



# **HYUNDAI** ELECTRO ELECTRIC SYSTEMS



## Nature-Ecology-Environment

Hyundai Heavy Industries' Key Concepts to a Better Future

[www.hyundai-elec.com](http://www.hyundai-elec.com)

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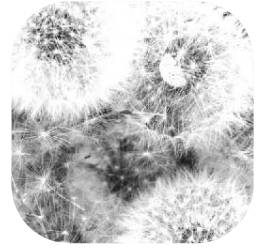
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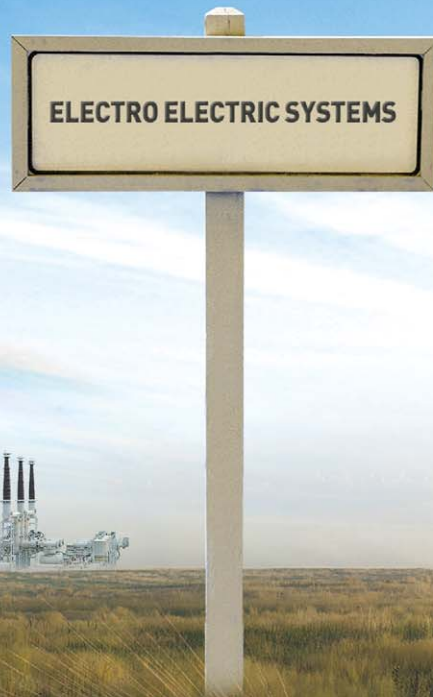
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Welcome to...





# Message from the Chief Operating Officer



**W**e 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, gas Insulated switchgear, switchgear, LV & MV circuit breakers, 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 services, we have established a complete set of quality assurance programs, from marketing to after-sales service, to comply with the requirements of ISO 9001 and ISO 14001.

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

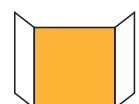
We would greatly appreciate if you review this brochure, and should you need any further information, please feel free to contact us.

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

Sincerely yours,

A handwritten signature in black ink, appearing to read 'Kim, Young-Nam'.

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





## Brief History

### 1970

- 1977 Feb.** Electrical Engineering Division(EED) becomes a new division of Hyundai Heavy Industries Co., Ltd.
  - 1978 Jan.** Switchgear Factory Completed
  - 1978 Nov.** Company Incorporated the name Hyundai Electrical Engineering Co., Ltd. (HEECO)
  - 1978 Dec.** Completed Transformer Factory No. 2 for manufacturing up to 500kV per annum
  - 1979 Aug.** Completed Rotating Machinery Factory
  - 1979 Sep.** Dedicated High Voltage Transformer Test Laboratory
- 

### 1980

- 1982 Dec.** Established Hyundai Industrial Research Institute
  - 1983 Dec.** Completed Circuit Breaker Factory
  - 1984 Dec.** Completed Power Electronics Factory
  - 1986 Jun.** Established Low Voltage Motor Factory "HIMCO" (Joint Venture with General Electric of the U.S.A.)
  - 1989 May.** Completed High Voltage Switchgear Factory
- 

### 1990

- 1994 Jan.** Merged with Hyundai Heavy Industries Co., Ltd.
  - 1996 Nov.** Completed Turbine & Generator Factory
  - 1997 Jul.** Acquired Elprom Trafo Co. in Bulgaria
  - 1998 Oct.** Established Research & Development Company in Hungary named HUNELEC Engineering & Technology Co.
  - 1999 Nov.** Completed 765kV Transformer & 800kV GIS Factory & Test Facility
- 

### 2000

- 2001 Jan.** Changed the name of the division from Industrial & Power Systems to Electro Electric Systems (EES)
- 2001 Jun.** Developed 800kV Gas Insulated Switchgear
- 2003 Jun.** Established Research & Development Institute for EV Equipment and Distributed Generating System (Joint Venture with ENOVA, U.S.A.)
- 2003 Oct.** Incorporated Jiangsu-Hyundai Electrical Company in China
- 2006 Dec.** Expanded 500kV Transformer Factory
- 2007 Apr.** Acquired Ideal Electric Company of the U.S.A. and Incorporated Hyundai Ideal Electric Company
- 2008 May.** Completed Solar Cell / Module Factory
- 2008 Jul.** Expanded 550kV GIS Factory





« Globalization with Technology  
« Globalization with Humanity



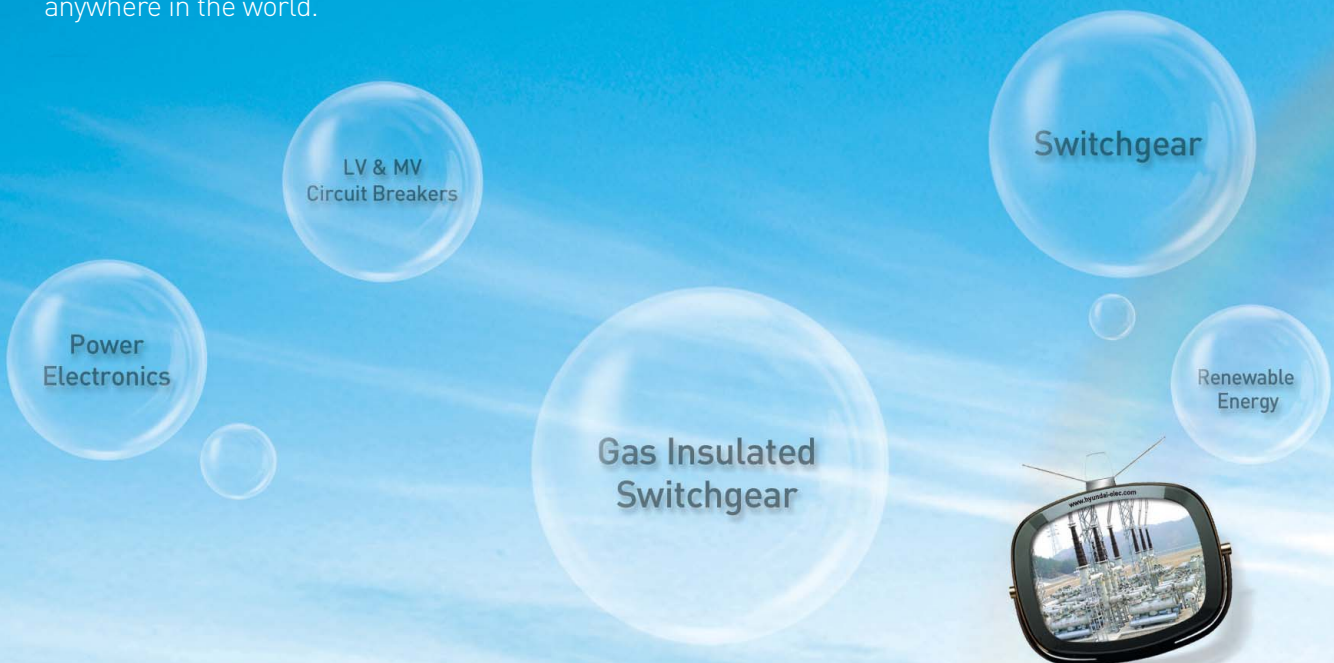


# We build a better future!

Total Solutions for Electrical & Automation Equipment

With a variety of products and proven engineering capabilities in every field of the electrical industry, we are fully prepared to meet the most demanding requirements and to provide turn-key solutions.

Our best quality products and services will satisfy the customers whenever they need our help, anywhere in the world.



## Business Areas

- 10 Transformers | 12 Gas Insulated Switchgear
- 14 Switchgear | 16 LV & MV Circuit Breakers
- 18 Rotating Machineries | 20 Electrical Marine Equipment
- 22 Integrated Control & Monitoring Systems | 24 Power Electronics
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Motors & Generators

Transformers

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# Transformers

01



- A 765kV Power Transformer
- B 500kV Power Transformer
- C 362kV Power Transformer
- D TPRS (Tank Pressure Relief System) Transformer
- E Cast Resin Transformer
- F 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 765kV and a capacity of up to 1,300MVA.



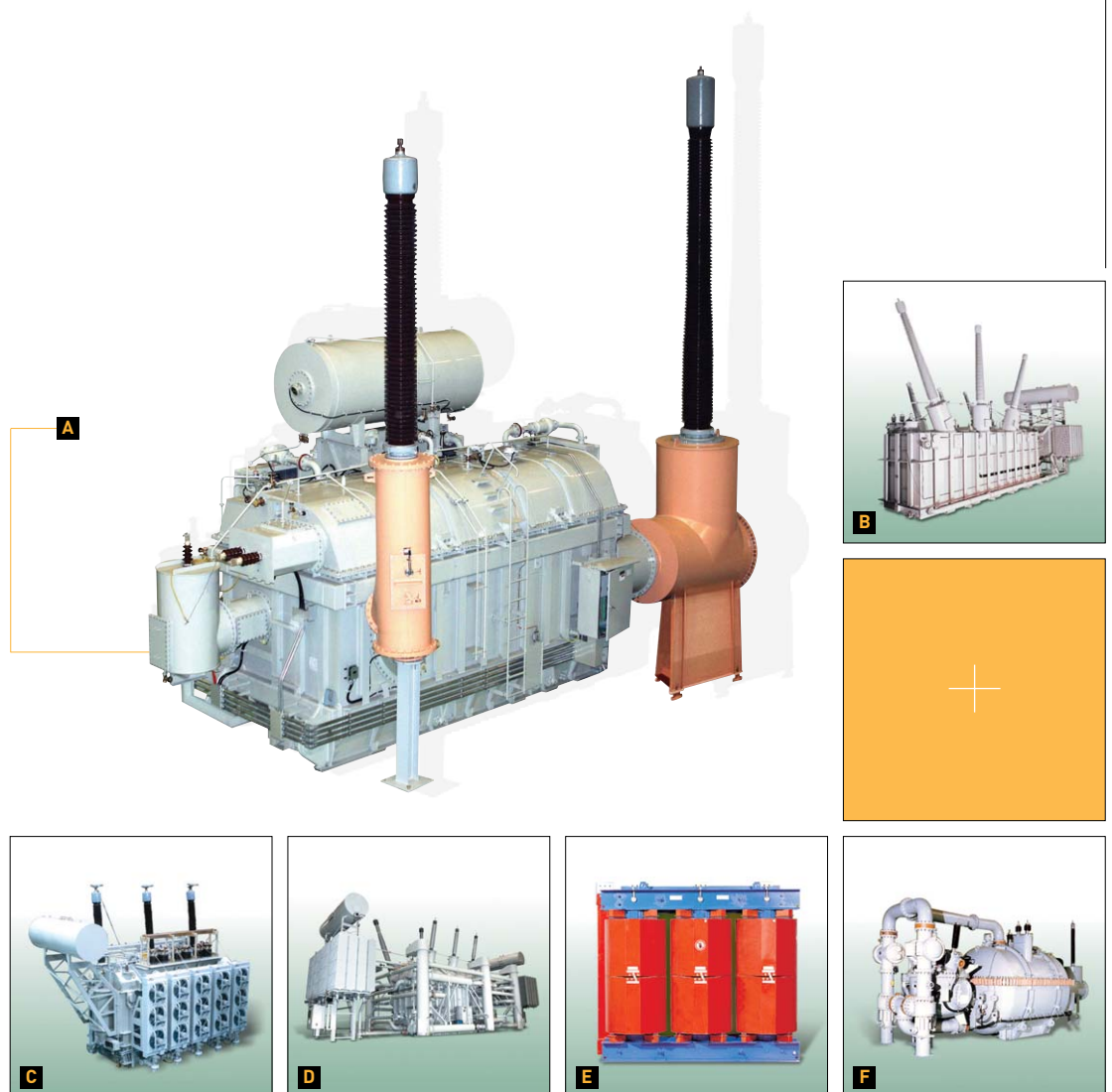
Hyundai transformers are widely used by the customers around the world and can meet various international standards such as IEC, ANSI, NEMA, CSA, AS, ES, etc.

**Prominent Features / Benefits:**

- Suitable for any site conditions and keeping sufficient supply record for end-users worldwide
- Environment friendly product of low loss, low noise and compact design
- High reliability and long service life

**Production Range:**

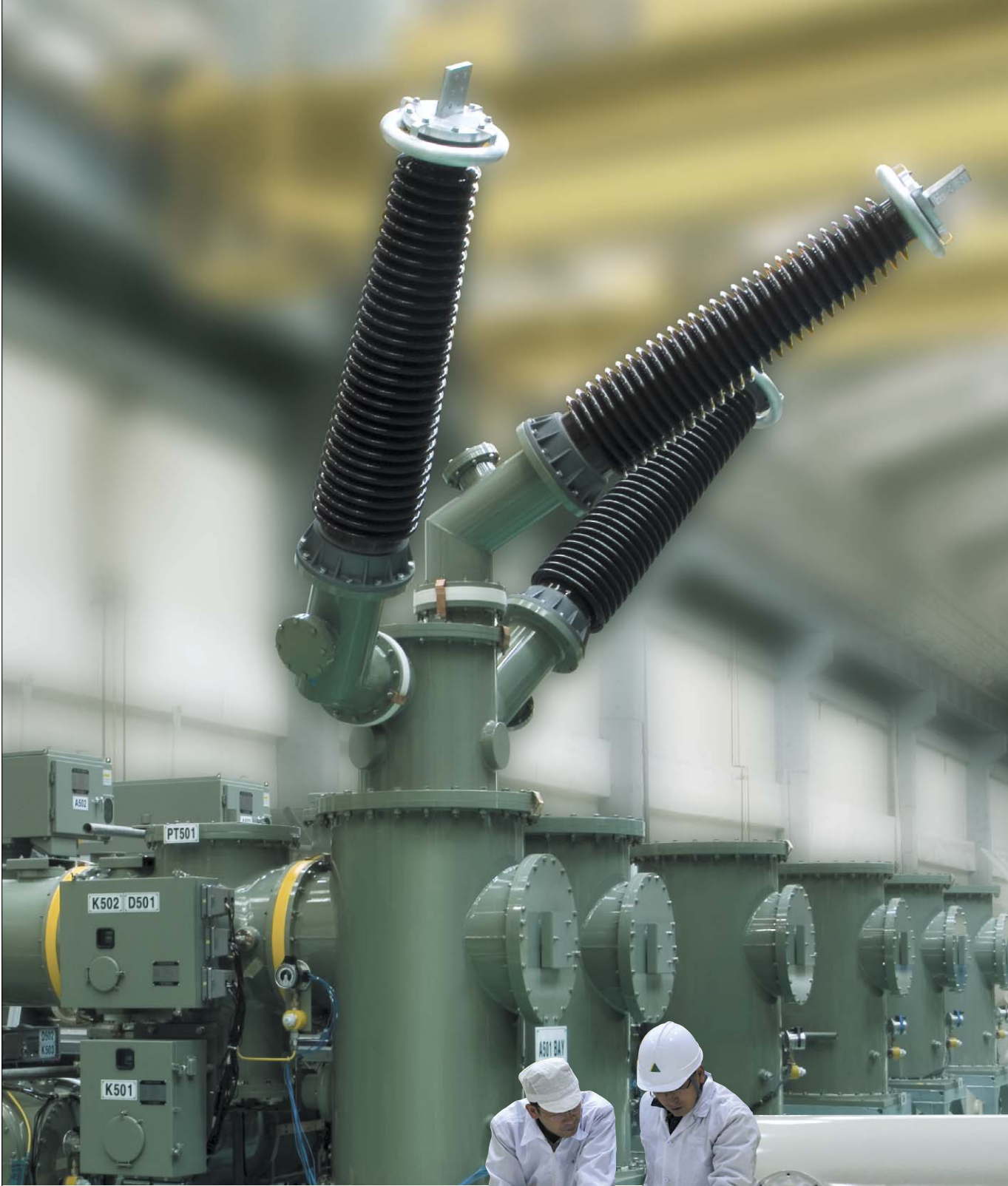
- Power Transformer up to 765kV Class
- Distribution Transformer
- Cast Resin Transformer
- Special Purpose Transformer such as Dry Type Transformer, Shunt Reactor, Gas Insulated Transformer, etc.





# Gas Insulated Switchgear

02



- A 800kV Gas Insulated Switchgear
- B 362kV Gas Insulated Switchgear
- C 245kV Gas Insulated Switchgear
- D 170kV Gas Insulated Switchgear
- E 145kV Gas Insulated Switchgear



The SF<sub>6</sub> Gas Insulated Switchgear (GIS) contains the major equipment used in a substation such as gas circuit breaker, disconnecting switch, earthing switch, voltage transformer, current transformer, lightning arrester, etc. in a grounded metallic enclosure. The switchgear is filled with SF<sub>6</sub> 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.

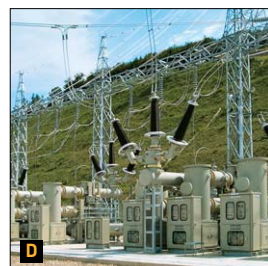
**Prominent Features / Benefits:**

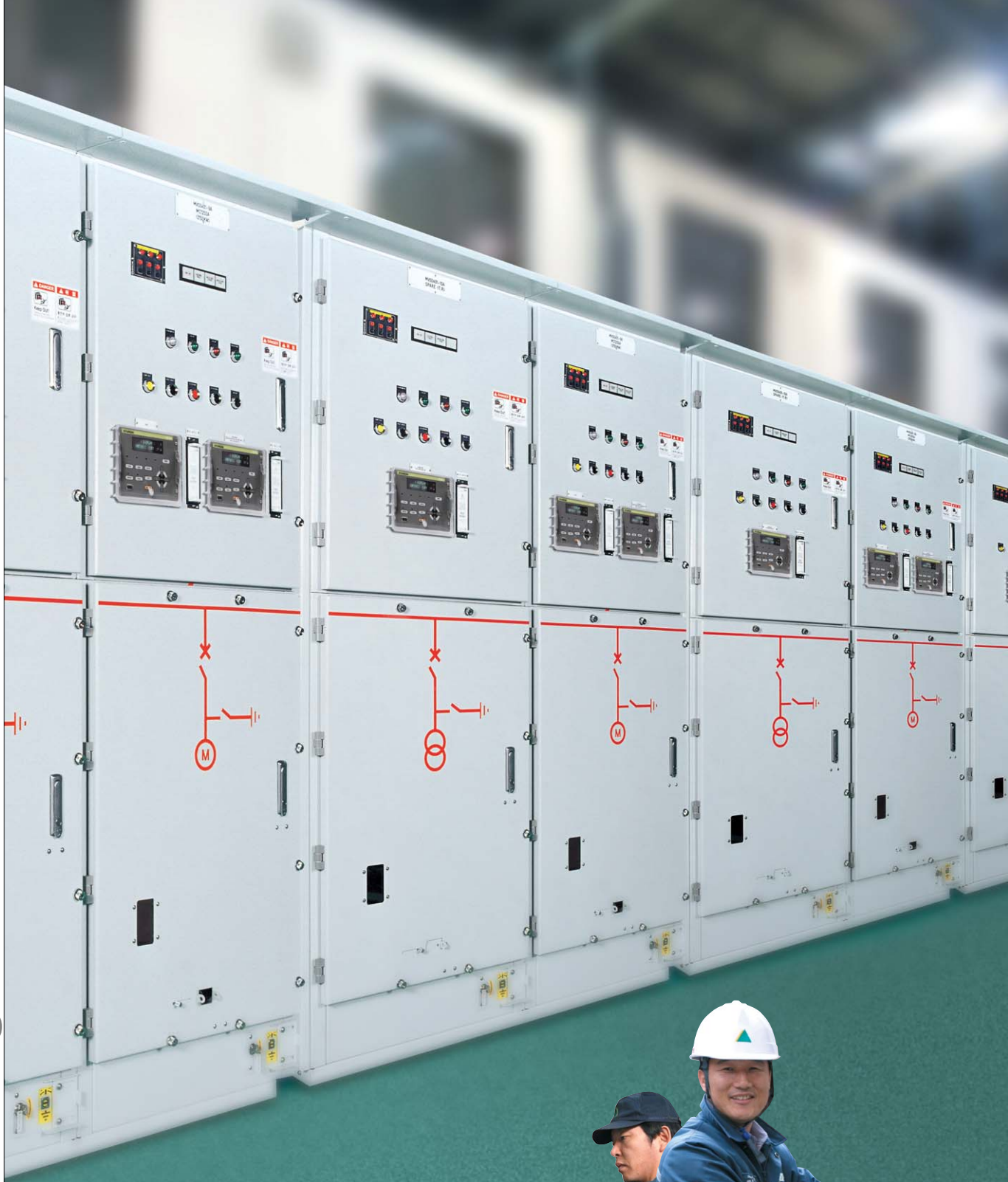
- Space-saving benefits
- Easy installation
- Simple maintenance
- Full protection against contact with live parts
- Protection against pollution
- Visual harmony with surroundings

**Production Range:**

**SF<sub>6</sub> Gas Insulated Switchgear (GIS)**

- Rated voltage: 24kV, 72.5kV, 145kV, 170kV, 245kV, 362kV, 420kV, 550kV, 800kV
- Rated short-circuit breaking current: 20~63kA





# Switchgear

03

- A** Cubicle-type Gas Insulated Switchgear
- B** Motor Control Center
- C** Hyundai Intelligent Measuring and Protection Device (HiMAP)
- D** Ring Main Unit
- E** Intelligent Preventive Diagnostic System for Transformer



Hyundai switchgear offers 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.

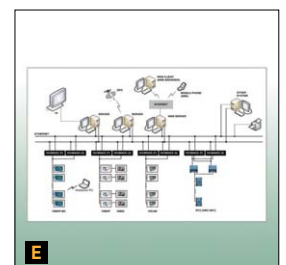
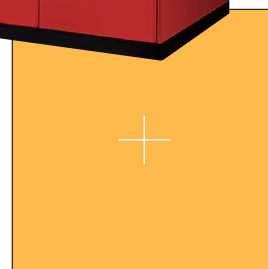
**Prominent Features / Benefits:**

- 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 a layout.
- Qualified for all aspects of applications, including for nuclear power plants



**Production Range:**

- Air Insulated Medium Voltage Metal-clad Switchgear up to 38kV
- Cubicle-type Gas Insulated Switchgear up to 40.5kV
- Low Voltage Switchgear & Motor Control Center
- Non-segregated Phase Bus & Bus Way
- Intelligent Measuring & Protection System
- Intelligent Power Management System
- Intelligent Preventive Diagnostic System for Transformer
- Current Transformer & Potential Transformer







# LV & MV Circuit Breakers

04



- A Vacuum Circuit Breaker
- B Air Circuit Breaker
- C Molded Case Circuit Breaker
- D Magnetic Contactor
- E Digital Motor Protection Relay



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

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

### Prominent Features / Benefits:

- HVF type VCB is adequately designed to meet the dimensional requirements of compact switchgear.
- Hi-series ACB has a digital type built-in APR which enables direct communication with SCADA system.
- Hi-series MCCB provides easy-to-use features while offering versatility and high performance to meet the requirements for easy maintenance.
- Hi-series Magnetic Contactor adopts a DC-controlled coil to reduce noise during operation and has a drawable cassette for easy maintenance.
- Digital motor protection relay accurately protects the circuit using MCU (Micro Control Unit).

### Production Range:

- Vacuum Circuit Breaker (VCB) up to 36kV, up to 50kA, up to 4,000A
- Vacuum Contactor (VC) up to 12kV 400A
- Air Circuit Breaker (ACB) up to 6,300A, up to 130kA
- Molded Case Circuit Breaker (MCCB) up to 1,600A, up to 150kA
- Magnetic Contactor (MC) up to 800A
- Digital & Thermal Type Overload Relay up to 800A
- Miniature Circuit Breaker (MCB) up to 10kA, 125A





# Rotating Machineries

05



- A Medium & High Voltage Motor
- B Low Voltage Motor
- C Synchronous Generator
- D Wind Turbine Generator
- E Co-generation System



Hyundai supplies high quality rotating machines attested by international rules and authorities such as IEC, NEMA, CSA, IEEE, KS, JEC, PTB and KOSHA for industrial applications and LR, ABS, DNV and KR for marine use.

We have a rich performance record of providing our latest technology for motor & generator in the fields of power, desalination, chemical, oil & gas industry as well as ocean-going vessels.

**Prominent Features / Benefits:**

- Low vibration and noise by precise rotor dynamic balancing and electromagnetic noise analysis
- Robust frames to satisfy various load conditions by FEM and vibration test
- Optimized Insulation System to guarantee durability against severe environmental conditions
- Customized engineering to customers' various specifications

**Production Range:**

- Medium & High Voltage Induction Motor up to 25,000HP 14kV
- Standard Low Voltage Induction Motor up to 1,000HP
- Premium Efficiency Low Voltage Motor from 1HP to 250HP
- Synchronous Generator up to 50,000kVA 14kV
- Wind Turbine Generator
- Co-generation System







# Electrical Marine Equipment

06



- A High Voltage Switchboard
- B Bridge Console
- C L2 Compressor Motor
- D Advanced Control & Integration System (ACONIS)
- E Water Cooling Generator



Hyundai 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 economics, 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.

### 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 offer the operator full integration of all control & automation functions in combination with several systems, such as integrated bridge system, CCTV, Internet and ship's computer systems.

### Control Console

Both conventional and microprocessor-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.







## SCADA System

To provide a truly open SCADA platform to make an 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.

### Features and Design Criteria of SCADA :

- Fully redundant data highway
- Distributed processing architecture
- X-Window or Windows based HMI
- Open System Network
- Support of multiple major R.T.U. protocols (Modbus, DNP V3.0, IEC60870-5)
- 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

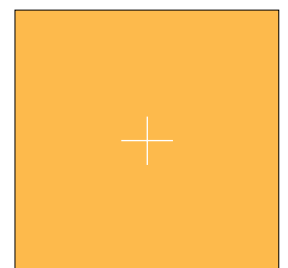
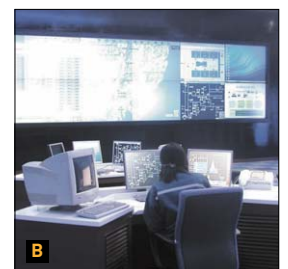
## DCS

Hyundai's HiMAX-2000 DCS is comprised of a full range of state-of-the-art distributed control systems for applications of CCPP, 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) and configuration tools. HiMAX-2000 DCS can be ported on multiple hardware platforms and operating systems to suit customers' specific requirements.

### Features and Design Criteria of HiMAX-2000 :

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







# Power Electronics

08



- A** Medium Voltage Inverter Panel
- B** N50 Inverter
- C** N100 Inverter
- D** N700 Inverter
- E** Power Supply (Converter/Inverter)
- F** Traction Transformer



## Quiet, powerful, and intelligent...

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

## Inverter

### Prominent Features / Benefits:

- Precise operation using sensorless vector control
- Quick response through a built-in DSP
- AVR function to ensure high starting torque
- Auto-tuning function for easier commissioning

### Production Range:

- 220V & 440V Class: 0.4~380kW
- 3.3kV, 4.16kV & 6.6kV Class: 155~5,000kW

## Rolling Stock Propulsion System

### Prominent Features / Benefits:

#### Traction power supply / Auxiliary power supply

- Fully integrated digital circuit using 32bit DSP
- Advanced algorithm adoption
- Self-diagnosis on operation
- More convenient man-machine communications
- Heat pipe cooling method

#### Traction Transformer

- Compact & light-weight
- High temperature insulation system
- Vibration-proof / Impact-proof
- High efficient cooling design

#### Train control & supervisory control system

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





# Turnkey Substations

09



- A 800kV Gas Insulated Switchgear
- B HiMAX-2000 DCS
- C 500kV Power Transformer
- D Solar Power System
- E Medium Voltage Metal-clad Switchgear

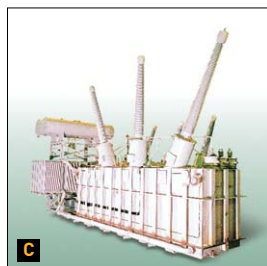
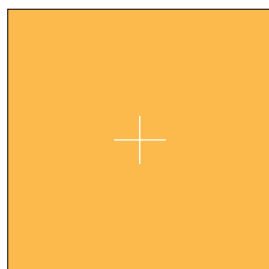
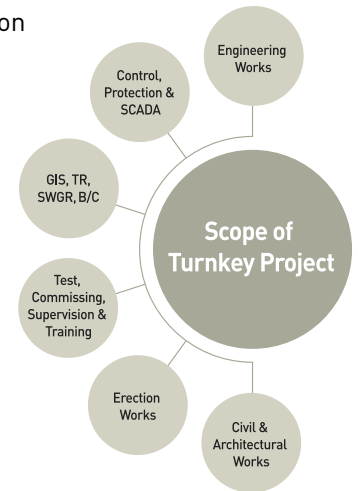


**D**rawing on three decades of successful performance in the areas of engineering and manufacturing a variety of electrical equipments, Hyundai provides turnkey substations as well as AC system solutions.

Our scope of supply covers project development, manufacturing and erection of substations on turnkey basis, 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.







# Solar Power Systems

10



- A** Solar Inverter (250kW)
- B** Power Plant (Spain)
- C** Power Plant (Spain)
- D** Power Plant (Korea)
- E** Roof-Top (Italy)
- F** Solar Inverter (12.5kW, 100kW)



**T**oday, 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 energy will take a major position in this field and is now rapidly growing in the global market. Hyundai will contribute to further development of photovoltaic technology and the growth of the market.

### Solar Module

- High efficiency
- High quality : IEC61215 and IEC61730 certified / ISO9001:2000 and ISO14001:2004 certified
- Fast and inexpensive mounting
- Wide application area
- Multi and mono-crystalline module from 182W to 212W

### Solar Inverter

- Compact design, lightweight, and easy to install
- Maximum efficiency with high performance MPPT control
- Increased flexibility due to a wide range of MPPT tracking
- Remote and local data monitoring
- LCD display of operating status
- Over-/Under-Voltage and frequency protection
- Solar inverter from 3kW to 250kW







# Wind Turbine Systems

11



- HQ1650
- A HQ2000
- B HQ2500
- C



**F**rom designing to operation and maintenance, Hyundai Heavy Industries provides overall solutions for wind.

We meet today's increasing demands for renewable energy through cost effective and reliable products.

**Prominent Features / Benefits:**

- A wide range of product design to best suit various site conditions
- Rugged and simple design reduces operation and maintenance costs
- Variable pitch system, lightning protection system, and our own exclusive safety lock system protect against system failure
- Noise decoupling minimizes noise
- Unique design of nacelle allows easy and safe maintenance



**Production Range:**

**HQ1650**

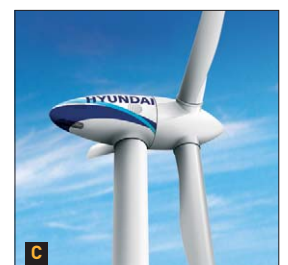
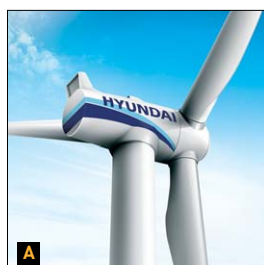
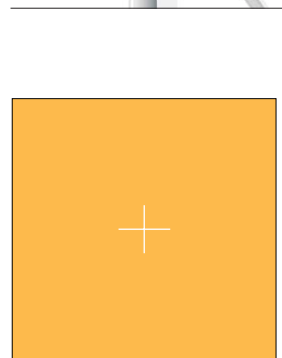
- Rated Power : 1,650kW
- Doubly Fed Induction Generator

**HQ2000**

- Rated Power : 2,000kW
- Doubly Fed Induction Generator

**HQ2500**

- Rated Power : 2,500kW
- Permanent Magnet Synchronous Generator







## Research & Development



Hyundai'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.

Hyundai 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, U.S.A.

These institutes are fully equipped with state-of-the-art R & D devices, used by specialist 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 Visual Communication Design Department is creating and refining colors, web based design and corporate or brand identities, and 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

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

Hyundai's quality assurance programs are designed, organized and implemented to ensure its strict standards for quality. All of Hyundai'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 Products
OHSAS 18001	2001	DNV-QA	All Products
KEPIC	1997	KEA (Korea)	Products for Nuclear Power Plant
CE Marking	1998 2006	TÜV (Germany) TÜV (Germany)	Induction Motor Solar Module
CSA	1997	CSA (Canada)	LV & HV Motor
KS	1986	KSA (Korea)	Molded Case Circuit Breaker Air Circuit Breaker Residential Panel Board Induction Motor
UL	2001	UL	Induction Motor Magnetic Contactor
KERI	2002	KERI(Korea)	Vacuum Circuit Breaker Air Circuit Breaker Magnetic Contactor
KEMA	2007	KEMA(Netherlands)	Molded Case Circuit Breaker Miniature Circuit Breaker
IEC 61215(Ed.2)	2007	TÜV(Germany)	Solar Module
IEC 61730	2008	TÜV(Germany)	Solar Module
ATEX	2008	Baseefa(England)	Ex nA II T3 or T4 (Totally Enclosed Type Motors)
CE & UL	2009	UL(Korea)	Inverter

