

HYUNDAI

ELECTRO ELECTRIC SYSTEMS



www.hyundai-elec.com



Nature-Ecology-Environment

Hyundai Heavy Industries' Key Concepts to a Better Future

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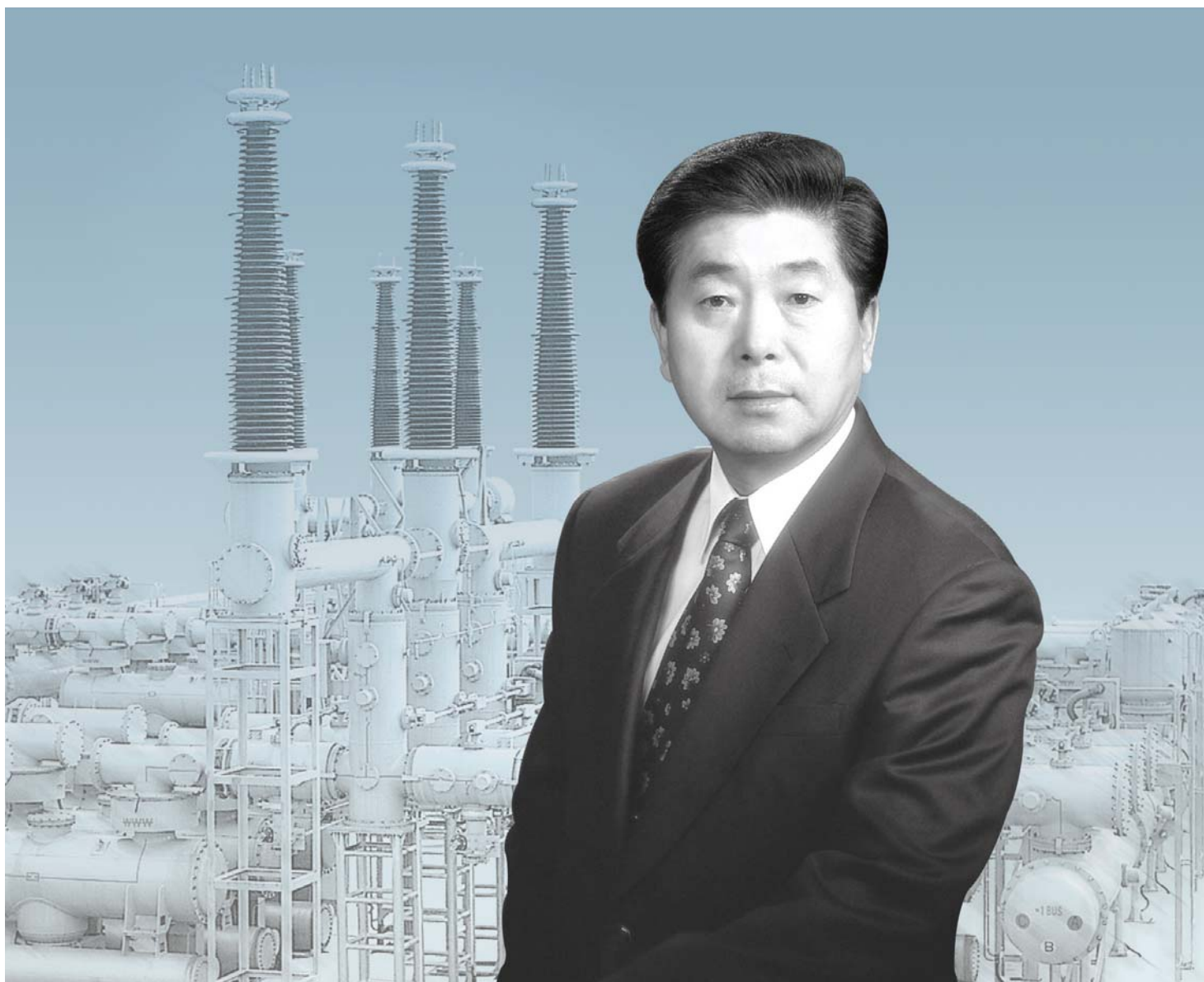
We build a better future!

Total Solutions

For Electrical & Automation Equipment



Message from the COO



Message from the Chief Operating Officer

We are greatly pleased to present our company's general brochure, which will help you gain a basic understanding of our core business activities.

As you will find out in the following pages, our product line covers a wide range of electrical equipment, such as transformers, high voltage circuit breakers, switchgears, motors, generators, integrated control & monitoring systems, power electronics, and renewable energy.

Since the establishment of our company, we have been actively engaged in designing, manufacturing, and constructing various electrical systems and have accumulated an enormous amount of experience in power industries, thus enabling us to provide turn-key solutions for our customers.

In order to satisfy our customers with the best quality products and service, we have established a complete set of quality assurance programs, from marketing to after-sales service, to comply with the requirements of ISO 9001 as well as ISO 14001.

We have an exceptional reputation and performance record on finished products and services provided to our customers around the world.

We would greatly appreciate if you read this brochure, and should you need any further information, please feel free to contact us.

We look forward to serving your esteemed organization in the near future.

Sincerely yours,



Kim, Young-Nam
Senior Executive Vice President & COO
Electro Electric Systems
Hyundai Heavy Industries Co., Ltd.



Hyundai Chronicle

HYUNDAI ELECTRO ELECTRIC SYSTEMS



Brief History

- 1970 Dec. 1973** Established Electrical Department at Hyundai Heavy Industries Co., Ltd. (HHI) in Ulsan
- Jan. 1978** Completed Switchgear Factory
- Nov. 1978** Incorporated the company under the name of Hyundai Electrical Engineering Co., Ltd. (HEECO)
- Dec. 1978** Completed Transformer Factory No. 2 for manufacturing up to 525kV
- Aug. 1979** Completed Rotating Machinery Factory
- Sep. 1979** Dedicated the High Voltage Transformer Test Laboratory

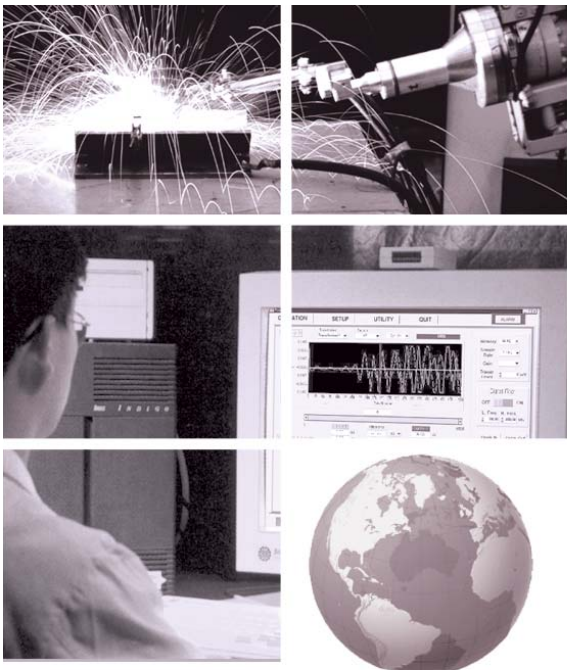
- 1980 Jul. 1981** Dedicated the Rotating Machinery Test Laboratory
- Dec. 1982** Established Hyundai Industrial Research Institute
- Dec. 1983** Completed High Voltage Switchgear Factory
- Dec. 1984** Completed Power Electronics Factory
- Jun. 1986** Established Low Voltage Motor Factory "HIMCO" (Joint Venture Company with General Electric of U.S.A.)

- 1990 Dec. 1990** Completed PCB & Inverter Factory
- Jul. 1993** Achieved Certificate of Registration to Standards Australia (SAQAS) and International Organization for Standardization (ISO) for all divisions
- Jan. 1994** Merged into Hyundai Heavy Industries Co., Ltd.
- Nov. 1996** Completed Turbine & Generator Factory
- Jul. 1997** Acquired Elprom Trafo Co. in Bulgaria
- Oct. 1998** Established Research & Development Company for Rotating Machinery in Hungary named Hunelec Engineering & Technologies kft
- Nov. 1999** Completed 765kV Transformer & Gas Insulated Switchgear Factory

- 2000 Jan. 2001** Changed the name of division from Industrial & Power Systems to Electro Electric Systems (EES)
- Jun. 2001** Developed 800kV Gas Insulated Switchgear
- Jun. 2003** Established Research & Development Institute for EV equipment and distributed generation system. (Joint Venture with ENOVA, U.S.A.)
- Oct. 2003** Incorporated Jiangsu-Hyundai Nanzi Electrical Company in China (Joint Venture with Nanzi Tonghua Electrical Group)
- May. 2004** Selected as "Korean World-class Product Award 2004" by Ministry of Commerce, Industry and Energy, the Republic of Korea (Synchronous Marine Generator)

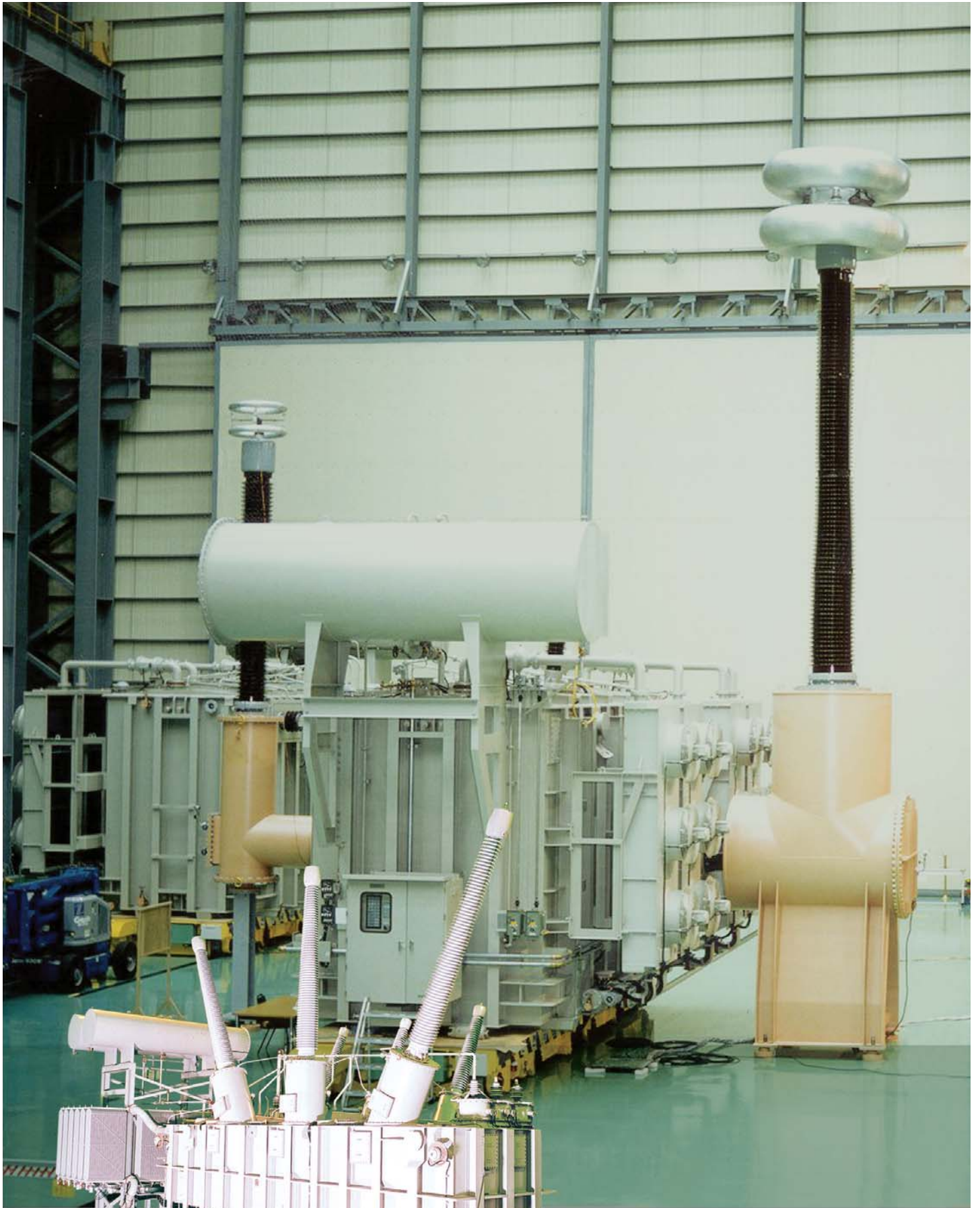
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HYUNDAI ELECTRO ELECTRIC SYSTEMS



Business Areas

- Transformers
- High Voltage Circuit Breakers
- Switchgears
- Low Voltage Circuit Breakers
- Rotating Machinery
- Marine Electrical Equipment
- Integrated Control & Monitoring Systems
- Power Electronics
- Locomotive Purpose Equipment
- Turnkey Substations
- Renewable Energy



Transformers

1	765kV Power Transformer
2	362kV Power Transformer
3	Shunt Reactor
4	Cast Resin Transformer
5	SF ₆ Gas Insulated Transformer

By utilizing our most modernized designs, manufacturing facilities and production technology, we manufacture high-quality power and distribution transformers with a rated voltage of up to 800kV and a capacity of up to 1,300MVA.

We are continuously developing and applying new design concepts, technical advances, and processes to our transformers to ensure high reliability, efficiency and a long, predictable service life.

Through strict quality control during manufacturing and a full series of tests at our state-of-the-art laboratory, our transformers have been proven to be of the highest quality and are internationally recognized by power utilities and other clients around the world.



Production Range:

- Power Transformer up to 800kV Class
- Distribution Transformer
- Cast Resin Transformer
- Special Purpose Transformer such as Dry Type Transformer, Shunt Reactor, Gas Insulated Transformer, etc



High Voltage Circuit Breakers

- 1 800kV Gas Insulated Switchgear
- 2 362kV Gas Insulated Switchgear
- 3 170kV Gas Circuit Breaker
- 4 170kV Gas Insulated Switchgear
- 5 25.8kV Gas Insulated Switchgear

The SF₆ Gas Insulated Switchgear(GIS) contains the major equipment used in a substation such as a gas circuit breaker, disconnecting switch, earthing switch, voltage transformer, current transformer, lightning arrester, etc. in a grounded, metallic enclosure. The switchgear is filled with SF₆ gas, which has the best insulation and arc-quenching capabilities.

With its outstanding technical features, Hyundai GIS can meet the current trends of customers' requirements.

Prominent Features / Benefits:

- Small space requirement
- Easy installation
- Simple maintenance
- Full protection against contact with live parts
- Protection against pollution
- Aesthetic compatibility with surroundings



Production Range:

- SF₆ Gas Insulated Switchgear (GIS)
 - Rated voltage: 24kV, 36kV, 145kV, 170kV, 245kV, 362kV, 550kV, 800kV
 - Rated short-circuit breaking current: 25~63kA
- SF₆ Gas Circuit Breaker (GCB)
 - Rated voltage: 145kV, 170kV
 - Rated short-circuit breaking current: 31.5~50kA



Switchgears

- 1 Cubicle-type Gas Insulated Switchgear
- 2 Medium Voltage Metal-clad Switchgear
- 3 Motor Control Center
- 4 Hyundai Intelligent Measuring and Protection Device (HIMAP)

Hyundai switchgears offer the best solutions in the fields of electric power distribution, protection, measuring, control, and communication in power plants as well as industrial and public facilities.

Combined with advanced software and hardware, our products are designed, manufactured, and tested in accordance with various industrial standards, including IEC, ANSI, NEMA, BS, IEEE, etc.

Prominent Features / Benefits:

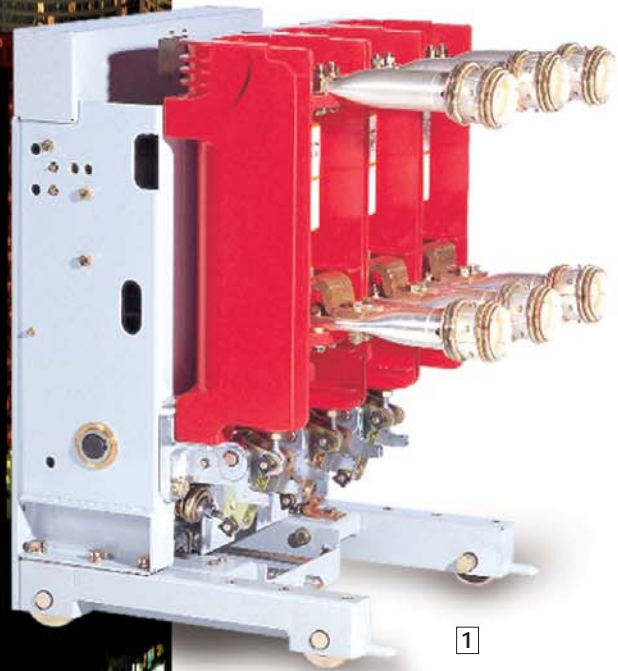
- Hyundai Metal-clad Switchgear provides maximum circuit separation and safety with an isolated and grounded metal compartment.
- Able to withstand high levels of seismic vibration without service interruption.
- Space-saving compactness helps simplify layout.
- Qualified for all aspects of application, including nuclear power plants.



Production Range:

- Medium Voltage Metal-clad Switchgear up to 38kV
- Cubicle-type Gas Insulated Switchgear up to 38kV
- Low Voltage Switchgear & Motor Control Center
- Bus Way System
- Intelligent Measuring & Protection System
- Intelligent Power Monitoring System
- Current Transformer & Potential Transformer

Low Voltage Circuit Breakers



1

- 1 Vacuum Circuit Breaker
- 2 Air Circuit Breaker
- 3 Molded Case Circuit Breaker
- 4 Magnetic Contactor
- 5 Earth Leakage Circuit Breaker

Hyundai circuit breakers and contactors offer the best circuit protection and switching performance for medium and low voltage power systems by satisfying a wide range of breaking capacities, and frames offer innovative solutions to meet all customer requirements.

Pursuing flexibility, safety, and reliability, Hyundai's various products are type-tested by internationally recognized test authorities, such as KEMA, KERI, ASTA, etc.

Prominent Features / Benefits:

- HVF type VCB is compactly designed to meet the dimensional requirements of compact switchgear.
- Hi-series ACB has a digital type built-in OCR which enables direct communication with SCADA system.
- Hi-series MCCB covers a wide range of short-circuit currents.
- Hi-series Magnetic Contactors (HiMC) adopt a DC-controlled coil to reduce noise during operation and has a drawable cassette for easy maintenance.
- Digital type over load relays accurately protect the circuit using MCU (Micro Control Unit)



Production Range:

- Vacuum Circuit Breaker (VCB) up to 38kV 3,000A
- Vacuum Combination Switch (VCS) up to 6.6kV 400A
- Air Circuit Breaker (ACB) up to 6,300A 85KA
- Molded Case Circuit Breaker (MCCB) up to 1,200AF
- Magnetic Contactor & Switch (MC & MS)
- Digital & Thermal Type Over Load Relay.



Rotating Machinery

Hyundai rotating machines have been supplied and tested in accordance with worldwide classification societies such as Lloyd, ABS, DNV and KR for marine use and IEC, NEMA, CSA, IEEE, KS, JEC and AS for industrial applications.



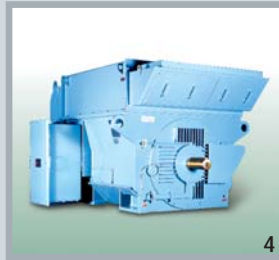
1	High Voltage Motor
2	Crown Triton L.V. Motor
3	Synchronous Generator
4	Wind Turbine Generator
5	Diesel Engine Generator

Prominent Features / Benefits:

- Low vibration and noise by virtue of accurate rotor dynamic balancing and magnetic noise analysis.
- Robust frames to satisfy various load conditions by FEM analysis and vibration test.
- Optimized Insulation System guarantees long-life performance reliability against harsh environmental conditions.
- Customized engineering to customers' specifications.

Production Range:

- High & Medium Voltage Induction Motor up to 25,000HP 14kV
- Standard Low Voltage Induction Motor up to 1,000HP
- Synchronous Alternator up to 50,000kVA 14kV
- Premium Efficiency L.V. Motor from 0.75HP to 250HP
- Wind Turbine Generator
- Diesel Engine Generator Set up to 10,000kVA 14kV





Marine Electrical Equipment

- 1 High Voltage Switchboard
- 2 ECR Console
- 3 Main Switchboard
- 4 Advanced Control & Integration System (ACONIS)
- 5 Synchronous Generator

Hundai marine electrical products include dry-type transformers, generators, main switchboards, engine control room consoles, bridge control consoles, automation systems, and various panels. They have been supplied and installed on a large number of ocean-going vessels and are recognized for their ergonomics, efficiency, and outstanding performance.

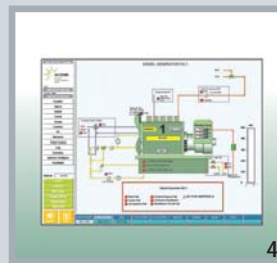
These products have been widely acknowledged by not only the major classification societies of LRS, ABS, DNV, GL, BV, NK and KR, but also leading shipowners around the world.



2



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Main Switchboard

Hyundai has accumulated decades of experience with marine electrical power distribution and control systems. Highly reliable designs of power distribution systems and coordination of protective devices ensure continuity of service.

Ship Automation System

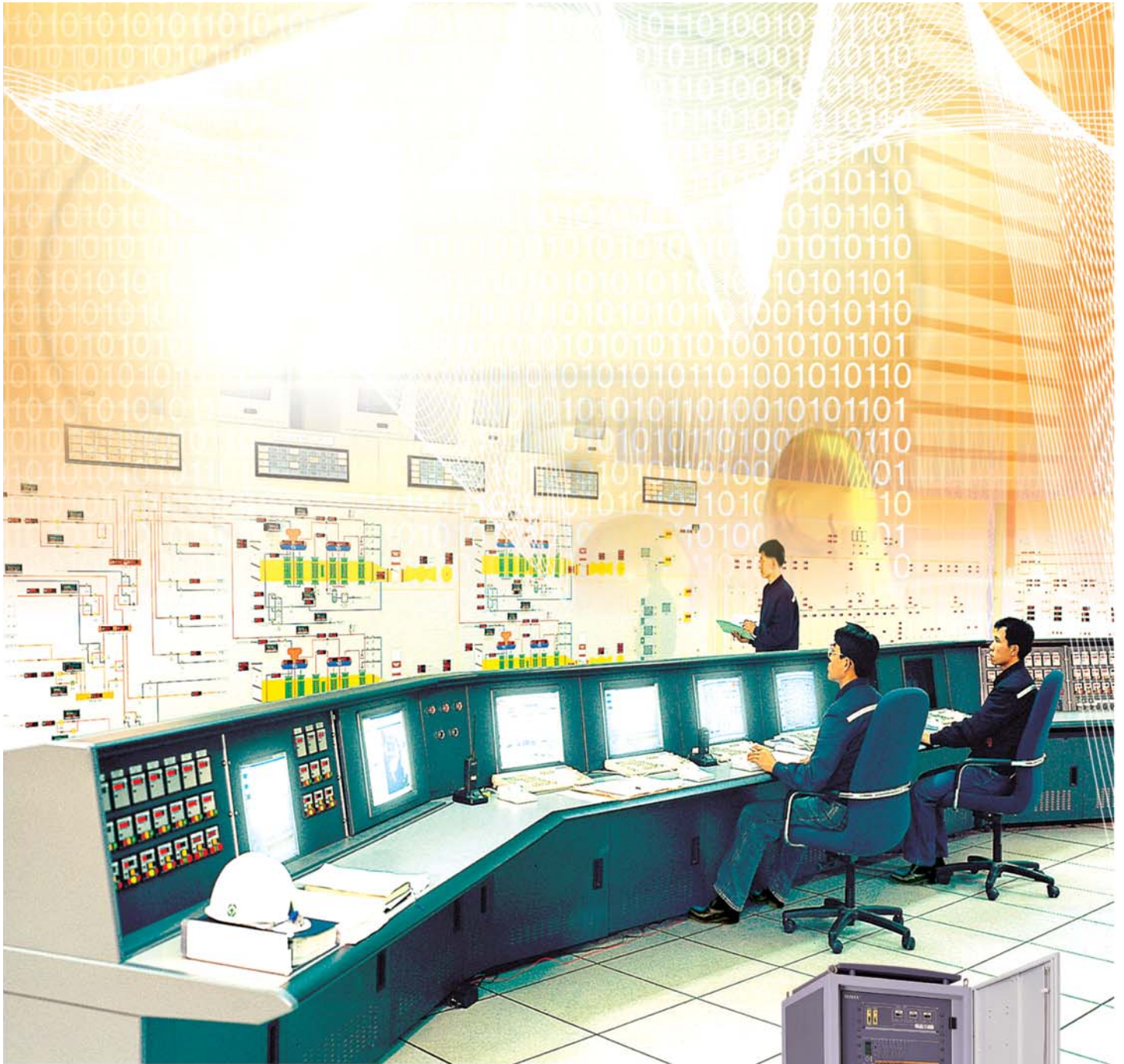
The Hyundai ACONIS series offers the operator full integration of all control & automation functions in combination with several systems, such as integrated bridge system, CCTV, Internet, and ships' computer systems.

Control Console:

Fully considered conventional and/or micro-processor powered automation control systems prevent every possible malfunction caused by ship motion.

Synchronous Generator

For outstanding performance, Hyundai Synchronous Generators have been widely acknowledged by ship owners and installed on many ocean-going vessels.



Hyundai manufactures and supplies various kinds of computerized control systems. The major products for industrial computer systems are Distributed Control System (DCS) and Supervisory Control and Data Acquisition (SCADA) Systems. Both are very flexible and open systems in respect to portability, scalability, interoperability, and connectivity.



Integrated Control & Monitoring Systems

1 HiMAX-2000 DCS

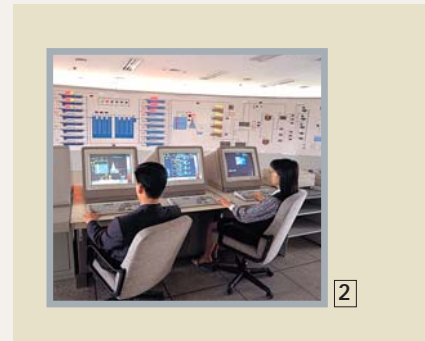
2 SCADA System

SCADA System

To provide a truly open SCADA platform to enable efficient integration of third-party software applications and system standard hardware/software, all software generation and hardware selections are designed and performed to meet industry standards.

The features and design criteria of SCADA provide:

- Fully redundant data highway
- Distributed processing architecture
- X-window or Windows NT-based HMI
- Open System Network
- Supports of multiple major R.T.U. protocols (Modbus, D.N.P, IEC870-5)
- Easy upgrade of modular software design
- Multi-level client server structure
- Guarantee to create any up-to-date system structure
- Facility of migration to any structure in the future without high upgrade costs
- Web-based user interface



DCS

Hyundai's HiMAX-2000 DCS is comprised of a full range of state-of-the-art distributed control systems for applications of boiler, water & waste water treatment, and incinerator plants.

HiMAX-2000 DCS features powerful and versatile functions for various kinds of plants and is easily used in HMI (Human Machine Interface) & configuration tools. HiMAX-2000 DCS can be ported on multiple hardware platforms and operating systems to suit customers' specific requirements.

The features and design criteria of HiMAX-2000 provide:

- Distributed processing architecture
- Open system network
- Fully redundant data highway
- Embedded control blocks for dedicated control
- Windows NT-based HMI
- Compliance with industry standards such as OPC, DDE, etc
- Web-based user interface

Power Electronics

Quiet, powerful, and intelligent...

Hyundai inverters feature sensorless vector & intelligent controls which allow more efficient use of the inherent power of a motor and an auto-turning function capable of easily accomplishing powerful operation.



Inverter

Prominent Features / Benefits:

- Precise torque regulation using sensorless vector control
- Quick response through a built-in DSP
- AVR function to ensure high starting torque
- Incorporated constant auto-turning function for easier commissioning
- Special applications: HV systems and Electric vehicles

Production Range:

- 220V & 440V Class: 0.2~280kW
- 660V Class: 450~1,200kW
- 3.3kV & 6.6kV Class: 500~5,000kW



- 1 High Voltage Inverter Panel
- 2 Dynamic UPS
- 3 N50 Inverter
- 4 N100^{Plus} Inverter
- 5 N300 Inverter
- 6 Inverter for Electrical Vehicle

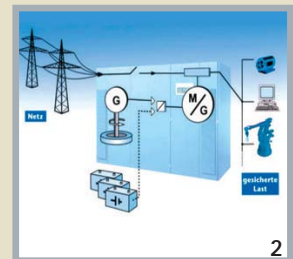
Uninterrupted Power Supply (UPS)

The rotary UPS system provides maximized reliability for continuous power supply in critical loads represented by data centers of ISP industries, semiconductor processing plants, etc.



Prominent Features / Benefits:

- Stabilized pure sinusoidal output voltage
- Galvanic isolation of mains and load
- Maximum reliability by doing away with sensitive power semiconductors and highly aging-prone capacitors
- Free from harmonics for nonlinear loads
- Various applications for power quality: Engine, Battery, Fly-wheel, etc.



High Speed Trains

Since 1980



Hundai has developed various types of traction propulsion, supervisory and control systems for light railway, subway, magnetic levitation, and high speed trains since 1980.

Hyundai has manufactured train propulsion converter/Inverters(VVVF), adopting new techniques such as 32bit DSP microprocessors, heat pipe cooling methods, and the highest rated GTO, IGBT, IGCT and IEGT inverter modules based on our 25 years of experience and product innovations.

Hyundai traction propulsion, supervisory and control systems have the highest reliability and quality in traction applications in the world.

Locomotive Purpose Equipment

1	Power Supply (Converter/Inverter)
2	Auxiliary Power Supply
3	Traction Transformer
4	Traction Motor

Prominent Features / Benefits:

Traction power supply / Auxiliary power supply:

- Fully integrated digital circuit using 32bit DSP
- Advanced algorithm adoption
- Fault tolerance functionality
- More convenient man-machine communications
- The heat PIPC cooling method

Traction motor:

- High reliability with high thermal capacity
- Compact & light weight size
- Low noise & vibration
- Designed with flexibility for various traction applications
- Favorable price

Train control & supervisory control system:

- Easy to manage
- Fail safe control data transmission
- Highly reliable system
- High speed data transmission
- Improved displaying device
- Easy to draw out failure record



*Total System
Provider...*



Turnkey Substations

- 1 800kV Gas Insulated Switchgear
- 2 HiMAX-2000 DCS
- 3 765kV Power Transformer
- 4 170kV Gas Circuit Breaker
- 5 Cubicle-type Gas Insulated Switchgear

Drawing on three decades of successful performance in the areas of electrical engineering and manufacturing a variety of electrical equipments, Hyundai provides substations as well as AC system solutions.

Our scope of supply covers project development, manufacturing, and erection of substations on turnkey bases, including civil works.

Many years of experience in substation projects with our quality products enables us to comply with the wishes of our customers and the needs of tomorrow.

Our proven technical expertise and industry experience have resulted in Hyundai achieving an internationally recognized position as a total solution provider in the field of turnkey substations ranging from 72.5kV up to 800kV.



From the Sun...
New Energy



Today, renewable energy sources play an important role in the energy balance. They must be aggressively developed both technologically and commercially if we want to realize meaningful environmental improvements.

Solar photovoltaic energy will play a major role in this field and is today rapidly growing in the world market. Hyundai will contribute to the further development of photovoltaic technology and the growth of the market.

Wind energy is also one of the rapidly growing renewable energies replacing fossil fuels, which generate greenhouse gases. Hyundai has been developing technology in this field and has experience in supplying wind turbine generators from 600kW to 1,500kW.

Renewable Energy

1	Solar PV
2	Wind Energy
3	Electric Vehicle

Features of Hybrid Electric Vehicle Driving System

- Adoption of wide operation range with MPTA and field weakening control
- Power limit function with respect to MCU & Motor temperature
- High power density, small size, and compactness
- High current low voltage to adopt battery power source
- High power for excellent acceleration performance of EV/HEV
- High efficiency system and high torque at low speed
- High speed operation with wide constant power range

Application Area of Electric Driving System

- Passenger Car
- SUV/MPV
- Heavy duty vehicle (Bus and Truck)
- Environmentally Friendly Brake System instead of Jake brake or Engine block
- Bus Rapid Transit



Solar PV:

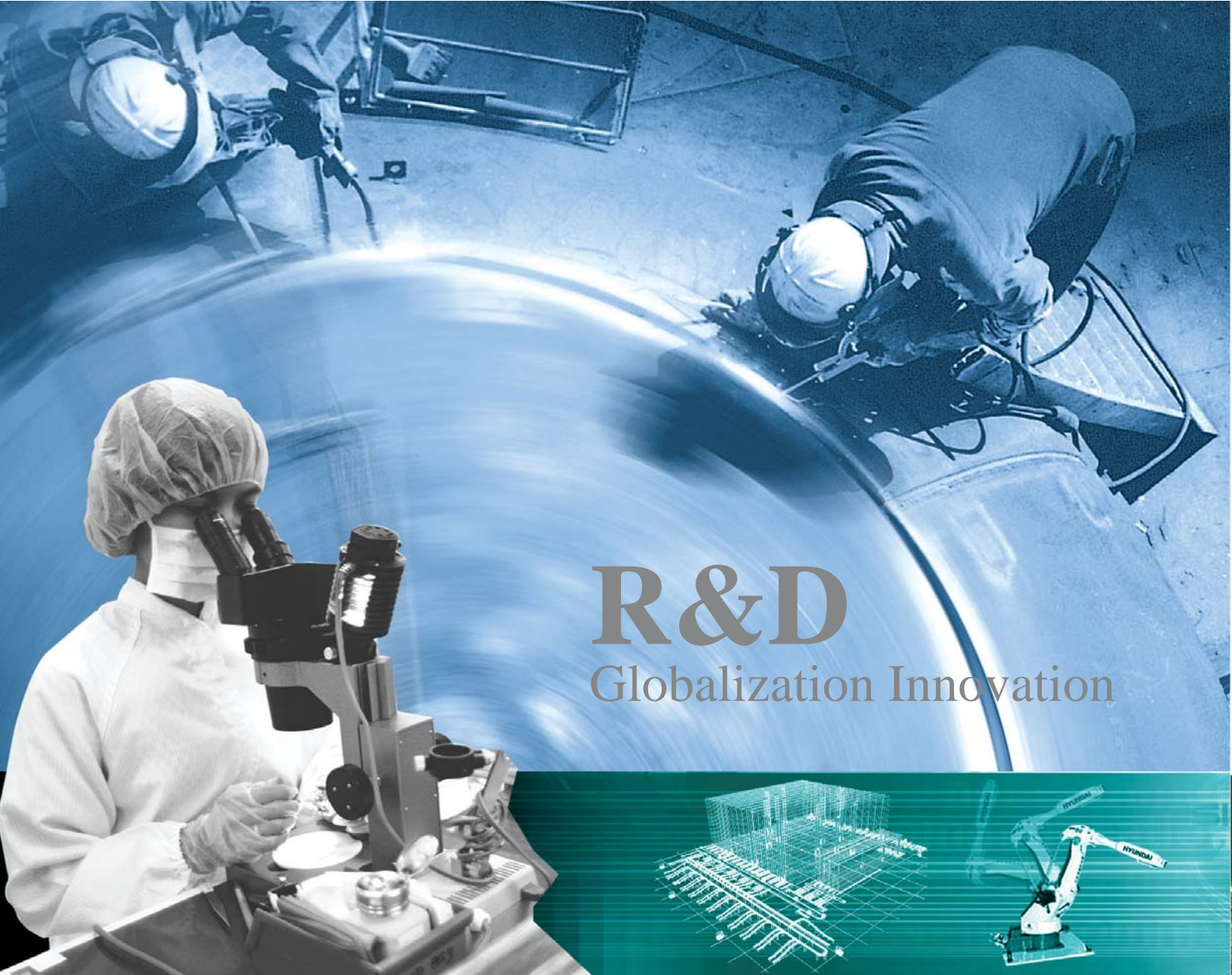
- Ingot / Wafer
- Solar Cell
- Solar Module
- Solar System

Wind Energy:

- Wind Turbine Generator
- Turnkey EPC

Electric Vehicle:

- Electric Motor
- Control Unit
- Management System
- Fuel Cell Stack Voltage Monitoring System



R&D

Globalization Innovation

Research & Development

Research & Development is an essential requirement for the improvement and advancement of modern technology.

HHI's commitment to research and development has been a motivating factor in the company's various technical achievements and will be vital to its continued success in the 21st century.

HHI operates three renowned in-house research institutes: HMRI (Hyundai Maritime Research Institute), HIRI (Hyundai Industrial Research Institute), and HEMRI (Hyundai Electro-Mechanical Research Institute), as well as two overseas institutes in Budapest, Hungary and California, USA.

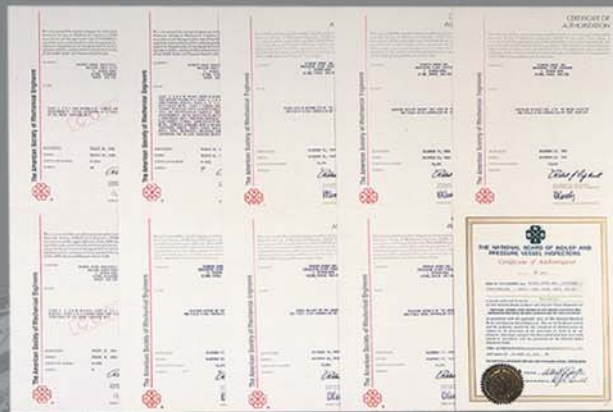
These institutes are fully equipped with state-of-the-art R&D devices, used by HHI's top brains to explore the future of high technology.

TDI (Techno Design Institute)

TDI was established in October 2000 and plays a main role in coordinating design development. It supports optimal design technologies by supplying new designs for various products and constructions. The institute is divided into two departments: Visual Communication Design and Product Design Department.

While the Visual Communication Design Department is creating and refining colors, web based design, and corporate or brand identities, the Product Design Department develops and defines products identities. TDI resolves problems quickly and improves design processes. It also contributes to the creation of a new culture of enterprise and works to actualize high value business by obtaining its own design technologies.







Quality Assurance

HHI's policy is to actively meet all contract specifications and regulations, in addition to satisfying the need of every client.

HHI's quality assurance programs are designed, organized and implemented to ensure its strict standards for quality. HHI's Quality Assurance Systems are acknowledged all over the world by scores of national & international design and manufacturing organizations. All of HHI's divisions have received ISO 9001 Quality Management Certification, as well as ISO 14001 Environmental Management System Certification.

Hyundai's well-developed resources for training enable us to continue providing our clients with high-quality, reliable products and better services.

Certificate	Year	Authority	Field
ISO 9001	1990	QMI (Canada) SAQAS (Australia)	All Products
ISO 14001	1997	DNV (Norway)	All Factories
OHSAS 18001 QS 9000 KEPIC	2001 2000 1997	DNV-QA DNV-QA KEA (Korea)	All Factories EV Equipment Atomic Power of EES
CE	1998	TUV (Germany)	Induction Motor Molded Case Circuit Breaker Magnetic Switch & Contactor
CSA	1997	CSA (Canada)	HV & LV Motor
KS	1986	KSA (Korea)	Molded Case Circuit Breaker Residential Panel Board Induction Motor
UL	2001	UL	Vacuum Circuit Breaker Induction Motor Magnetic Switch & Contactor