



Electrolytic Scale Removal & Automatic Discharge System for Circulating Cooling Water

Scale Power Cleaner

Our scale removal technology



Scope of application

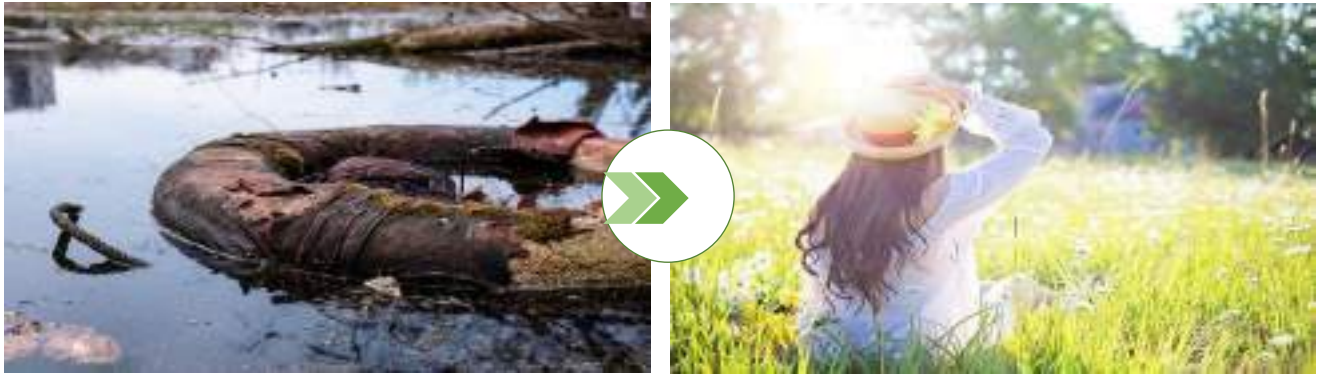
Building, Factory, Water & Sewage Treatment Facility etc.

I



Providing the effect of **planting tens of thousands of trees for global carbon neutrality (energy saving)**

II



Leading the eco-friendly campaign by the prevention of environmental pollution (no wastewater generation)

With carbon neutrality, environmental pollution prevention technology

A Company protecting the future of humankind

Issues Caused by Scale

- ① Limitation or Problem of the conventional technology
- ② Product Overview
- ③ Main Function
- ④ Application
- ⑤ Installation Case
- ⑥ Installation Effect
- ⑦ Specifications
- ⑧ Certification Status
- ⑨ Patent
- ⑩ Cost Reduction Case
- ⑪ Major Customers
- ⑫ Neo-Semitech. Co., Ltd.

Appendix



Scale Power Cleaner



Issues Caused by Scale



Problems caused by scale

- ✓ Reduction of fluid transport capacity due to the shrinkage of the cross-sectional area by the scale inside the pipe
- ✓ Reduction of the efficiency of heat transfer due to the scale generation inside the heat exchanger
- ✓ Providing the cause of the failure of various valves and machines by the deteriorated water quality
- ✓ Increase of the electrical power consumption by the scale
- ✓ Increase of the facility maintenance and service cost
- ✓ Frequent blow-down of the cooling water due to the concentration of chemicals
- ✓ Efficiency reduction of the facilities caused by slime and various germs

I Limit & Problem of Conventional Technology

Method	Mechanism	Demerit
Magnetic	<ul style="list-style-type: none"> By passing water through the center of the magnetic field, inhibition of molecular bonding of Ca^{2+}, Mg^{2+} ions and prevention of the attachment of dissolved materials to the pipe 	<ul style="list-style-type: none"> Ineffective, contrary to the theory Problem of the non-persistence of magnet and impossibility to discharge scale out of water
Electronic	<ul style="list-style-type: none"> Neutralizing and removing the potential difference in the water-metal interface by dispersing ions to the heat transfer surface 	<ul style="list-style-type: none"> Operation and effective within the limited section Impossibility to discharge scale out of water
Ultrasonic	<ul style="list-style-type: none"> Scale removal by applying continuous micro-vibration using the ultrasonic oscillator 	<ul style="list-style-type: none"> Limited using within the effective range of the ultrasonic wave Impossibility to discharge scale out of water
Ion Exchange Resin	<ul style="list-style-type: none"> Scale removal by converting hard water to soft water 	<ul style="list-style-type: none"> Necessity of preventing corrosion by Na^+ ion
Ion	<ul style="list-style-type: none"> Prevention of rust formation and scale removal by blocking oxygen by attaching metal with higher oxidation power than iron 	<ul style="list-style-type: none"> Difference in effect with water potential and pH, high price and problem of pipe cutting in installation
Catalyst	<ul style="list-style-type: none"> Prevention of rust and scale by changing magnetic property of water and removal by weakening binding force of existing rust and scale 	<ul style="list-style-type: none"> Impossibility to discharge scale out of water Insufficient removal efficiency
Induction Coil	<ul style="list-style-type: none"> Accelerating CaCO_3 formation in the water using Lorentz force of electromagnetic field and draining, and decomposition of existing scale by CO_2 	<ul style="list-style-type: none"> Operation and effective within limited section Impossibility to discharge scale out of water
Electrolysis	<ul style="list-style-type: none"> Attachment of scale to the cathode during flowing of the cooling water between two electrodes with different electric polarity in the reactor and removal of attached scale by switching the electric polarity 	<ul style="list-style-type: none"> Maintaining below 2bar of cooling water pressure during operation is recommended due to the equipment structural characteristic

I Limit & Problem of Conventional Technology

	Israel C company	Japan E company	SPC (Neo Semitech)
Reactor			
Scale removal	<ul style="list-style-type: none"> •Nonseparation of reactor and scale extraction part •Manual scale removal 	<ul style="list-style-type: none"> •Separation of reactor and scale extraction part •Liquid drain (Unclear effectiveness) 	<ul style="list-style-type: none"> •Separation of reactor and scale extraction area •Automatic or manual discharge 

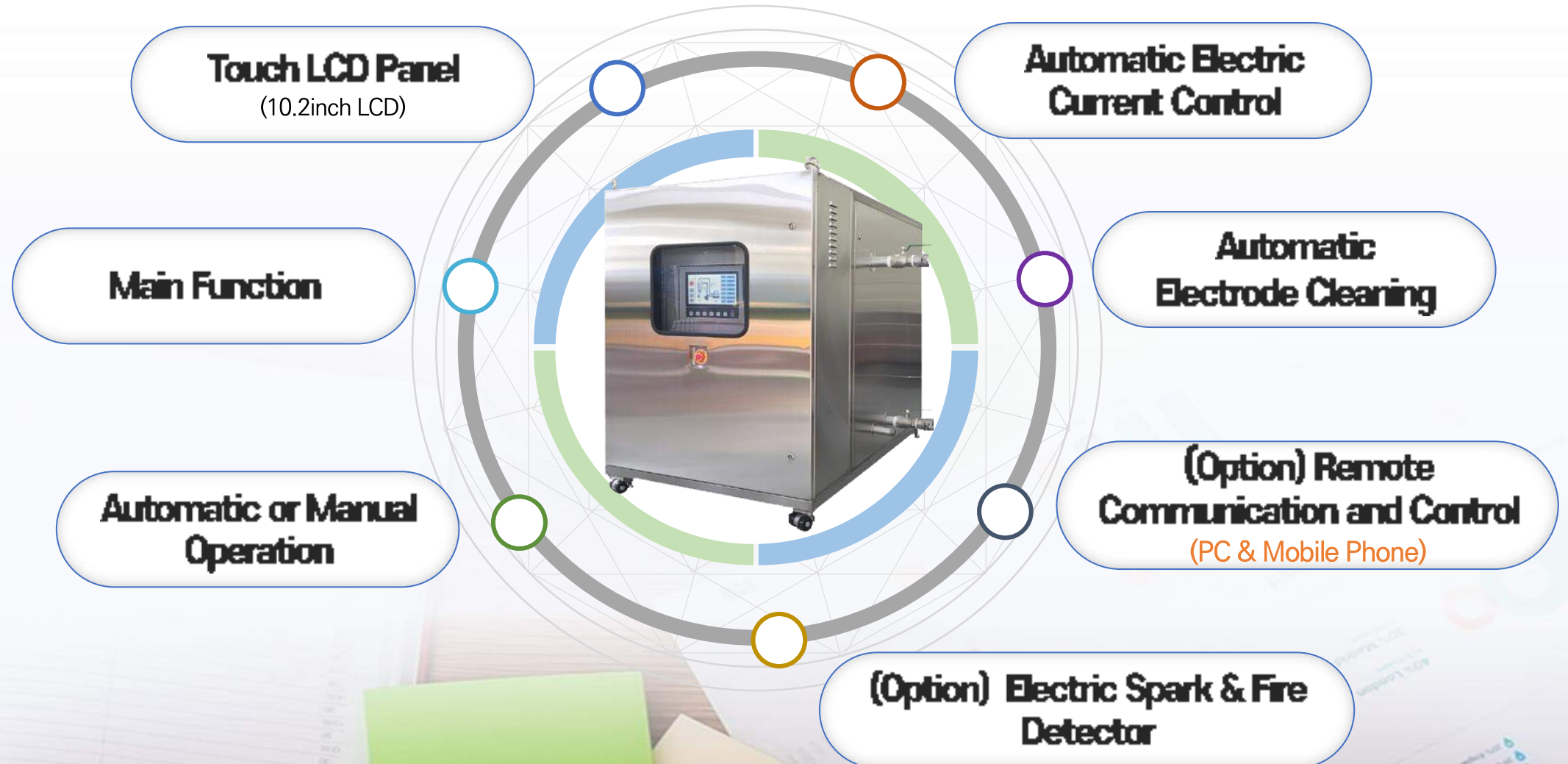
II Equipment Overview

Scale removal equipment using electrolysis principle

- 1 Scale formation in the pipe of cooling system is prevented by automatic discharge after extraction in a form of CaO(Calcium oxide) reduced on the cathode through the electrolysis process of Ca^{2+} (Calcium), Mg^{2+} (Magnesium), SiO_2 (Silicon dioxide) dissolved in the cooling water.
- 2 While circulating, the water converted to electrolyte structure takes away the cause materials from existing scale attached to the circulation system such as cooling tower, circulation pipe, heat exchanger, etc. for maintaining equilibrium state supplementing the scale cause materials lost by electrolysis reaction and discharge it out of the water system.



III Main Function



Smart Factory Application

Conventional Method



- patrol and check by people
- In the event of machine failure, controller is located in the rooftop or machine room, so the alarm cannot be heard and the problem is detected by patrol

Labor cost loss

SPC



- Status of the machine can be checked on the office PC and mobile phone and controlled with remote control
- Patrol labor cost reduction
- Quick response in case of the abnormal errors

No Patrol

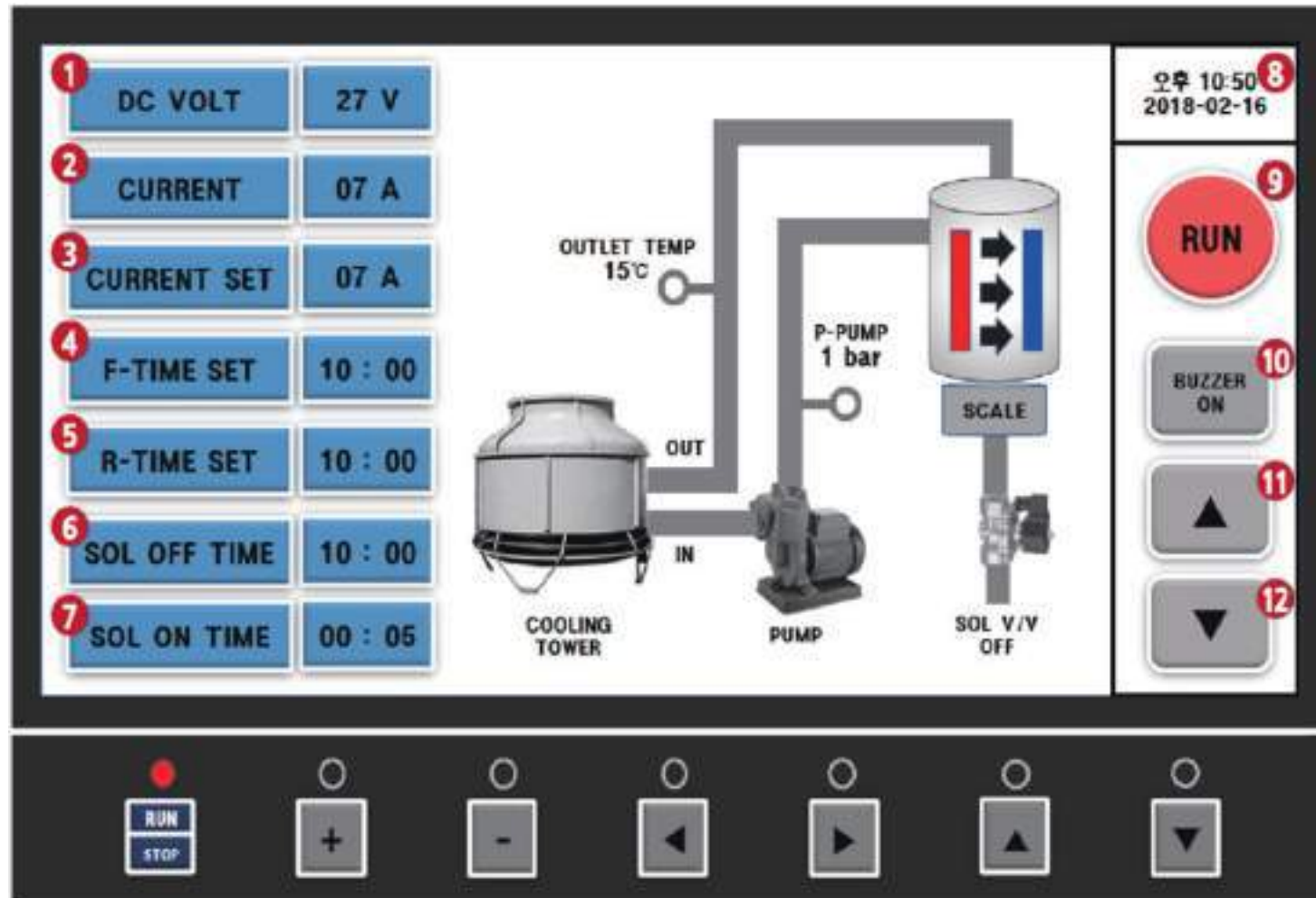


In the office in stead of patrol



Status check and adjustment with mobile phone

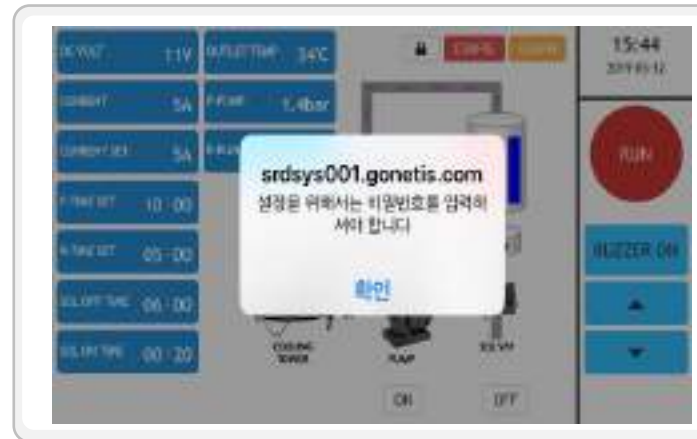
Screen Design – Premium (Touch panel type)



NO	표시내용
1	Applied Voltage (Electrode)
2	Applied Current (Electrode)
3	Applied Current Setting
4	Forward Time Setting
5	Reverse Time Setting
6	SOL V/V Off Time Setting
7	SOL V/V On Time Setting
8	Date & Time Display
9	Operation & Stop Button
10	Alarm On/Off Setting
11	Set Value Increase button
12	Set Value Decrease button

Remote Communication & Control – (Option)

Remote operation and maintenance are possible in both mobile phone and user PC



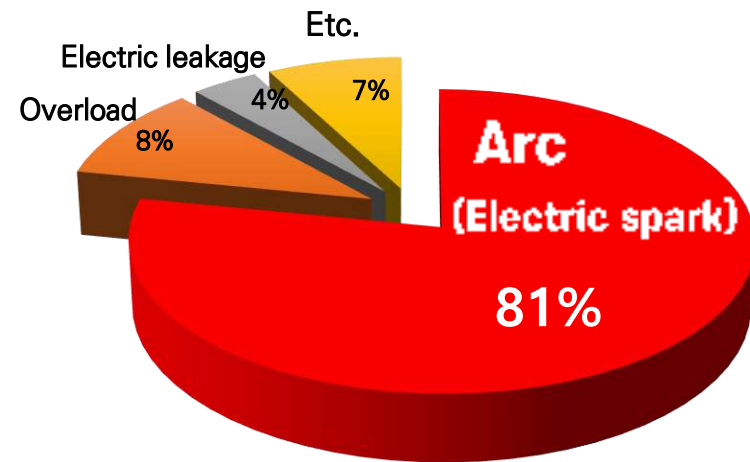
날짜	DC VOLT	CURRENT	OUTLET TEMP	P-PUMP
2019-05-02 08:10:00.0	14	0	28	2.1
2019-05-02 08:20:00.0	4	12	27	0
2019-05-02 08:30:00.0	4	12	27	0
2019-05-02 08:40:00.0	4	12	27	0
2019-05-02 08:50:00.0	4	12	27	2.1

Electric Spark Fire Detector– (Option)

Fire prevention in SPC is possible through early detection of electric spark

Cause of the electric fire

(Fire statistics, 2020)



Major Cause of electric fire is
arc (electric spark)

Fire caused by **leakage: 4%**

Fire caused by **Spark: 81%**

Electric spark detector

- Normal electric leakage breaker

- Electric spark



Unable to prevent electric spark fire

- Spark detector



※ Applied Technology:

- Photoelectric effect of metal
- Gas multiplication effect

Able to detect electric spark
as well as fire and flame

IV Application

Applicable to all areas using the circulating cooling water system



V Installation Case

Installation of scale removal equipment at industrial site

1. Model : SPC-500
2. Operation Period : 01 June, 2018 ~ Current
3. Scale Collection Inspection Date : 15 June, 2018
4. Installation Facility : Cooling Tower 350RT × 2ea



Picture of scale collected in the strainer (15 days after operation)

– automatic discharge function off

* Automatic discharge after confirmation of manual scale collection

V Installation Case _Scale Composition Analysis



TEST REPORT

시행결과

시행항목	단위	시험구분	결과치	시험방법
CaO	%	-	45.0	KS L 3316 - 2014 (준용)
SiO ₂	%	-	4.84	KS L 3316 - 2014 (준용)
MgO	%	-	3.23	KS L 3316 - 2014 (준용)
SO ₃	%	-	0.55	KS L 3316 - 2014 (준용)
Na ₂ O	%	-	0.26	KS L 3316 - 2014 (준용)

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참고: 품질관리용

비고: 1. 이 성적서는 제작자가 제시한 시험 결과 시료명으로 시험한 결과로서 전체 계통에 대한 품질을 보증하지 않으며, 성적서의 진위확인용 홈페이지(www.ktr.or.kr) 또는 QR code로 확인 가능합니다.
 2. 이 성적서는 종이, 인편, 우편 및 소독 등으로 사용할 수 없으며, 광도 미만의 사용은 인정되지 않습니다.
 3. 이 성적서는 원본(제발행)을 소멸한 후 유출하여, 사본 및 전자 전송본/파일본은 결과치 효력이 없습니다.



According to the analysis of the scale composition, CaO(Calcium oxide) accounted for the most 45.0%.

(Reference: KTR (Korea Testing & Research Institute) Test Report)

V Installation Case

Comparison of the cooling tower upper area between before and after operation (after 60 days operation)

Removal of scale and slime was confirmed



Scale before operation

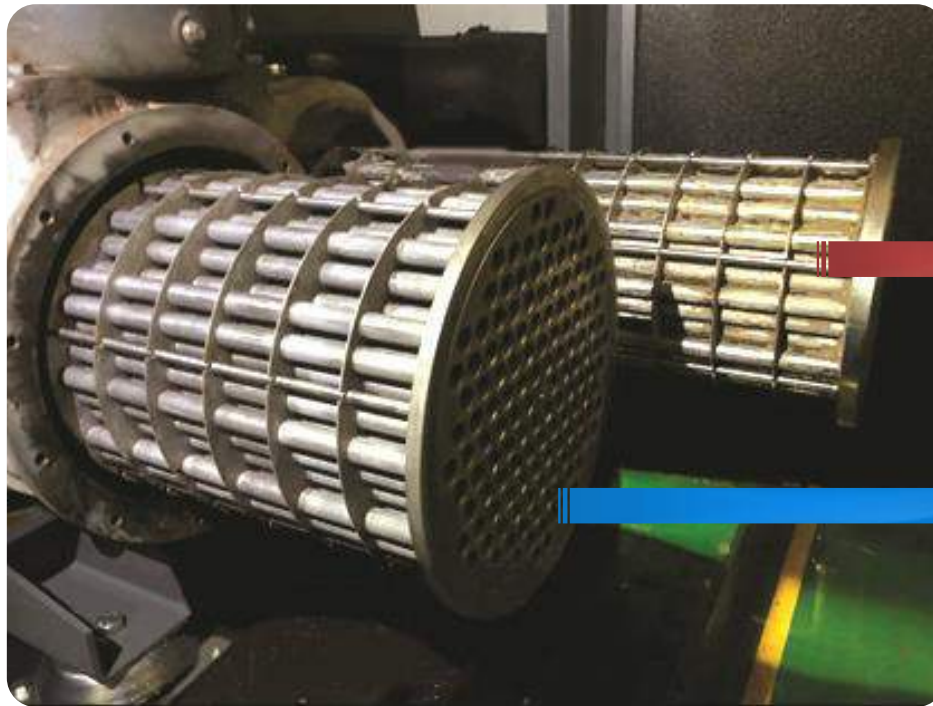


Scale after operation

V Installation Case

Comparison of the heat exchanger between before and after scale removal (Inter cooler)

Removal of scale and slime of the surface was confirmed without facility cleaning



Without SPC

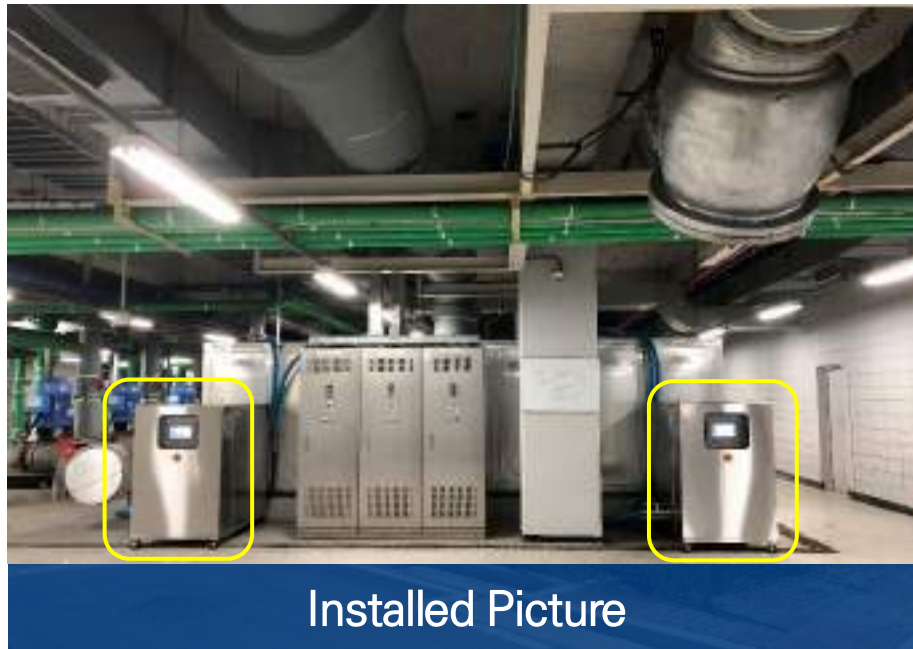
With SPC



V Installation Case

Installation of scale removal equipment at industrial site

1. Model : SPC-1000A × 2ea
2. Operation Period : 05 August, 2019 ~ Current
3. Scale Collection Inspection Date : 30 August, 2019
4. Installation Facility : Cooling Tower 1000RT × 3ea



Picture of scale collected in the strainer (3weeks after operation)

– automatic discharge function off

* Automatic discharge after confirmation of manual scale collection

V Installation Case

Comparison of the cooling tower eliminator between before and after scale removal (after 35 days operation)

Removal of scale and slime on the surface was confirmed



Scale before operation



Scale after operation

V Installation Case

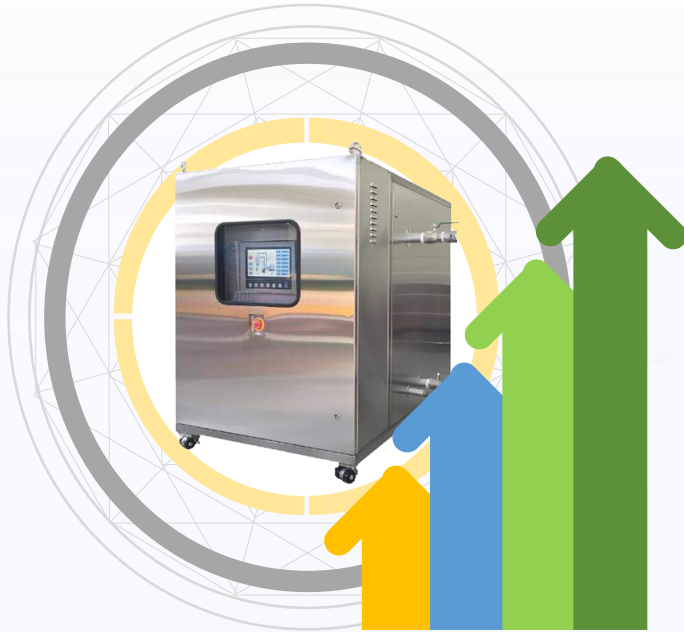


V Installation Case

✓ The color of collected scale depends on the water quality



VI Effect of Installation



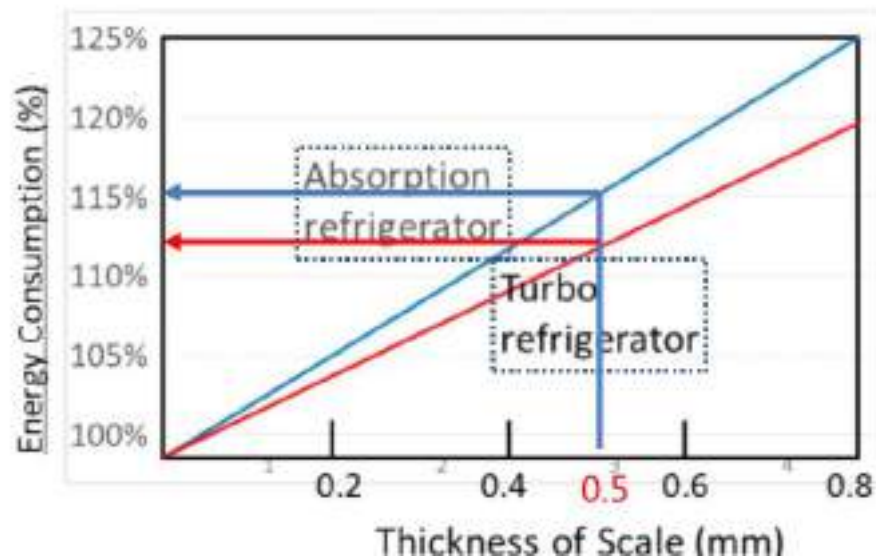
- 01 Removal of scale cause materials dissolved in circulating water
(Ca⁺⁺ (Calcium), Mg⁺⁺ (Magnesium), SiO₂ (Silicon dioxide))
- 02 Efficiency improvement of the heat exchange facility by scale removal
- 03 Electric energy saving (reduction of fan operation time and compressor load)
- 04 Reduction of the chemical cost for cooling water management
- 05 Water saving by the reduction of cooling water blow-down
- 06 Life time extension of the facility by scale elimination and chemical usage reduction
- 07 Reduction of the maintenance cost by extending the cycle of pipe cleaning and facilities overhaul
- 08 Prevention of environment pollution by controlling circulating water using electricity only

Increase in Energy Efficiency

Energy loss rate with scale thickness of the heat exchanger (Beatrix @Japan)

* In case of 0.5mm scale thickness of the heat exchanger

- Absorption refrigerator power : ~16% additional use
- Turbo refrigerator power : ~13 additional use



Source) Beatrix : scale removal & prevention equipment company



Removing or preventing scale can reduce energy costs by increasing energy efficiency.



Increase in Energy Efficiency

Energy loss rate with scale thickness of the heat exchanger (Carrier @USA)

* In case of 0.5mm scale thickness of the heat exchanger

- Compressor power : ~18% additional use

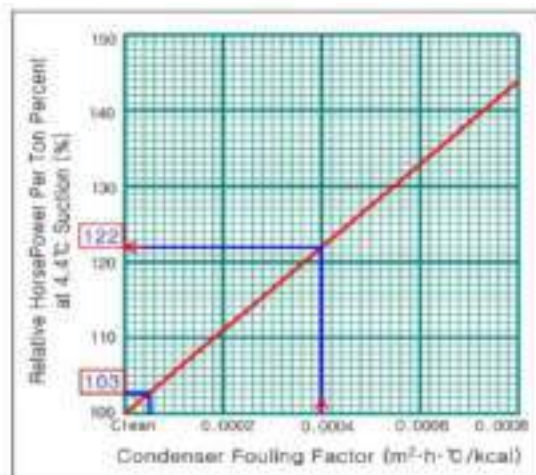
- Energy loss of vapor compression refrigerator by scale
 - fouling factor of refrigerator manufacturer design criteria : 0.0001
 - actual fouling factor of field operation facility : range of 0.0004 ~ 0.0006

- ✓ Increase rate of required power with pollution degree (scale thickness)

동력 (%)	오염계수 (m ² ·h·°C/kcal)	오염두께 (mm)	동력 (%)	오염계수 (m ² ·h·°C/kcal)	오염두께 (mm)
0.0	0.00000	0.000	22.0	0.00040	0.610
3.0	0.00005	0.075	24.2	0.00045	0.671
5.5	0.00010	0.152	27.5	0.00050	0.782
8.8	0.00015	0.244	29.7	0.00055	0.823
11.0	0.00020	0.305	33.0	0.00060	0.914
13.2	0.00025	0.366	35.2	0.00065	0.975
16.5	0.00030	0.457	39.6	0.00070	1.097
18.7	0.00035	0.518	42.9	0.00075	1.189

Source) Carrier : refrigerator handbook

- ✓ Variation of compressor required power with pollution of condenser tube



Removing or preventing scale can reduce energy costs by increasing energy efficiency.



VII Specifications

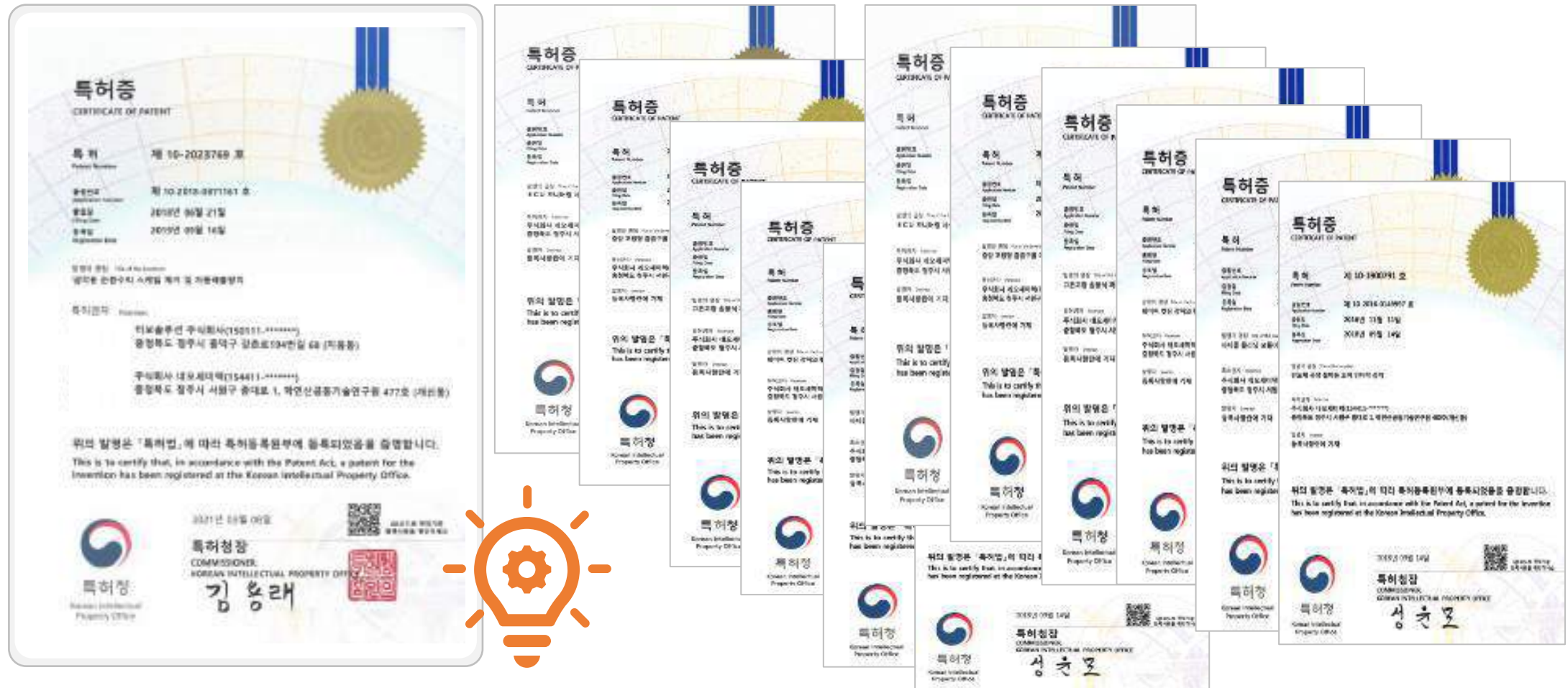


	Model 1	Model 2	Model 3
Model	SPC-200A	SPC-500A	SPC-1000A
Target Facility	Cooling Tower 100~300RT	Cooling Tower 400~600RT	Cooling Tower 700~1200RT
Capacity	5m ³ /hr	10m ³ /hr	20m ³ /hr
Suction/Discharge Height	8M/7M (MAX)	8M/13M (MAX)	8M/19M (MAX)
Input Power	Single Phase AC220V / 60Hz	Single Phase AC220V / 60Hz	Single Phase AC220V / 60Hz
Power Consumption	1.8kW (MAX)	2.7kW (MAX)	3.2kW (MAX)
Electrode Life Time	3 years (5A, 365 days, 24hr)	3 years (5A, 365 days, 24hr)	3 years (5A, 365 days , 24hr)
Pipe Diameter	Water Supply-40A, Water Discharge -40A, Drainage-32A	Water Supply-40A, Water Discharge -40A, Drainage-32A	Water Supply-50A, Water Discharge -50A, Drainage-32A
Dimension	W:1100 / L:750 / H:950	W:940 / L:1500 / H:1250	W:940 / L:1640 / H:1440
Weight	150kg	380kg	480kg

VIII Certification Status



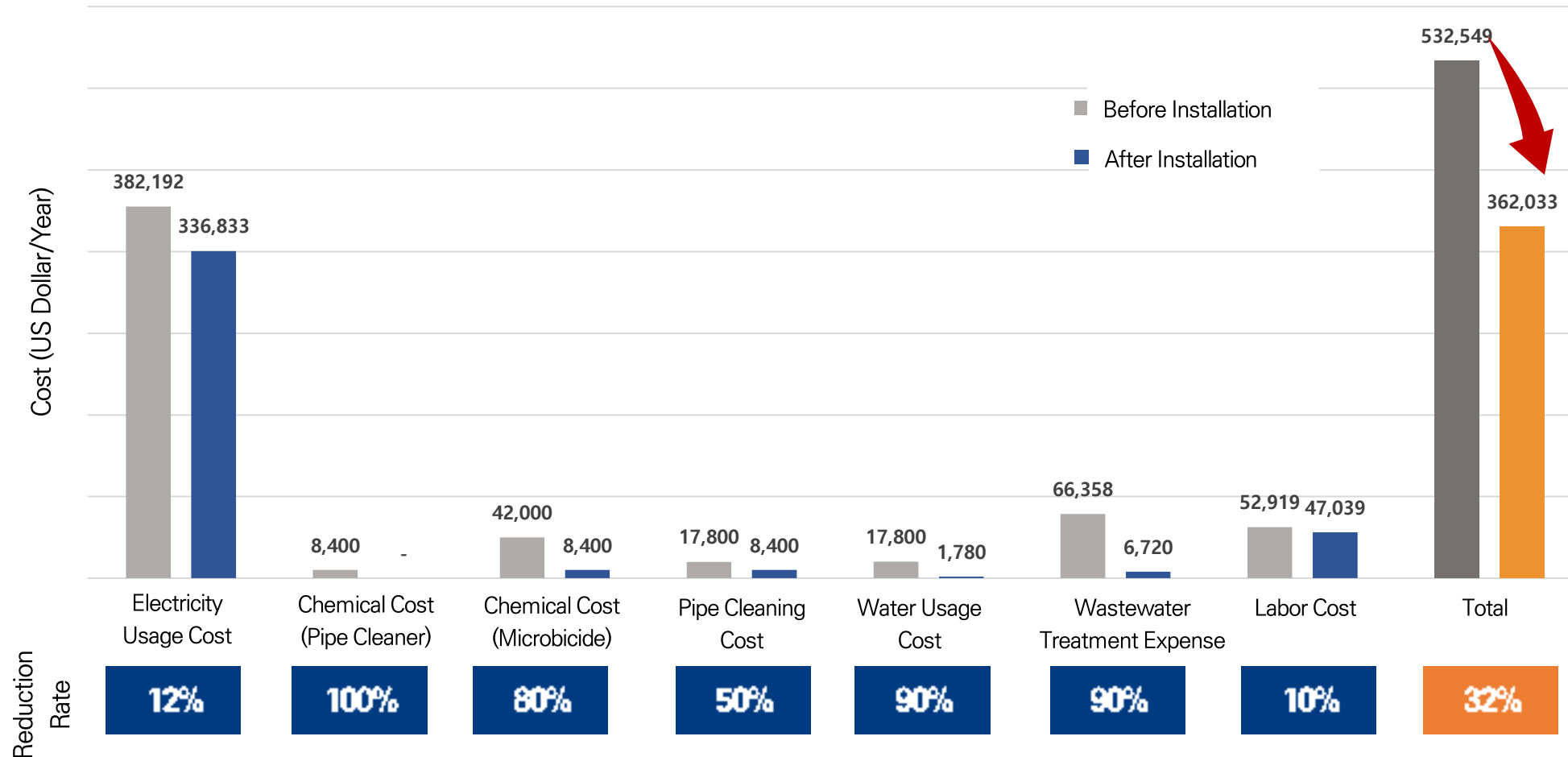
IX Patent [34 patents besides scale remover]



X Cost Reduction Case

✓ Korea A Chemical Company 900RT Cooling Tower

 **\$170,516 Saving / Year**



XI Major Customers

**“Many customers haven’t chosen yet.
However, no customers regret their choice of our product.”**

XII Neo Semitech Co., Ltd

Headquarters :

Academy-Research-Industry Joint R&D Center, Cheongju-Si, Korea



R&D Center :

Future Fusion Complex, Cheongju-Si, Korea



Factory :

Knowledge Industry Center, Cheongju-Si, Korea



Equipment
Development
& Marketing

Module
Development
& Marketing

Material
Development
& Marketing

UI
Development
& Marketing

Mechanical / Material / Chemical / Semiconductor / Computer Engineering



Semiconductor Equipment



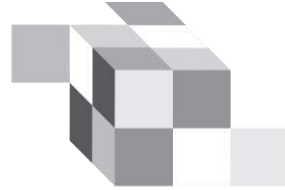
IoT Smart Product



Utility Product



Thank you



NEO SEMITECH
Solution For Particle & Haze

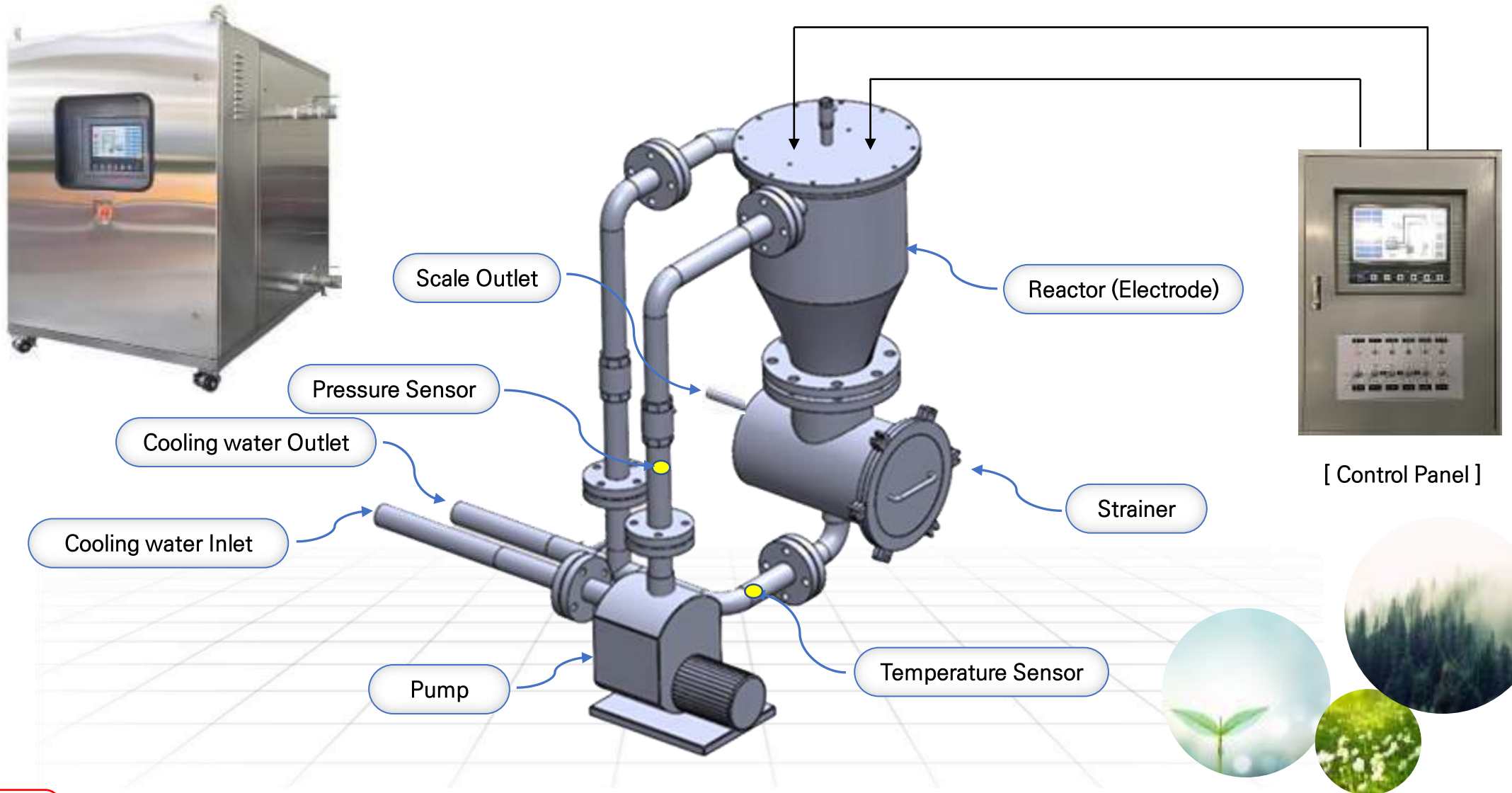
NEO SEMITECH Co.,Ltd

Address : Room 215, Future Fusion Complex, 76, Yeongudanji-ro,
Ochang-eup, Cheongju-si, Chungcheongbuk-do, Korea

Contact : Tel. 08-43-903-3900

E-mail sk.kim@neo-semitech.com

Appendix – Equipment Overview (Structure)



Appendix – Installation Case





Appendix – Installation Case



Appendix – Installation Case

Comparison of the heat exchanger between before and after scale removal (after cooler)

Removal of scale and slime on the surface was confirmed



Appendix – Installation Case (Scale Collection)

- The color of collected scale depends on the water quality



Appendix – Effect of Installation



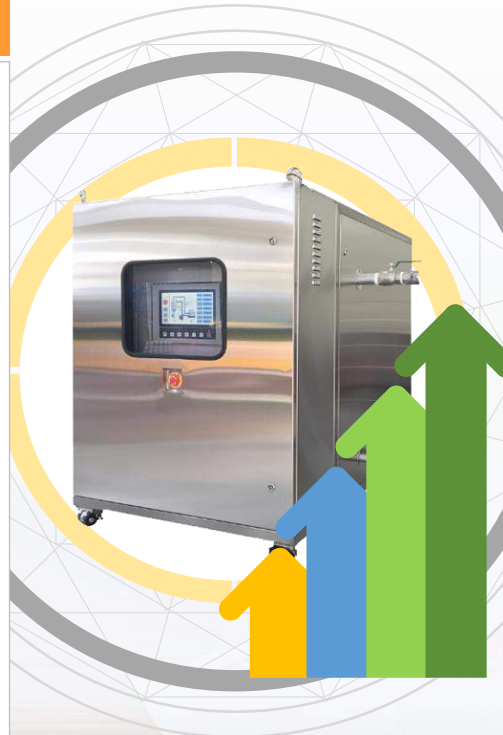
Key Effect

- 01 Chemical cost reduction
- 02 Pipe cleaning cost reduction
- 03 Scale removal & prevention
- 04 Reduction of electricity usage cost
- 05 Extension of main facility life time
- 06 Reduction of water usage



Sub Effect

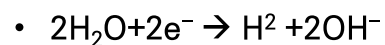
- 01 Decrease in microbial reproduction
- 02 Suppression of slime formation
- 03 Increase in energy efficiency
- 04 Corrosion prevention (Pinhole)
- 05 Providing eco-friendly working environment



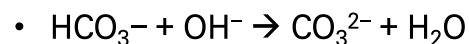
Appendix – Principle of Scale Removal by Electrolysis

Cathode _ Reduction Reaction

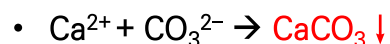
Cathode Surface (Reduction Reaction) – Scale Extraction



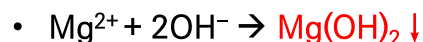
In a strong alkali environment,
 HCO_3^- (bicarbonate) changes to CO_3^{2-} (Carbonate)



Calcium carbonate precipitation of by the reaction of
calcium ion and carbonate ion



High pH condition promotes magnesium hydroxide
precipitation



Anode _ Oxidation Reaction

Anode Surface (Oxidation Reaction) – Expecting Additional Sterilization Effect

- $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$
- $\text{Cl}_2 + \text{H}_2\text{O} \rightarrow \text{HOCl}$ (hypochlorous acid) + H^+ + Cl^-

Consequently, microbial suppression can be additionally expected
by the generation of HOCl and OH radical with sterilization power

(Note) major ingredient of scale

Calcium carbonate, CaCO_3

Calcium carbonate is the active ingredient in agricultural lime and is created when calcium ions in hard water react with carbonate ions to create limescale.

Magnesium hydroxide, $\text{Mg}(\text{OH})_2$

It occurs in nature as the mineral brucite. It is a white solid with low solubility in water.

Calcium carbonate



Magnesium hydroxide



(Source) wikipedia