Design control
- Measuring and test equipment
- Procurement document control
- Storage, handling and shipping
- Purchased materia
- Nonconforming item
- Identification
- Quality assurance records
- Special Process



Product Development History

Year	Milestones
2009	High Efficiency Certificate for Oil-Immersed Transformers Development of Eco-Friendly Transformers
2007	Short-Circuit Test for 45MVA and 2.5MVA Oil-Immersed Transformers
2004	Development of Low Loss Oil-Immersed Transformers for Export to Japan
1998	Development of 170kV Gas V/T for GIS
1997	Supply of 30MVA Shunt Reactors for KEPCO

Year	Milestones
1995	Development of PAD Transformers for KEPCO Development of Low Loss Pole Transformers for KEPCO
1993	Development of Self-Diagnostic Pole Transformers for KEPCO
1990	Development of Amorphous Core Type Pole Transformers
1984	Earthquake-proof Test for 630kVA Mold Transformers
1981	Development of C.S.P Pole Transformers
1962	Production of Oil Immersed Transformers and Pole Transformers

Global Network

