

# A Global Leader of Green Power Electronics

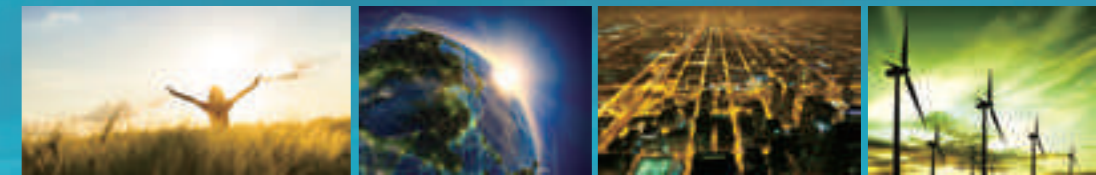


A Global Leader of Green Power Electronics

**DAWONSYS**

Dawonsys is leading a new paradigm of rolling stock and power electronics industry Based on creativity and technology.

On the basis of basic science, the cutting-edge technology of Dawonsys spreads out in industries and life for the better future.



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## "A Global Leader of Green Power Electronics"

With 'Family-Friendly Management', 'Knowledge Management' and 'Future Management', we aim for 'the Best of the Best'.



With 'Family-Friendly Management', 'Knowledge Management' and 'Future Management', we aim for 'the Best of the Best'.

The customers, employees and shareholders of Dawonsys are growing and developing together as a family, and the company is doing family-friendly management that increases the value-added.

Dawonsys is up for advance knowledge system through passionate investment in training and education, 'Knowledge Management' to create innovative products to stay one step ahead of customer needs through creative thinking and enthusiasm.

Always looking into the distant future, longing for a great dream and sympathizing with it, in order to accomplish it, we are doing 'Future Management' to choose 'what we must do in the present' with priority and put it into action with alacrity.

Dawonsys moves forward "World Wide Business" and by the efforts and passion to provide "World Best Product" and "World First Process", it will give it its best shot to grow into the top-notch global company in the near future.

Thank you.



CEO/President Park, Sun Soon Ph.D

### [ CEO Profile ]

Hanyang Univ. / Electric Engineering  
KAIST / Master  
KAIST / Ph.D  
Univ. of Wisconsin / Post Doc.



“Heading to the Future with bright hopes and dreams for tomorrow through endless innovation and creativity!”

- Company** Dawonsys Co., Ltd.
- Establishment** 09-Jan-96
- CEO/President** Park, Sun Soon Ph.D
- H/Q** 485, Sihwahosu-ro, Danwon-gu, Ansan-si, Gyeonggi-do, Korea
- Web** www.dawonsys.com
- Employees** 439
- Core Business**
  - Rolling Stock
  - Fusion Power Supply
  - Accelerator
  - IT Plasma System
  - Electrostatic Precipitator
  - Induction Heating System
  - Industrial Rectifier

**Foundation  
Establish Business Basis**

- 2002. 06. Started Induction Heating System Business
- 2002. 01. Participated in Development of KSTAR Superconducting P/S
- 2002. 01. New Intellectual Company (SMBA)
- 2001. 01. Participated in Development of NBI P/S
- 1999. 05. Promising Power Venture Company (KEPCO)
- 1998. 03. Started Nuclear Fusion Business (KSTAR High Voltage P/S)
- 1996. 01. Dawonsys Establishment

**Expansion & Growth  
Construct Future Growth of  
Business Basis**

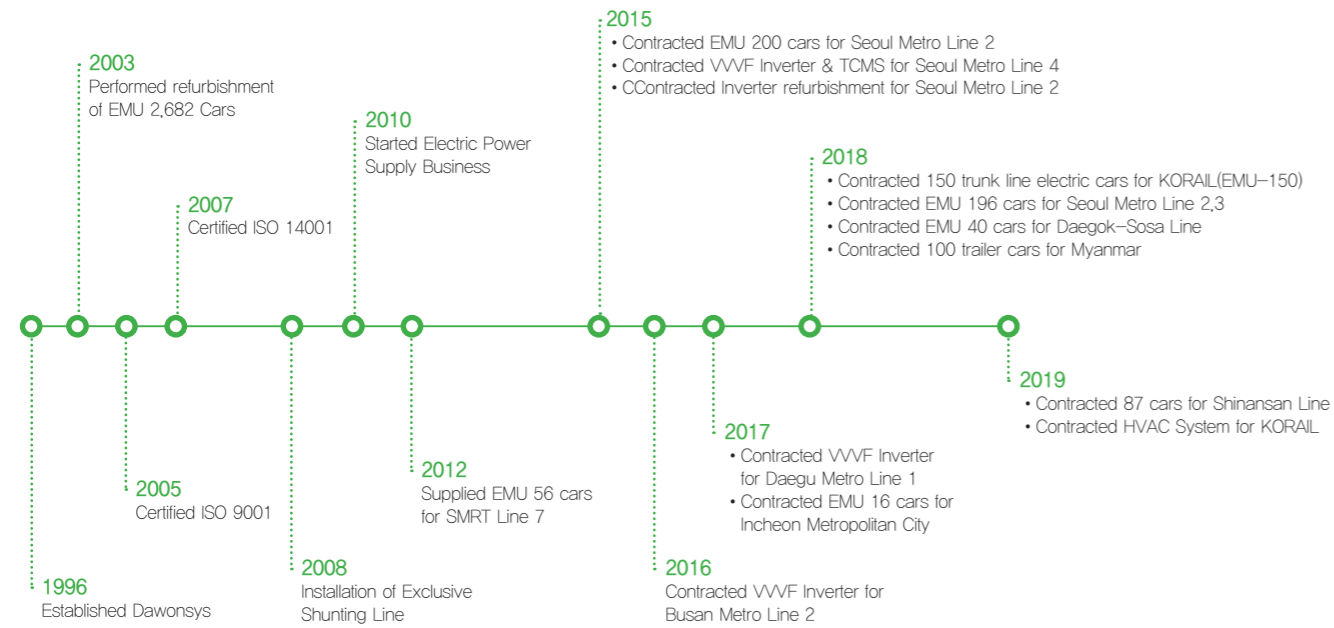
- 2009. 10. Participated in PLS-II MPS Development
- 2009. 06. Excellent R&D Center (MIKE)
- 2009. 06. Power Supply for Polysilicon Production
- 2009. 05. Power Supply for KSTAR NBI1-A
- 2008. 06. Promising Export Company (SMBA)
- 2007. 06. Copper Refining Rectifier to LS-NIKKO
- 2007. 05. Participated P/S Development for KSTAR LHCD / ECCD
- 2006. 12. Innovative Business Company (SMBA)
- 2004. 01. Power Supply for KSTAR TF/PF
- 2004. 01. Induction Heating System to POSCO
- 2003. 04. Material and Parts Specialize Company (MOTIE)

**Globalization Leap Forward  
As the Leading Company in  
Rolling Stock & Electronics  
Industry**

- 2019. 05. Contracted 87 cars for Shinansan Line
- 2019. 05. Contracted HVAC System for KORAIL
- 2018. 12. Contracted 150 trunk line electric cars for KORAIL(EMU-150)
- 2018. 12. Contracted 100 trailer cars for Myanmar
- 2018. 10. Contracted EMU 196 cars for Seoul Metro Line 2,3
- 2018. 07. Contracted EMU 40 cars for Daegok-Sosa Line
- 2017. 06. Contracted EMU 16 cars for Incheon Metropolitan City
- 2017. 03. Supplier for Daegu Metro Line 1 VVVF Inverter
- 2017. 02. Merger of Dawonsys & Rowin**
- 2016. 05. Supplier for Busan Metro Line 2 VVVF Inverter
- 2015. 05. Supplier for Seoul Metro Line 4 TCMS & VVVF Inverter
- 2015. 03. Supplier for Seoul Metro Line.2 200 Cars**
- 2014. 12. 500 Million Dollars Export Tower Award
- 2014. 05. World Class 300 (SMBA)
- 2014. 01. 2.4 MW Enhanced Huels Type Plasma Torch System to CBNU
- 2013. 07. Supplier for XFEL 200 MW Pulse Modulator
- 2013. 04. KSTAR NBI1-C Power Supply
- 2013. 01. Japan's Medical Accelerator (BNCT) P/S Contract
- 2013. 01. Global Potential Company (SMBA)
- 2012. 10. High Precision MPS for KBSI LEBT
- 2012. 06. High Precision MPS for PAL XFEL
- 2011. 12. Train Propulsion Inverter to Seoul Metropolitan Rapid Transit
- 2011. 11. KSTAR NBI1-B P/S
- 2011. 08. Supplier of P/S for ITER
- 2011. 07. Hidden Star Company 500 (KB)
- 2011. 03. LCD Plasma System to Samsung
- 2011. 03. Global Business Promotion Agreement (POSCO)
- 2010. 10. PLS-II 200 MW Pulse Modulator
- 2010. 09. Listed in the KOSDAQ
- 2010. 07. Electrochemical Rectifier to LG Chem,
- 2010. 03. Power Supply for KSTAR ECH/CD
- 2010. 01. Started Atmospheric Pressure Plasma System Business

**"A Global Leader of  
Green Power Electronics"**

History



Electric Multiple Unit (EMU)

Supply Record

Item	Client	Project	Quantity
New EMU (256 cars)	Seoul Metro	Line 2	200
	SMRT	Line 7	56
Refurbishment (3,013 cars)	Korail	T → TC Car	14
	Seoul Metro	MC,T,M Car	272
	Malaysia	MC,T,M Car	45
	Others	Interior Refurbishment	2,682
TEC (Trunk line electric car)	KORAIL	EMU-150	150
EMU	Seoul Metro	Line 2,3	196
	KRNA (Korea Rail Network Authority)	Daegok~Sosa	40
	Incheon Metropolitan	Line 7	16
	Seoul Metro	Line 2	200
	Seoul Metro	Line 7	56
Wagon	KORAIL	Gondola	197
	KORAIL	Container	53
	Private enterprise	Interior refurbishment	11
EMU Refurbishment	KORAIL	T TC Car	14
	Seoul Metro	MC, T, M car	272
	Malaysia KTMB	MC, T, M car	45
	KORAIL etc.	System Refurbishment	2,682
Locomotives	ANC	Diesel	55
Coach	Myanmar	Passenger Coach	100

EMU 200 cars for Seoul Metro Line2



Characteristics of Line 2 EMU

- Safe, High-performance vehicle by application of Railway Safety Law for the 1st time
- Reduction of operating cost by modularization/ light weight/miniaturization of aluminum
- Implement SMART train with IT technology
- Eco-friendly vehicle which made of recyclable aluminum body



Car Type/Specification

Trainset	10 cars/trainset (TC-M1-M2-T1-M2-T2-T1-M1-M2-TC)	
Type of Electricity	DC 1,500V	
Catenary	Ground: Catenary	Underground: rigid trolley bar system
Design Speed	100km/h	
Operating Speed	80km/h	
Speed Control	VVVF Inverter with Regenerative Brake	
Passenger Capacity	TC	145 (Seat 39, Standee 106/Wheelchair)
	M1,M2,T2	160 (Seat 48, Standee 112)
	T1	160 (Seat 45, Standee 115)





EMU 56 cars for Seoul Metro Line 7



Car Type/Specification

Transit	8cars/trainset (TC-M1-M2-T1-T2-M1-M2-TC)
Type of Electricity	DC 1,500V
Catenary	Ground : Catenary Underground : Rigid trolley bar system
Design Speed	100km/h
Operating Speed	80km/h
Speed Control	VVVF Inverter with regenerative brake
Passenger Capacity	1,256 (Seat 362, Standee 894)
Door Type	Electric Type
Signal Type	ATC/ATO

EMU 16 cars for Incheon Metropolitan



Car Type/Specification

Transit	8cars/train set (TC1-M1-M2-T1-T2-M1-M2-TC)
Type of Electricity	DC 1,500V
Catenary	Ground : Catenary Underground : Rigid trolley bar system
Design Speed	100km/h
Operating Speed	80km/h
Speed Control	VVVF Inverter with regenerative brake
Passenger Capacity	1,256(Seat 420, Standee 836)/trainset
Door Type	Electric Type
Signal Type	ATC-ATO

150 trunk line electric cars for KORAIL(EMU-150)



Car Type/Specification

Transit	4cars/trainset (Tc-M'-M-Tc) 8cars/trainset (Tc-M'-M-T-M'-Tc)
Type of Electricity	AC 25,000V
Catenary	Catenary
Design Speed	165km/h
Operating Speed	150km/h
Speed Control	VVVF inverter control
Passenger Capacity	4cars: 264/trainset, 6cars: 392/trainset
Door Type	Electric type
Signal Type	ATP/ATS

EMU 40 cars for Daegok-Sosa Line



Car Type/Specification

Transit	4cars/train set (TC-M'-M'-TC)
Type of Electricity	AC 25kV
Catenary	Ground : Catenary Underground : Rigid trolley bar system
Design Speed	120km/h
Operating Speed	110km/h
Speed Control	VVVF Inverter with regenerative brake
Passenger Capacity	616(Seat 198, Standee 418)/trainset
Door Type	Electric Type
Signal Type	ATP-ATS

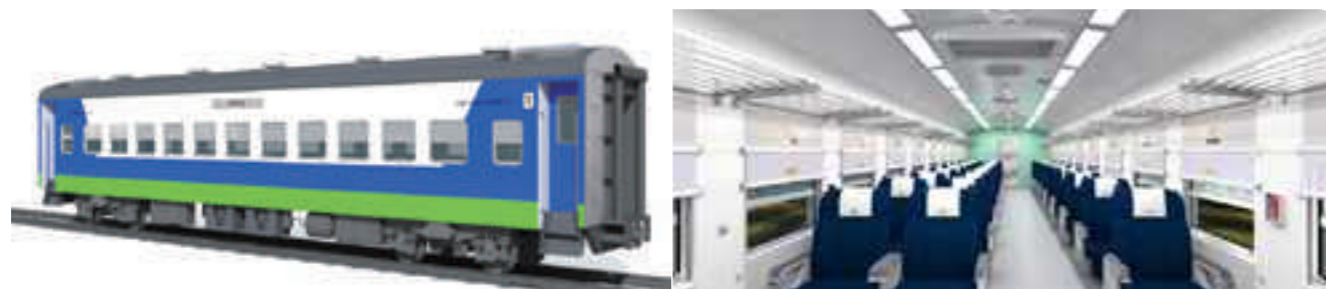
EMU 196 cars for Seoul Metro Line 2,3



Car Type/Specification

Transit	Line 2 : 6cars/train set (TC1-M1-M2-T1-M2-TC2) Line 3 : 10cars/trainset (TC1-M1-M2-T1-M2-T2-T1-M1-M2-TC2)
Type of Electricity	DC 1,500V
Catenary	Ground : Catenary Underground : Rigid trolley bar system
Design Speed	120km/h
Operating Speed	100km/h
Speed Control	VVVF Inverter with regenerative brake
Passenger Capacity	Line2 : 930(Seat 267, Standee 663)/trainset Line3 : 1,570(Seat 456, Standee 1,114)/trainset
Door Type	Electric Type
Signal Type	Line 2: ATP-ATO Line 3: ATC

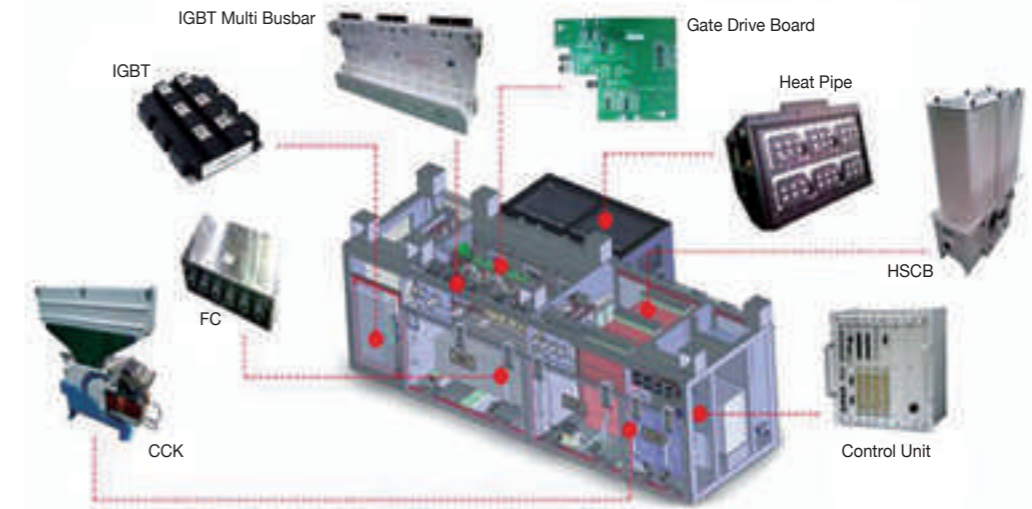
100 trailer cars for Myanmar



Car Type/Specification

Transit	Upper class 40-cars, ordinary coach 60-cars
Power	Diesel locomotives
Max Design speed	100km/h
Seats	Upper class : 33, Ordinary : 66
Door type	Hinge type
Carbody	Mild steel
Brake Syetem	Pneumatic
Bogie	Welded bogie
Coupler	AAR-H type

Propulsion Control Unit (VVVF INVERTER)



VVVF Inverter?

An inverter which is capable of outputting AC voltage of variable voltage and variable frequency in the DC section

Characteristic

- High precision control by implement of high performance microprocessor
- Easy to check problems by self-diagnosis of controller
- Easy to maintenance by program installation on commercial computer by applying LAN communication
- Improves stability and maintenance convenience by modularization of functions

Specification

Items	Specification
Inverter system	2 Level 3-phase Voltage PWM INVERTER
Main element	3.3kV/1,200 A Modular IGBT
Overvoltage control element	3.3kV/1,200 A Modular IGBT
Cooling system	Natural cooling in application of heat pipe
Input voltage specifications	Continuous Rating DC 1,500V
	Maximum DC 1,800V
Output Specifications	Minimum DC 900V
	3-phase voltage 0V ~ 1,100V (rms)
	Frequency 0 ~ 160Hz
Induction motor rating	Max. capacity 1,640kVA
	210 kW(continuous rating)
	AC 1,100 / 136A
	4 units parallel drive

Static Inverter (SIV)

Product Features

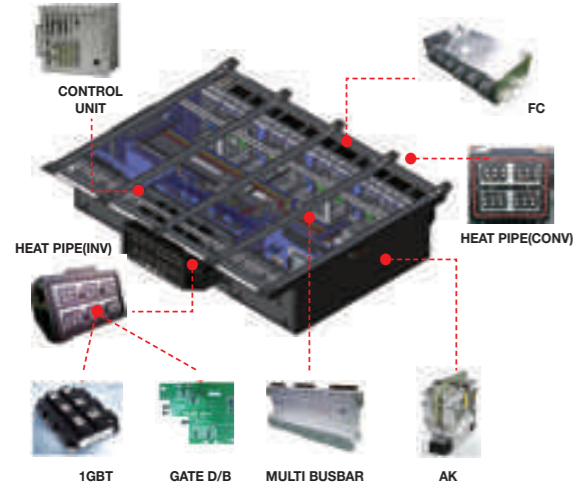
- High-speed precision control in application of high-performance microprocessor
- Easy to view & control the fault parts by self-diagnosis function of controller
- Simple maintenance management by installing program even in the commercial computer in application of LAN communication
- Improved reliability and convenient maintenance as a functional modularity
- Convenient maintenance of cooling system and reduced noise by applying heat pipe



ADV Converter/Inverter (C/I)

C/I?

A device that converts power from catenary line to the power required for a vehicle traction motor.



Specification

Contents		Specification
Mode		Converter / Inverter
Input voltage		AC 25kV(AC 20~27.5 kV), 60Hz DC 1,500V(DC 900 ~ 1,800V)
CONVERTER	output voltage	DC 1,650V
	continuous output	936kW
	maximum output	1,350kW
INVERTER	output voltage	0 ~ 1,100V AC
	continuous output	970kVA
	maximum output	1,520kVA

Train Control and Monitoring System (TCMS)

TCMS?

Integrated train control system that intensively controls and monitors in-vehicle devices by connecting with various controllers of the vehicle



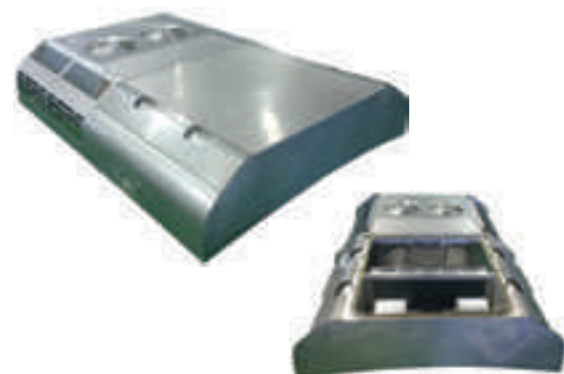
Specification

Contents		Specification
Input voltage		DC 100V (variable range 70 ~ 110V)
Control method		Micro processor control method (above 32bit)
Back plain method		VME Bus method between the control devices
Speed range		high than 0 ~ 120km/h
Trace Data		lately 100times/car
Memory capacity		above 1Gbyte (RAM) above 512k byte (ROM) 64M byte (operating record for Tc car) : more than 720 hours
Detailed Specification	Train Computer	- Dual Core Process(cotex9/1GHz) - Digital Input : 120ch - Digital Output : 32ch
	Car Computer	- Dual Core Process(Cotex9/1GHz) - Digital Input : 60ch - Digital Output : 16ch
	Display Unit	- Display Size : 12.1inch touch panel TFT LCD - RS-422 Communication(ASYNC) - Power Input : DC 110V(70~160)

Heating, Ventilating, and Air Conditioning (HVAC)

HVAC?

Circulates air ventilation, heating, and air conditioning in each car



Specification

Item		Specification
Type		Roof mounted unit
Power	Main	AC 380V 3Ph 60Hz
	Control	DC 100V, DC 24V
Cooling Capacity		23,000kcal/hr
Power Consumption		12.5kW
Total air flow rate		3,300m³/h
Refrigerant Circuit		2 cycles
Protection		Dual(High/Low) Pressure Switch
Weight		Up to 520kg
Temperature Control		Microprocessor Controller
Communication		RS485

KSTAR (Korea Superconducting Tokamak Advanced Research)

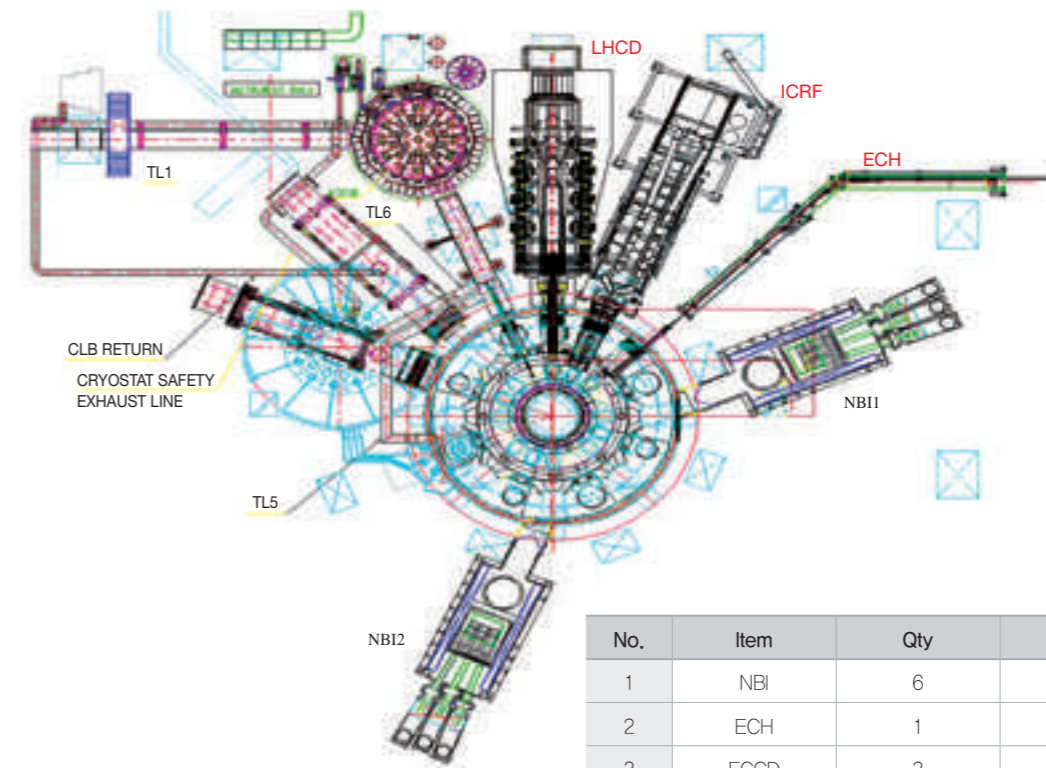
KSTAR, the next-generation superconducting tokamak, is the nuclear fusion device of world highest level developed and built by Korean technology to secure the fundamental technology on nuclear fusion and lead the commercialization of nuclear fusion energy in 21st century. KSTAR had been constructed in September 2007, passed through the comprehensive trial run, succeeded in the first plasma generation and entered the full-fledged operational stage in July 2008. In the future to achieve the each stage's performance goal of the first operation, the second operation, the third operation, and the commercialization stages, the investment to the nuclear fusion power devices and others should be made continuously by stages, and the investment plan is already confirmed. KSTAR will mutually provide the complementary technical data on the fundamental experiments necessary for the construction and operation of ITER (International Thermal-nuclear Experimental Reactor) until its construction is completed and carry out the independent research necessary for the construction of a Korean nuclear fusion experimental reactor.

Dawonsys, the only professional manufacturer of fusion power supply equipment in Korea, will not only continue to supply the nuclear fusion power supply unit based on the experience and confidence which are obtained through the participation in the project from the first stage of nuclear fusion research, but also do its best to ensure that power supplies may demonstrate their best performance.



High voltage pulse type power supply

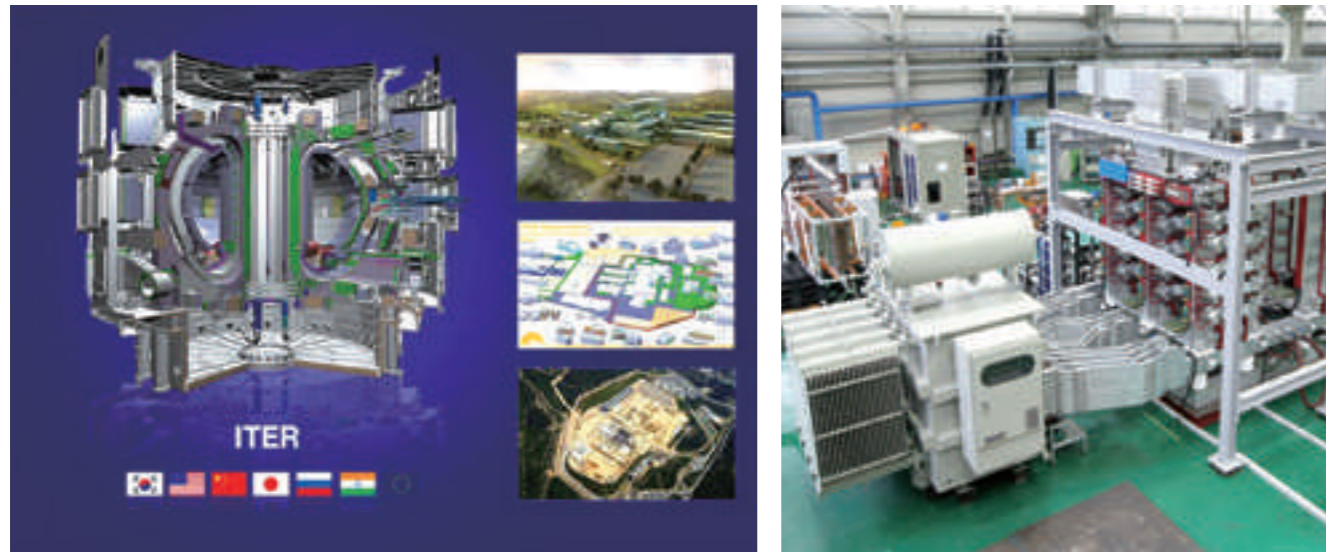
There are various kinds of the device for heating plasma. One of them is NBI (Neutral Beam Injector) using high-energy beam of neutral atoms, and the others are the device using electromagnetic waves such as ECH, ECCD, LHCD and ICRF. High voltage power supply is required for all these devices. High voltage power supply is required.



No.	Item	Qty	Voltage	Current
1	NBI	6	120 kV	70 A
2	ECH	1	-70 kV	30 A
3	ECCD	3	-60 kV	55 A
4	LHCD	3	-70 kV	60 A
5	ICRF	3	25 kV	120 A

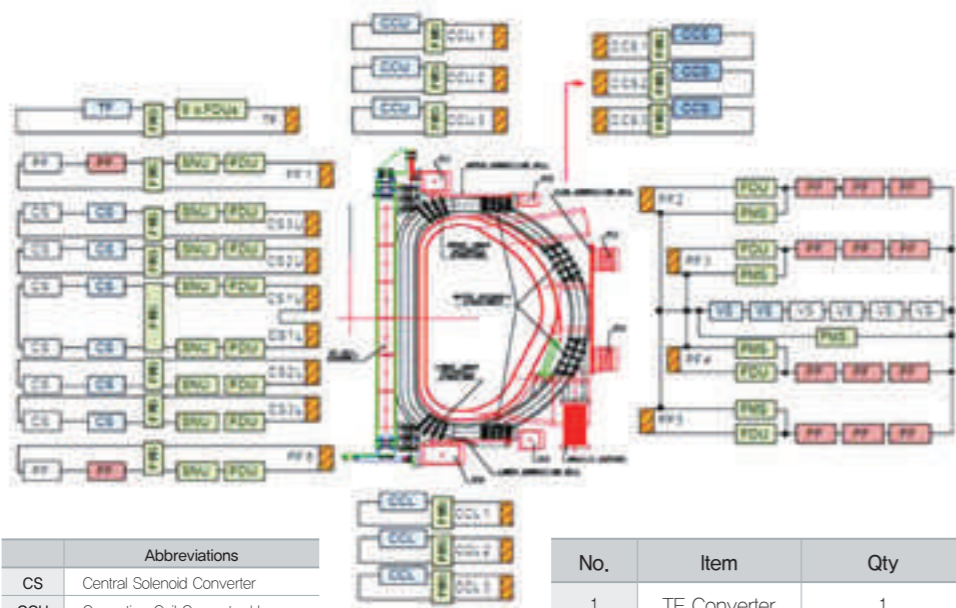
ITER (International Thermal-nuclear Experimental Reactor)

ITER is a future massive clean green energy and an international cooperative development project aiming the final scientific and technical demonstration for the commercialization of nuclear fusion energy. Seven developed countries including EU, US, Russia, India, China, Japan and Korea participates. The ITER is a large-scale project in which total cost of about 20 trillion won over 35 years from construction and operational stages to attenuation and decommission stages. The ITER fusion reactor is the 25 times expansion type of KSTAR, and much of the KSTAR technology will be reflected in it. In Korea The ITER Korea Agency in NFRI (National Fusion Research Institute) was designated as the organization in exclusive charge and conducts the project. Dawonsys concluded the first contract for supplying power supply system and successfully conducts the part of the project.



High current power supply

Basic structure of the nuclear fusion power reactor is consist of the superconducting magnetic coils covering the vacuum vessel in various directions. If the high electric current flows to the coils with a certain direction, then the magnetic field to the corresponding direction is generated. Therefore, to flow the currents to the various coils, the same number of the power supply as the numbers of the coils are needed.



Abbreviations	
CS	Central Solenoid Converter
CCU	Correction Coil Converter Upper
CCS	Correction Coil Converter Side
CCL	Correction Coil Converter Lower
FDU	Fast Discharge Unit
PF	Poloidal Field Converter
PMS	Protective Make Switch
SNU	Switching Network Unit
TF	Toroidal Field Converter
VS	Vertical Stabilization Converter

No.	Item	Qty	Voltage	Current
1	TF Converter	1	±650 V ±160 V	68 kA
2	PF Converter	16	±1,000 V	±25 kA
3	CS Converter	12	±1,050 V	±45 kA
4	VS Converter	6	±1,050 V	±22.5 kA
5	CCU/L Converter	6	±65 V	±10 kA
6	CCS Converter	3	±325 V	±10 kA

A particle accelerator is a system that generates a strong light (in a broad sense) emitted with a certain wavelength of a narrow spread when the particles are accelerated to light speed.



Dawonsys has been supplying magnetic power supply with small and large capacity (uni-polar & bi-polar) for research accelerator, pulse modulator for Klystron power supply for medical accelerator, and CCPS(Capacitor Charging Power System), domestic and foreign customers. Moreover, Dawonsys is accelerating the development of high-end power supply equipment with high performance and high precision according to the progress of the technology.

Magnetic power supply

Magnetic power supply is used for the beam orbit calibration to maintain a stable beam orbit in a storage ring. The output current of the power supply must satisfy the requirements of long time stability, high accuracy of current control, control reproducibility, and high reliability. For the feedback control of beam orbit, short time, long time stability of the output current is very critical.



Pulse modulator

The modulator is divided into two types— line type and hard type — depending on power supplying methods. Recently, a line type modulator applied CCPS is mainly used, and impedance matching is a critical variable because only by matching the PFN and the load the power can be sent with the loss minimized. As the load to be used mainly uses the klystron the stability of the voltage applied to the cathode electrode and the current drawn at that time is important. The frequency applied to the klystron is driven by S-band using 2,856MHZ. The power and load applied to the modulator is insulated by pulse transformer and the system specification is decided by determining the pulse transformer's turn ratio



CCPS

High frequency inverter power supplying constant current is the switching power supply and forms AC voltage of high frequency by the series resonance of inductor and capacitor. The load current is constant, and the charging time varies depending on the capacity of the capacitor. The parallel port can increase the output current capacity and reduces the charging time. High frequency inverter power can be customized for the parallel port by load capacity like 5kJ/s, 10kJ/s, and 30kJ/s and can be used according to the condition of the load.



DAWONSYS

Major Clients List

1. Pohang Accelerator Lab
  - PLS I
  - PLS II
2. KBSI(Korea Basic Science Institute)
3. KEK: High Energy Accelerator Research Organization
4. Russia Joint Institute of Nuclear Research(JINR)



MPS (Magnet Power Supply)

	10 A	20 A	30 A	50 A	70 A	100 A	150 A	200 A	250 A	300 A	400 A	500 A	1 kA
10 V	●	●		●									
20 V	●	●											
50 V			●		●	●	●	●	●	●			
100 V			●			●	●	●	●	●	●	●	
500 V											●	●	●
800 V												●	●

\* Unicolor & Biolar are available

Pulse Modulator[Short-pulse(PFN Type), Long-pulse(Hard-tube)]

Item	Unit	Short Pulse	Long Pulse
Max power	MW	200	2,97
Inverter CCPS average power	kJ/sec	30 * 4set	180 * 5set
Operating frequency	Hz	60	200
Pulse output max voltage	kV	400	90
Pulse output max current	A	500	33
Pulse width	Sec	7.5us	1.02ms
PFN Impedance	Ω	2.66	2.7k
PFN Section	-	28	-
Total Capacitance	μF	1.4	μF
Each Capacitance	nF	50	nF
Total Inductance	uH	10.5	uH
Each Inductance	uH	1.5	-
PFN Stage	-	14 Parallel	-
Pulse Transformer Turn Ratio	-	1:17	-
HV Switch	-	E2V CX1836A(Thyratron)	Semiconductor S/W
Flat-top Width	Sec	4us	1ms
Flatness	%	0.10%	0.10%
Jitter	us	< 5	< 10
Charging time	ms	12	CW

CCPS (Capacitor Charging Power Supply)

Item	Unit	5 kJ	30 kJ	180 kJ
Average output	kJ/s	5	30	-
Max charge output	kJ/s	6.5	37.5	180
Max output voltage	kV	± 50	± 50	± 90
Output current	A	0.2	1.2	2
Power factor	-	0.9	0.9	0.9
Voltage Stability	%	± 0.01	± 0.01	± 0.1
Efficiency at full load	%	> 85	> 85	> 85
Three phase input power	V / Hz	480 / 60	480 / 60	480 / 60
Coolant	LPM	> 8	> 8	> 15
Size	mm	482.5(W) x 324(H) x 500(D)	482.5(W) x 324(H) x 704(D)	700(W) x 2005(H) x 1200(D)
Weight	kg	120	120	350

Atmospheric Pressure Plasma (AP Plasma) Outline and Strength



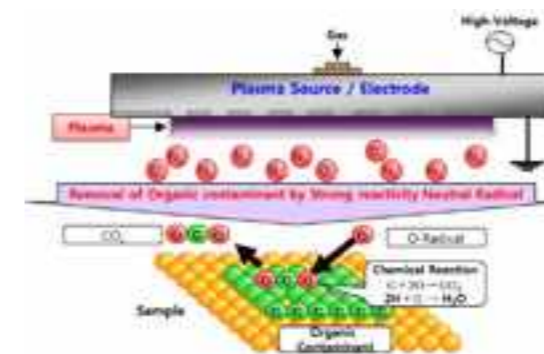
Product Features

- A fourth material, plasma is generated at atmospheric pressure to remove organic contaminants and change surface modification
- No need of vacuum facility → economical, high-speed processing solution
- Wide range of applications, large area, multiple and 3D shape processing

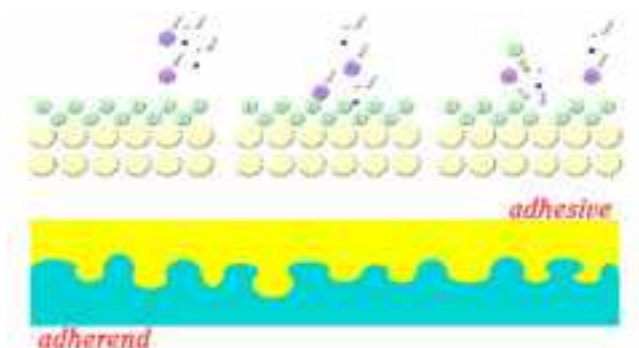
※ AP Plasma : Atmospheric Pressure Plasma

Effects of atmospheric pressure plasma (AP plasma) treatment

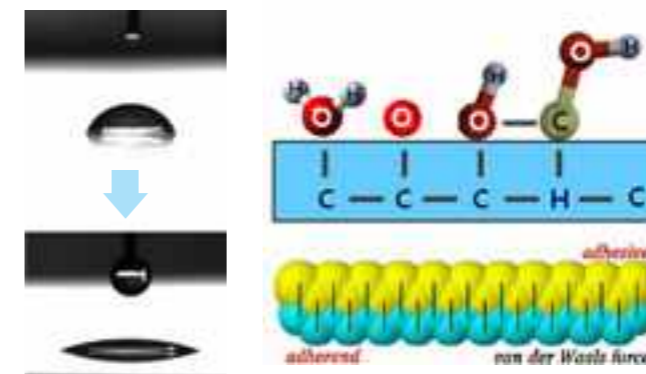
Cleaning of Organic contaminant



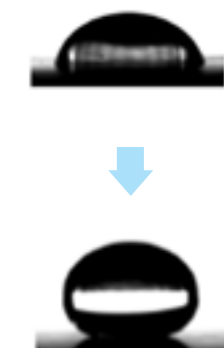
Improvement of surface roughness



Surface hydrophilicity



Surface hydrophobicity



Atmospheric Pressure Plasma (AP Plasma) Applications

FPD field



- LCD, OLED, Module processing
- Surface cleaning & modification of various substrate layers
- Pre-treatment for lamination and Printing
- Removing processing of organic residual film

TSP field



- Cleaning, OCA/OCR, lamination processing
- ACF, AR/AF coating processing
- Treat glass and film without damage

Film field



- Cleaning & modification of organic contaminant on various film surface
- Improvement of adhesion between film or other materials

Secondary /Fuel, Battery field



- Improvement of wettability and coating performance of polymer material
- Formation of hydrophilicity or hydrophobicity and improvement of surface roughness
- Removal of oil on battery surface and enhancement of adhesion

Semiconductor field






- Semiconductor molding processing
- Die attach & wire bonding processing
- Solder ball Attach & mount processing

Other related field



- Solar cell, automobile, household appliances and various manufacturing industries
- Surface treatment for hydrophilicity, hydrophobicity on glucose strips
- Pre-treatment for evaporation, plating, painting of various kinds of materials

Atmospheric Pressure Plasma (AP Plasma) Product Type


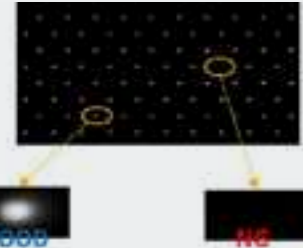
DWD - C,A Series	DWA, H - C Series	DWJ - C Series	DWV - Series
			
<b>DBD Type</b> <ul style="list-style-type: none"> <li>• Available for needed working size (Max. 3,370mm, 10,5G)</li> <li>• Patented electrode (<math>\alpha</math>-electrode) structure ensures uniformity and high performance</li> <li>• Particle free &amp; damage free</li> <li>• World's largest sales record in display industry</li> </ul>	<b>Ar/He Plasma Type</b> <ul style="list-style-type: none"> <li>• Low gas usage &amp; economical maintenance cost</li> <li>• Small installation space &amp; simple Set-up</li> <li>• Particle free</li> <li>• NOx free &amp; Ozone free</li> <li>• Possession of sales record for 8G line</li> </ul>	<b>Jet Type</b> <ul style="list-style-type: none"> <li>• Ability to 3D geometry processing</li> <li>• Ability to selective area of Films &amp; Substrate</li> <li>• Economical cost for introduction of equipment &amp; maintenance</li> <li>• Convenient set-up &amp; maintenance</li> <li>• Applicable to module processing</li> </ul>	<b>Vacuum Plasma Type</b> <ul style="list-style-type: none"> <li>• Low vacuum plasma device</li> <li>• Available for processing 3D object in batch-type</li> <li>• Applicable to new App. processing development (3D object)</li> <li>• Semiconductor/OLED/LED/Automobile/etc.</li> </ul>

Application example of AP Plasma System

- Characteristic**
- System configuration by processing
  - Available to consist of stand-alone or interlocking devices according to customer's need
- Application record**
- Pre-treatment for Encapsulation in OLED industry
  - Pre-treatment for De-smearing, Slit Coater, Bonding in FOPLP industry
  - Pre-treatment for package, R&D, Molding in semiconductor industry
  - Pre-treatment for bonding and coating in battery of mobile phone industry
  - Pre-treatment for OCTA panel bonding in mobile industry
  - Pre-treatment for printing in Image Sensor Filter
  - Pre-treatment for cleaning and coating in film and Secondary battery membrane filec



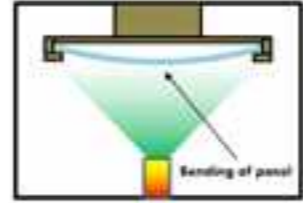
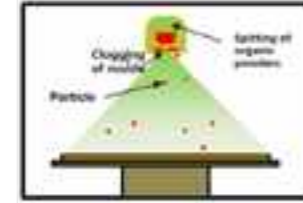

※ Option : Monitoring System of atmospheric pressure plasma

- Vision inspection system of electrode hole state of AP Plasma System
- Prevent defects and automatically maintain process quality
- Hole clogging degree can be distinguished and inspection cycle can be adjusted
- High-speed inspection(1.2 sec based on 8G size) and Alarm and I/O communication function
- Provide Independent operation System(PC + Monitor)
- Imaging and inspection of the whole electrode simultaneously by multi-camera
- Equipped with protection window against falling and settling foreign object
- Patent application of Dawonsys

JIES - OLED evaporation equipment business

Dawonsys's evaporation technology for OLED(JIES)

Upward Deposition	Downward Deposition	JIES Process
		
<b>ISSUES</b> <ul style="list-style-type: none"> <li>✓ Bending due to gravity</li> <li>✓ Misalignment of FMM mask</li> <li>✓ Difficulty of transportation</li> </ul>	<b>ISSUES</b> <ul style="list-style-type: none"> <li>✓ Particle contamination</li> <li>✓ Clogging of nozzle</li> </ul>	<b>JIES Process</b> <ul style="list-style-type: none"> <li>✓ No bending problem</li> <li>✓ Easy to transfer large-sized panel</li> <li>✓ No particle contamination</li> </ul>

Advantages of Dawonsys JIES technology

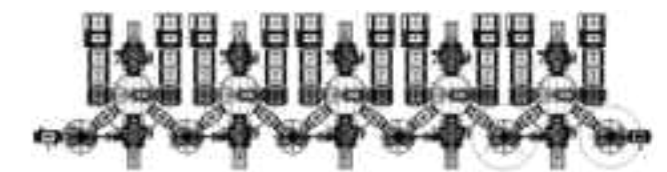
Items	evaporation	solution coating	JIES
existing organic material	○	×	○
Productivity of large size panel	×	○	○
Material usage	×	○	○
Luminance, efficiency, Life time	○	×	○
8th gen glass	×	○	○

Point Source	Point Source	JIES
<b>Advantages</b> <ul style="list-style-type: none"> <li>• Low heat-damaged(Panel in room temp)</li> <li>• FMM applicable</li> </ul>	<b>Advantages</b> <ul style="list-style-type: none"> <li>• Rapid evaporation speed(dozens of Å/s)</li> <li>• Efficiency of material usage is higher than Point source(20~40%)</li> </ul>	<ul style="list-style-type: none"> <li>• Rapid evaporation speed(thousands of Å/s)</li> <li>• No heat-damaged by momentary heating (Panel in room temp)</li> <li>• High efficiency of material usage by short evaporation distance(over 90%)</li> <li>• FMM applicable</li> </ul>
<b>Disadvantages</b> <ul style="list-style-type: none"> <li>• Low evaporation speed(a few Å/s)</li> <li>• Efficiency of material usage is low</li> </ul>	<b>Disadvantages</b> <ul style="list-style-type: none"> <li>• Heat damaged by proximity distance (Panel temp~60)</li> <li>• difficult to apply FMM</li> </ul>	

5G JIES System (1100 x 1250 [mm])



6GH Manufacturing Equipment concept



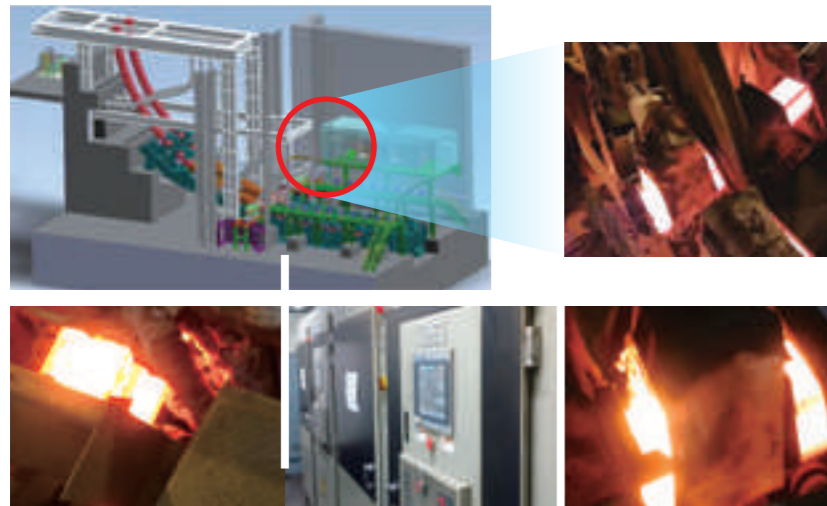
Item	Spec
Substrate	1500x950mm <sup>2</sup> glass
Tact time	60sec.
Up time	Over 700 Hr
Uniformity	< ±1%
Material efficiency(Usage)	> 90%
Device structure	10 layer

HOT ROLLING MILL

Induction technology of DAWONSYS is based on the special power supply that is engineered to be used in various applications in the steel industry. In particular, our various references are related to heating units which can be used in the continuous casting, hot rolling mill and cold rolling mill process line. Our customers have been satisfied with our induction heating solutions, which have improved the quality of steel strips. We have strong belief that we are capable of serving our customers better and best from numerous successful experiences in the past in induction heating industry that requires tough efforts.

CONTINUOUS CASTING MACHINE

The bloom edge heater is installed at the unbending zone of continuous casting line to compensate the temperature drop on the bloom edge. It is to prevent edge cracking on the upper corners of the bloom.



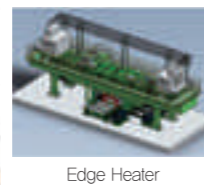
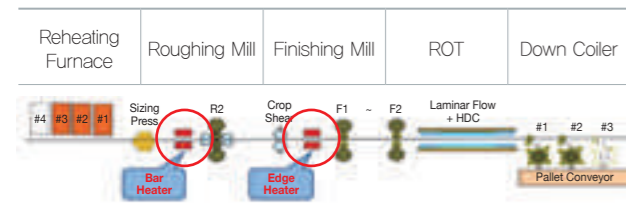
- Prevention of cracks
- Increasing of production yield due to minimizing of post-process such as machine scarfing and hand scraping
- The very focused heating saves energy compared to other heating systems
- Due to the improvement of the quality, the need of inspection is less
- High Reliability & Stability

HOT ROLLING MILL

In conventional hot rolling mill, there is bar heater installed before roughing mill and edge heater installed between roughing mill and finishing mill stand.

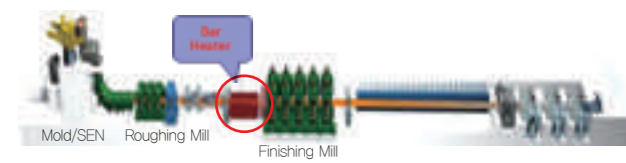
In the endless strip production plant, they can be many induction heaters installed after the roughing mill stand. This heating helps to reach the optimum hot rolling temperature in order to gain the highest quality product and secure the life-time of work rolls in mill stands.

Conventional Hot Rolling Mill



- Optimizing of the rolling temperature
- Optimizing of the shape of the slab by preventing of uneven wearing of the work roll
- Secures an uniform grain structure for the rolled product on the edge corner of slab
- Improving of production yield by minimizing side trimming work of the slab

Endless Strip Production Plant

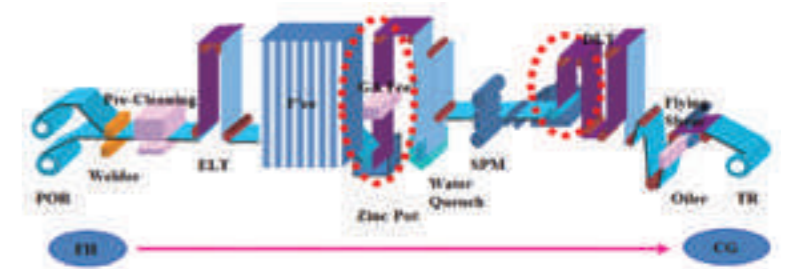


GA and POST TREATMENT

The GA heater is installed above zinc pot in continuous galvanizing line. It is to heat up zinc coated strip to form a new Fe-Zn alloy which can give a protection against corrosion and gives additional benefits such as good weld-ability and good surface treatment for other coatings.

The induction heater is installed for the post-treatment in the steel process line, such as electro galvanizing line, continuous galvanizing line, pickling galvanizing line, annealing and pickling line and color coating line. By applying it to the drying process of strip, it can prevent a poor quality due to contamination and fingerprint.

- Improvement of corrosion-resistance of strip due to Fe-Zn alloying by optimizing heating
- Providing of optimal and targeted heating solution suitable for the galvanizing line
- Forming strip surface with good properties for painting
- Accurate heating system for Anti-finger print and Cr-free coating
- Combination of heating and fume exhaust technology



HEAT TREATMENT

The induction heater is installed in heat treatment line and it increases the temperature of steel material above than magnetic transition point (about 900°C). The steel structure is transformed to martensitic and the remained austenite structure will be removed.

- The hardness is increased and high wear-resistance gained
- The heat treatment takes place in continuous automatic production lines
- A short heating zone with high efficiency
- Increasing of production yield



Seamless Pipe Heater & Quenching equipment



INDUCTION HEATING SYSTEM

Characteristics

- High availability and reliability
- Maximized the heating efficiency and objective temperature control
- Optimized cooling system for inductive heating coils and power supply panels
- Reliable power supply system and less capital spare parts
- Quickly replacing spare parts and easy maintenance
- Simple foundation and installation



Special Rectifier Business Status

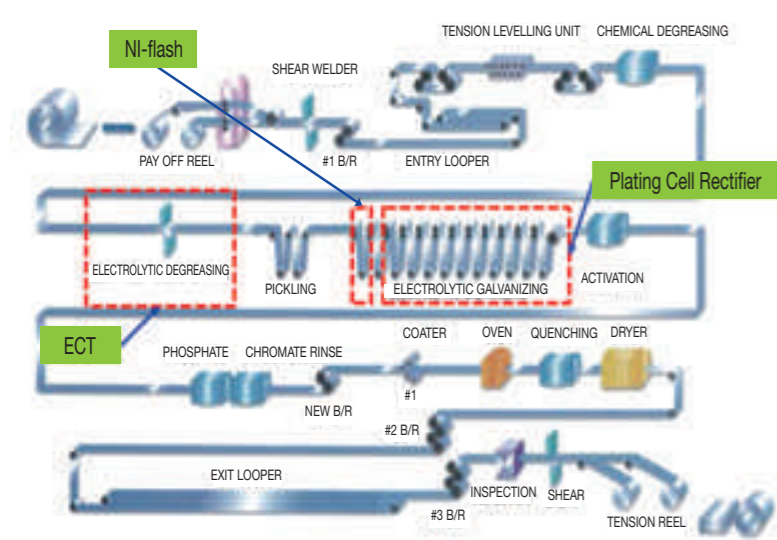
Applied to Chemical plant, Steel plant, Seawater desalination, Electrolytic cell and etc. Previously supplied to LG chemical, LS -Nikko Copper Inc, POSCO and others. Dawonsys has a lot of experience and several references in making high currency power supplies with high reliability and stability by using IGBT in the special rectifiers. This kind of excellent references have been supplied to chemical, steel and nonferrous industry.

Chlor-Alkali Rectifier



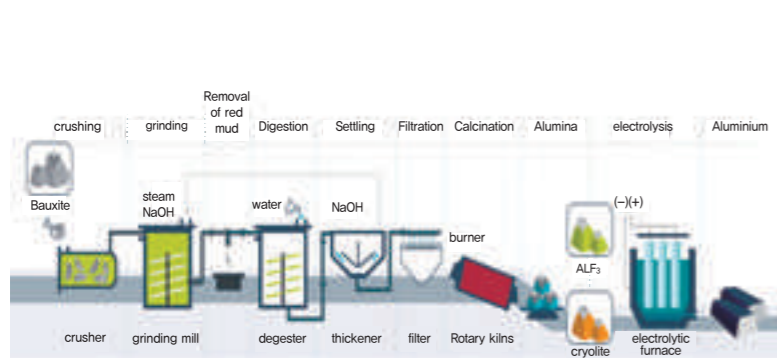
Voltage	Ampere	Output
300 Vdc ~ 700 Vdc	7,000 A ~ 20,000 A	2,000 kW ~ 14,000 kW

Steel Plating Process Rectifier



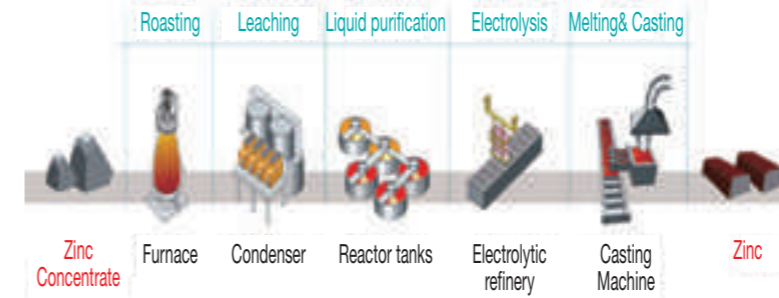
ITEM	SPEC	Application
ECT	±50 Vdc / 12 kA	CGL, EGL, CAL, PGL
	±25 Vdc / 6 kA	
NI-flash Rectifier	30 Vdc / 4 kA	EGL
Plating Cell Rectifier	35 Vdc / 22 kA	EGL, STS
	20 Vdc / 17 kA	

Aluminum Electrolytic Smelting Rectifier



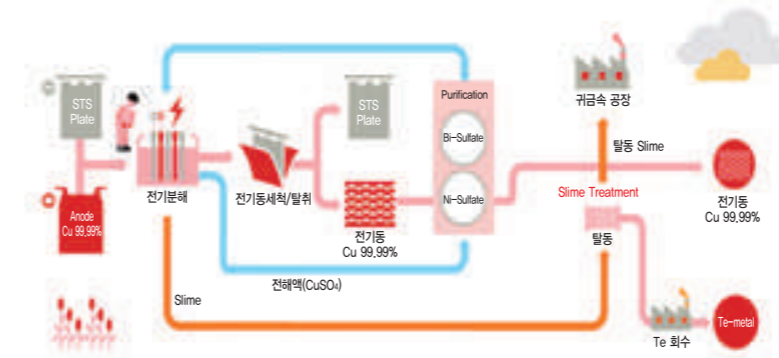
Voltage	Ampere	Output
300 Vdc ~ 700 Vdc	7,000 A ~ 20,000 A	2,000 kW ~ 14,000 kW

Zinc Electrolytic Smelting Rectifier



Voltage	Ampere	Output
60 Vdc ~ 500 Vdc	10,000 A ~ 150,000 A	5,000 kW ~ 80,000 kW

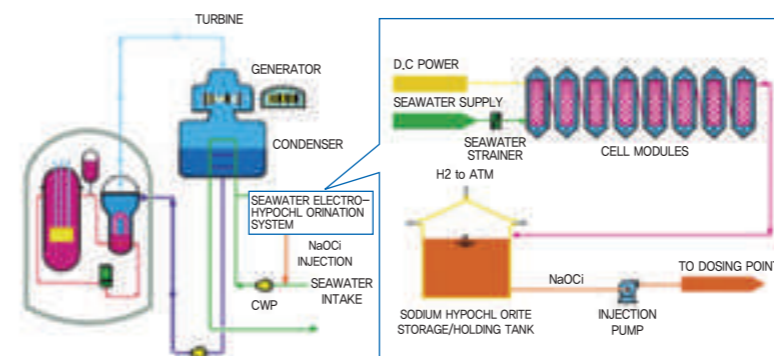
Copper Electrolytic Refining Rectifier



Voltage	Ampere	Output
15 Vdc ~ 600 Vdc	6,000 A ~ 50,000 A	90 kW ~ 30,000 kW

Hypogen System

Typical Seawater Electro-hypochlorination System in PWR Nuclear Power Plant

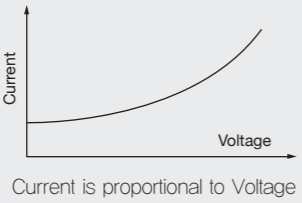
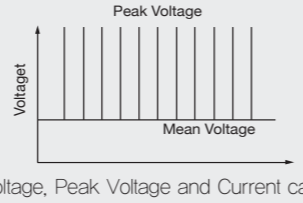
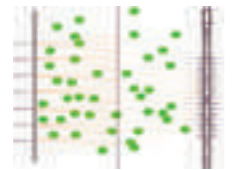
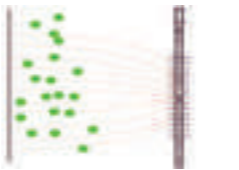


Voltage	Ampere	Output
36 Vdc ~ 180 Vdc	5,500 A ~ 15,000 A	200 kW ~ 2,700 kW

Electrostatic Precipitator—Micro Pulse P/S

- Accomplished 30~70% enhanced dust removal efficiency comparing to DC P/S.
- Significantly reduced power consumption (80 to 90% electricity savings).
- Unnecessary to build new huge EP facility. The same effect achievable just by replacing power supply in the existing facility.
- An emerging environmental market focusing on the removal of the fine dust in the coal-fired plant and steel sintering line.

[ The comparison of DC/TR and Micro Pulse P/S ]

	DC T/R	Micro Pulse P/S
Application	- Coal-fired power plant / Boiler - Incinerator, Combustion Facility	- Sintering / Cement / Combustion Facility - Coal-fired power plant
Features	 Current is proportional to Voltage	 Mean Voltage, Peak Voltage and Current can be individually controlled
Power Consumption	 Current is used for particles charging as well as wasted for generation of back corona	 Current is only used for particles charging → It can reduce power consumption up to 90% compared to Dc power supply

One of the most cost-effective solutions to increase dust removal efficiency is EP-MPS installation. EP-MPS prevents Back Corona for the stable dust removal efficiency as well as power consumption savings.



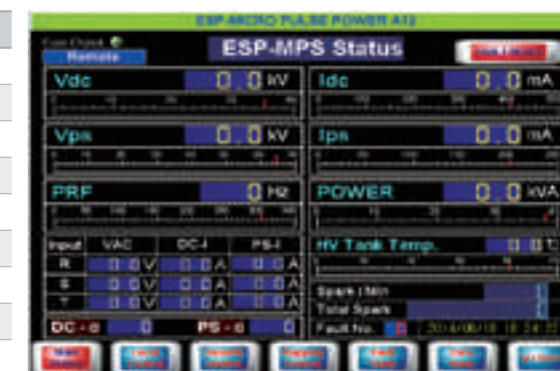
Control Panel	
Size	800mm(W) * 600mm(D) * 2,000mm(H)
Weight	280kg
Color	RAL 7035

HV-Tank	
Size	2,500mm(W) * 1,800mm(D) * 1,600mm(H)
Weight	3,800kg
Color	RAL 7032 (EPOXY)

Section	Unit	Symbol	Parameter
ESP Capacitance	nF	CEP	50 ~ 150
Pulse Width	us	T	120
Repetition Rate	Hz	F	200
Input Voltage	Vac	V	TBD
Input Frequency	Hz	F	TBD
Max. Pulse Voltage	kV	VPS	65
Max. DC Voltage	kV	VDC	35
Average DC Current	mA	IDC	400
ESP Peak Current	mA	Ips	200

Micro Pulse P/S Specifications



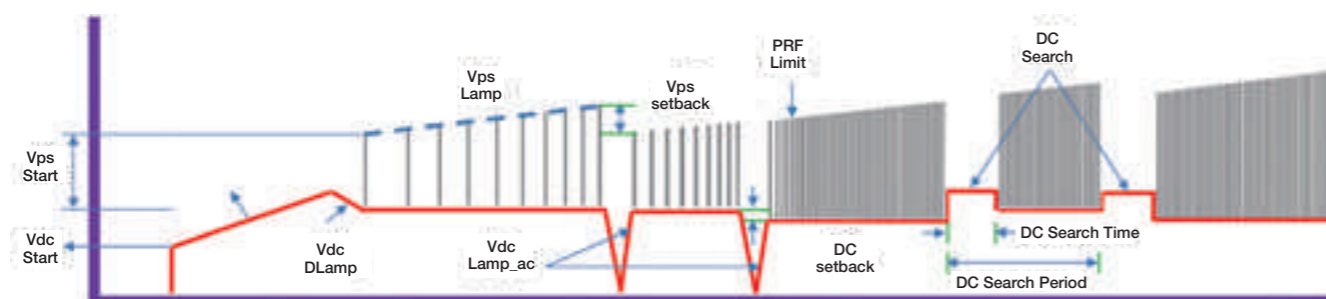
Touch Screen



Micro Pulse P/S in Arcelor Mittal, Poland

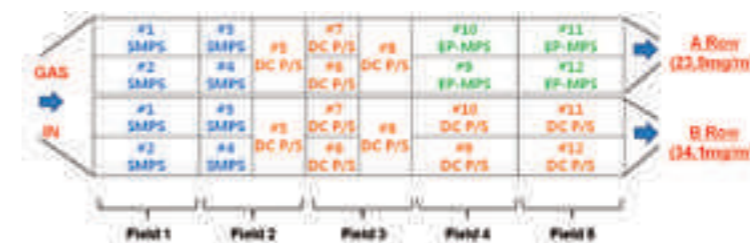


Micro Pulse System in coal power plant in Hunan province, China



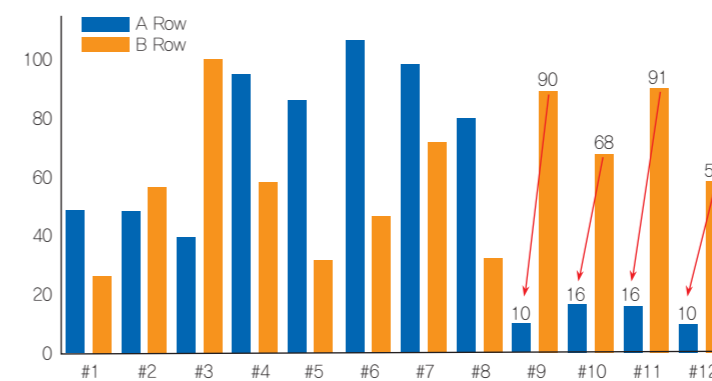
Micro Pulse P/S Operation Procedure

[ Project Reference in Hunan province, China ]

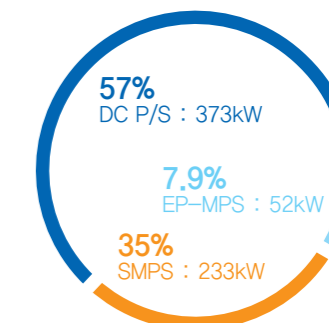


ESP Configuration

- 4 sets of EP-MPS were installed in A row. We got 23.9mg/m<sup>3</sup> as outlet concentration of A row by replacing with EP-MPS, → 30% increase of dust removal efficiency was obtained



Comparison data (A row vs B row) of power consumption saving



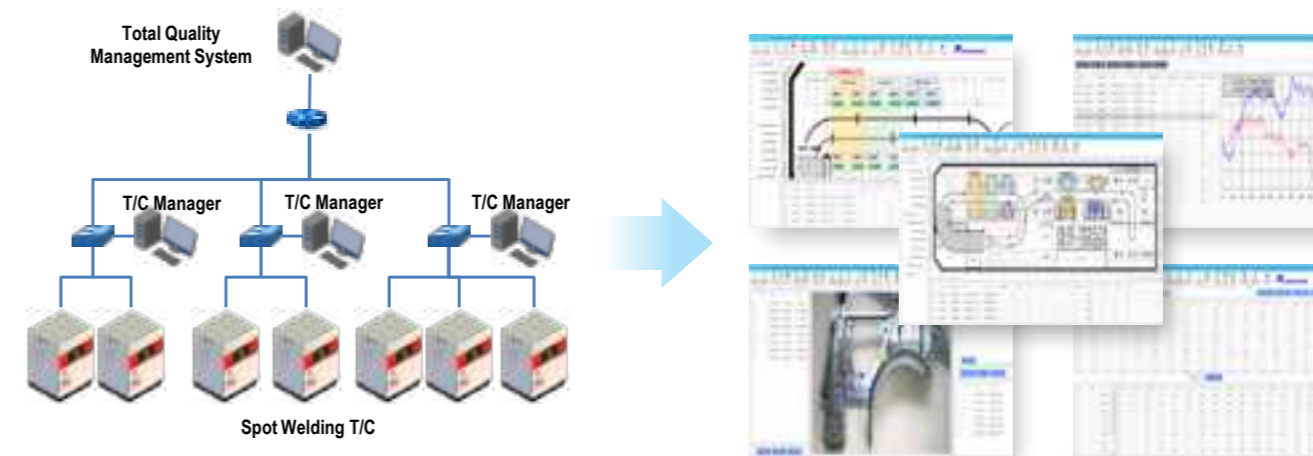
Power consumption ratio of each power supply in A row

- 1 High quality welding by applying intelligent algorithm
- 2 Precise control and provide various interfaces by adopting of High-speed controller
- 3 Verification through weldability evaluation by steel grade and application of intelligent control using extracted optimal control pattern
- 4 Integrated management of lines by obtaining network system (welding quality, condition, equipment operation status)
- 5 Enlargement of Nugget size and increase of welding strength
- 6 Enable narrow pitch welding by improvement of shunt welding quality
- 7 Significant spatter reduction in welding
- 8 Simplify setup of all welding conditions by applying touch screen
  - (1) All settings are possible to control with touch screen only
  - (2) Real-time monitoring of all welding data and various history retrieval are possible
  - (3) Possible to search all stored welding data & having a screen saving function



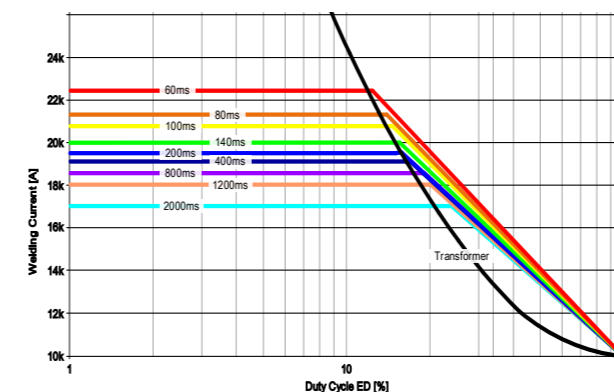
Network System(T/C Manager)

- 1 Easy to manage quality by storing operation condition, welding result and quality status of welding Machine T/C
- 2 Easy to manage product welding point by synchronizing product with welding point
- 3 Easy to see results and statistical analysis
- 4 Possible to integrate with customer's management system



TR(Transformer)

- 1 Minimization and light weighting with compact design
- 2 Insulation Class: F-type
- 3 Protection against overheating of transformers and rectifier diodes
- 4 Ensure durability and electrical safety by molding insulation



MODEL	AISW-T25
Input Voltage	500V
Frequency	1kHz
Id (DC Current)	10kA
DC Output Power	90kW
Current Sensing Coil	150mV/kA (±3%)
Temperature Switch	135°C, 2EA (primary, secondary coil)
	90°C, 1EA (diode)
Insulation Class	F (155°C)
Cooling Water Flow / Pressure	3lpm / 3bar
Turn Ratio (N <sub>1</sub> / N <sub>2</sub> )	55
Capacity	301kVA @20%
	191kVA @50%
	134kVA @100%
Weight	15.5kg



Item	Long Pulse
Input Voltage	3Φ 440Vac 60Hz
Input Protection	MCCB
Average Output Power	135kW
Output Voltage	500V
Output Current	400A
Over Temperature	85°C
Isolation Voltage	1.8kVac, 60Hz for 1min(IEC60146-1-1)
Display	7 inch 800x480 color touch panel
Cooling	Air
Dimension	AISW-A25S-A : 415(W) x 610(H) x 360(D) mm
	Weight
Weight	AISW-A25S-A : 30kg
	AISW-A25S-B : 50kg
Interface	D-Net, CC Link, Interface I/O



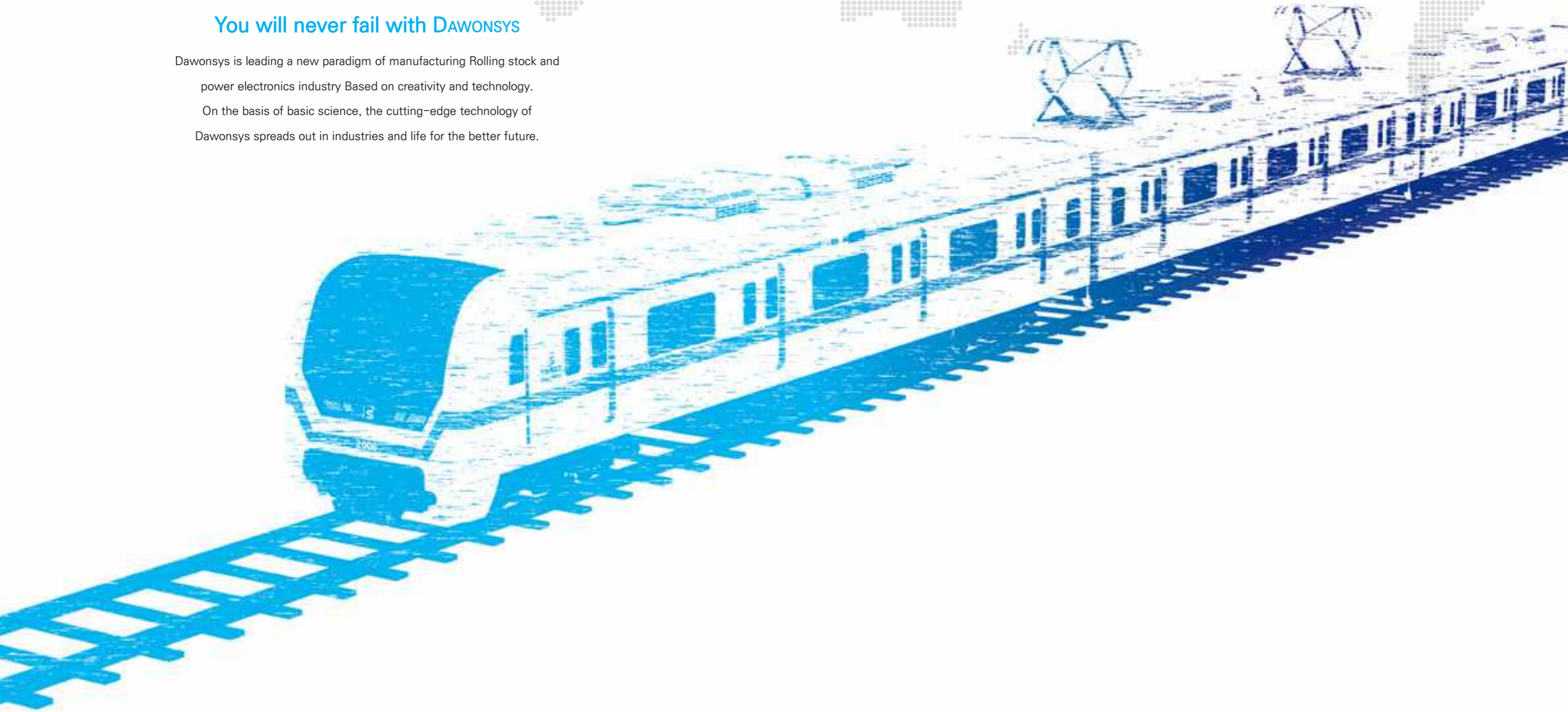
*World Wide Business*  
*World Best Product*  
*World First Process*

**DAWONSYS**

**You will never fail with DAWONSYS**

Dawonsys is leading a new paradigm of manufacturing Rolling stock and power electronics industry Based on creativity and technology.

On the basis of basic science, the cutting-edge technology of Dawonsys spreads out in industries and life for the better future.





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