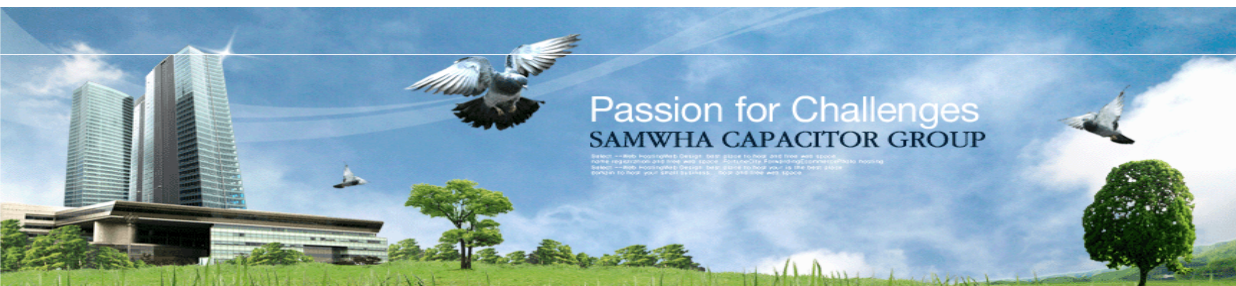


SAMWHA PRODUCTS

Power Capacitor





KOREA



THAILAND



INDONESIA

COMPANY NAME

SAMWHA CAPACITOR CO., LTD.

ESTABLISHMENT

AUGUST 1956

HEADQUARTER

124, BUK- RI, NAMSA- MYUN, YONGIN- SI, KYUNGGI- DO, KOREA

CAPITAL

USD10,000,000

REVENUE

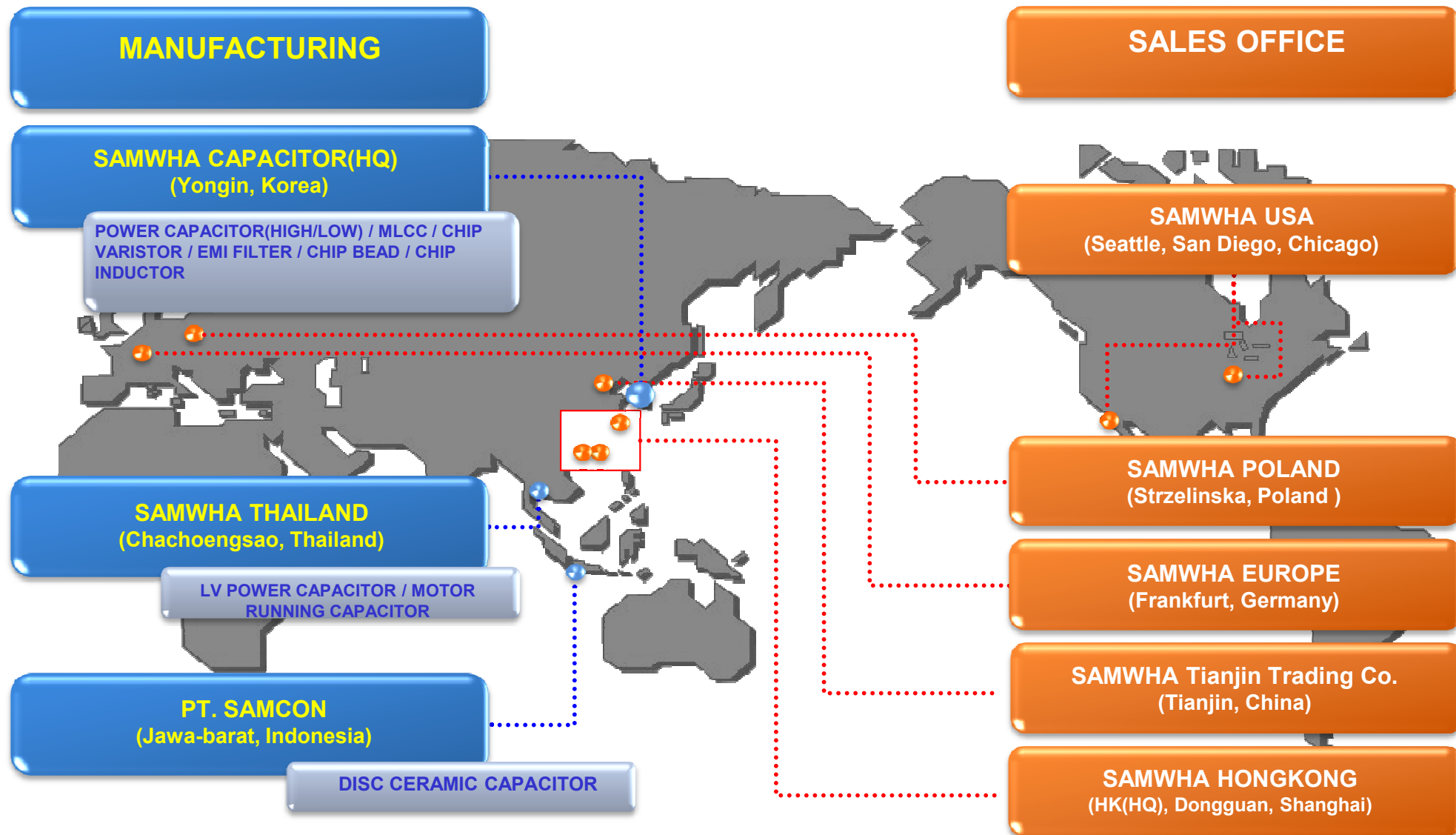
USD150,000,000 (2009)

CORPORATIONS

**MANUFACTURING - KOREA, THAILAND, INDONESIA
SALES - USA, GERMANY, POLAND, HONGKONG, CHINA, INDIA**

PERSONNEL

400 (EXCLUDING OVERSEAS)



- **Competitive Power for Q.C.D.S**

- ✓ **Longtail Altitude**

- ❖ Samwha capacitor think only customer : our customer's needs are our ultimate mission
- ❖ Samwha capacitor design, manufacturer & deliver every capacitors requested as well as standard rating units to every customer
- ❖ Samwha manufacture our best even for one capacitor order

Reliable Quality 3 years guarantee

Low Cost Competitive price

Fast Delivery Avg. within 4 weeks (power capacitor)

Excellent Service Prompt response to customer

- **Reliable high Quality in the field of Transmission & Distribution**

- ✓ **We dedicate Capacitors business since 1956**
- ❖ We optimize our processes to only capacitors in order to enhance product quality and increase customer satisfaction (since 1956)
- ✓ **Environmental friendly**



- **Reliable high Quality in the field of Transmission & Distribution**
- ✓ **Keep the highest level of cleanliness in production line**
- ❖ **Motoring everyday, every subpart**
- ❖ **Variable & Sustained process management program**
 - AHP, Analytic Hierarchy Process
 - 6sigma
 - Everywhere QC Tools application
 - Quality control circles
 - Clearing activities



- Operate Reliability Testing Lab by IEC, IEEE
- ✓ Samwha establish all Special test (Endurance test) facilities and verify manufacturing reliability at every moments

- ❖ Ageing test
- ❖ Overvoltage cycling test

Evaluation of Reliability

SHUNT CAPACITORS FOR AC POWER SYSTEMS HAVING A RATED VOLTAGE ABOVE 1000 V

IEC 60871-2 : Endurance testing (special test)

Ageing test

To ascertain that the progression of deterioration resulting from increased voltage stress at elevated temperature does not cause untimely failure of the dielectric.

Test condition

1. Temperature

a) 60°C

b) The sum of the highest mean temperature in 24 h and the dielectric temperature rise attained at the end of the thermal stability test for the unit to be manufactured

2. Voltage

Test voltage	Duration
1.25 Un	3000 h
1.40 Un	1000 h

- 1 -

Samwha Capacitor Co., Ltd.

Evaluation of Reliability

SHUNT CAPACITORS FOR AC POWER SYSTEMS HAVING A RATED VOLTAGE ABOVE 1000 V

IEC 60871-2 : Endurance testing (special test)

Overvoltage cycling test

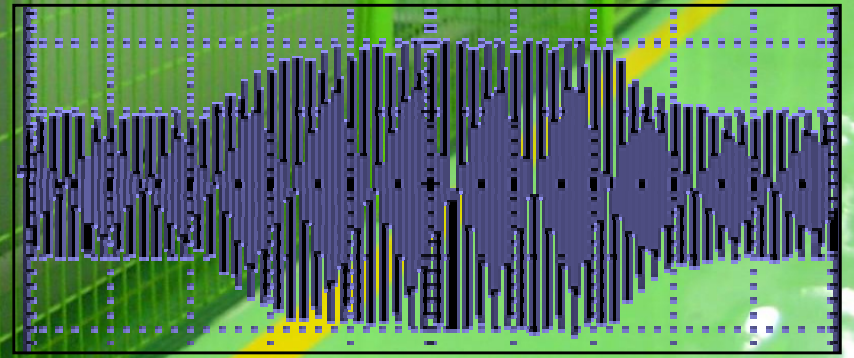
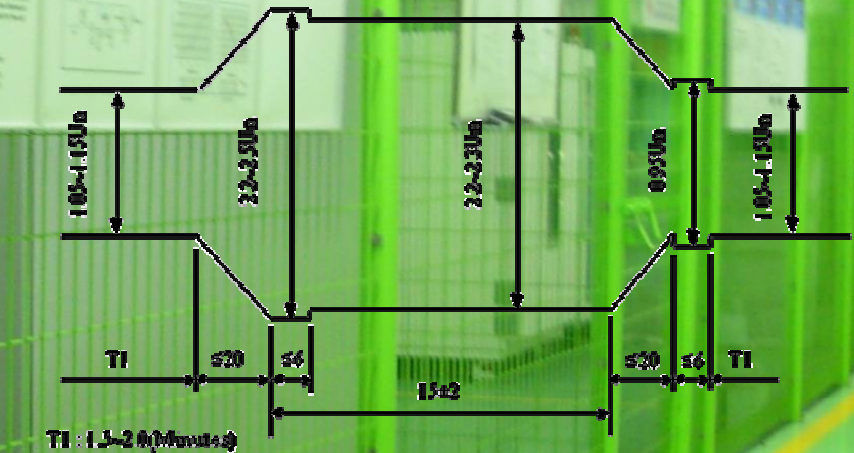
To ascertain that repeated overvoltage cycles, at temperatures ranging from the lowest rated temperature to room temperature, do not cause a dielectric breakdown

Test condition

T1 : 1.5-2.0(Minute)

- 4 -

Samwha Capacitor Co., Ltd.



Successful Type Test Passed from internationally reputed testing laboratories periodically

- ❖ **CESI (Italy)**
- ❖ **FGH(Germany)**
- ❖ **KERI(Korea)**
- ❖ **ENIN(Russia)**

SAMWHA CAPACITOR CO., LTD.
124, Buk-Ri, Namsa-myeon, Cheongu, Yongin-si, Gyeonggi-do, Korea

DESIGN, DEVELOPMENT AND PRODUCTION OF MULTI-LAYER CERAMIC CAPACITOR, DISK CERAMIC CAPACITOR, FILM CAPACITOR, FEED-THROUGH-CAPACITOR, MULTI-LAYER CHIP VARISTOR, DISC VARISTOR, FILTER AND CHIP NTC/NEGATIVE TEMPERATURE

Routine test & Type test Inspection conducted from electricity

ISO9001, ISO14001, ISO/TS 16949 certified

CERTIFICATE
QUALITY MANAGEMENT SYSTEM

kfg Korean Foundation for Quality

SAMWHA CAPACITOR CO., LTD.
124, Buk-Ri, Namsa-myeon, Cheongu, Yongin-si, Gyeonggi-do, Korea

Issuance Date: 2010.05.10
Revision Date: 2013.05.09
K Registration Date: 2007.05.15
K Scale Number: TS-04429

Korean Foundation for Quality certifies that the above organization, having been audited in accordance with the "Rules for the edition" open, complies with

Standard

ISO/TS

TEST REPORT

KERI

Test Report KESI TEST
AT-A0/007374 p.1

client: **SAMWHA CAPACITOR CO. LTD.** - Yongin City, Republic of Korea

equipment under test: Medium voltage capacitor type TAF-T1325665510R

tests performed: Routine and type tests

CERTIFICATE OF REGISTRATION ENVIRONMENTAL MANAGEMENT SYSTEM

Certificate No.: **KRE-001**

Company Name: **SAMWHA ELECTRIC CO., LTD.**
#02, Dviche-Dong, Hwaseong-Ku, Chungju City, Chungbuk, Korea
#20-4, Molsaeng-Dong, Changju City, Chungbuk, Korea
53th Floor SAM YOUNG Bldg, 97-8 Shinsu-Dong, Kangbuk, Seoul, Korea

Certification Scope: **Design, development, production and of Aluminium Electrolytic Capa and Film Capacitors**

Quality System Standard: **KS A 9001:1998 / ISO 9001**

This is to certify that the Quality Management System of this has been found to conform to the above Quality System Standard Institute of Industrial Technology Evaluation & Planning(IIEP)

Certificate Release: 1998, May, 2000
Certificate Expiry: 29th April, 2003
(Registration on 21st February, 1994)

KAB

CERTIFICATE

INTERNATIONAL CERT Zertifizierung GmbH certifies that

Samwha Capacitor Co.,Ltd.

located at:

#124 Buk-ri Namsa-myeon Cheoin-gu, Yongin-si Gyeonggi-do,

FGH Engineering & Test GmbH

Test Certificate

No. **H 07010** (Duly signed copy 0E)

Reference: HV-S-0008

Capacitor B consists of 10 individual elements connected in parallel. Capacitor A contains 5 capacitors of the type B connected in series.

Manufacturer: **Samwha Capacitor, Ltd.**
124, Buk-Ri, Namsa-Myeon, Yongin-Si, Kyunggi-Do, Korea

Customer: **Samwha Capacitor, Ltd.**
124, Buk-Ri, Namsa-Myeon, Yongin-Si, Kyunggi-Do, Korea

Place and Date of Tests: **FGH+HPF Mannheim, 30. October to 13. November, 2006**

Test Specification: IEC 60071-1 (2005-07) Ed. 3.0
IEC 60071-4 (1999-09) Ed. 1.0

Capacitor A: Routine tests
Type tests with exception the disconnecting test on fuses
Capacitors B: Disconnecting test on fuses

Test Results: **All tests passed successfully.**
For details see sheet 4.

Mannheim, 5 February, 2007 Number of sheets: 21
This document may only be used complete and unaltered.
FGH Engineering & Test GmbH is a laboratory of the **CESI** Group

Independent test laboratory accredited acc. to DIN EN ISO/IEC 17025 by Deutsche Akkreditierungsstelle GmbH (DAkkS) e.V. in the fields of high voltage equipment and components, power cables and their accessories, electric magnetic compatibility (EMC), quality of voltage and frequency.

Member Laboratory of the Short-Circuit Testing Liaison (STL)

FGH Engineering & Test GmbH | Hülshausweg 40 | 68219 Mannheim | Germany
Telefon +49 (0)62118847-0 | Telefax +49 (0)62118847-250 | www.fgh-ma.com | info@fgh-ma.com

Constant Research & Analysis

✓ Satisfy both international practice & local practice

- ❖ Study local regulations
- ❖ Find key factors in the regulations
- ❖ Suggest the best way of bank design
- ❖ Simplify designing tools

Internal fused type Capacitor Bank _ IEEE C 37.99, 2000'

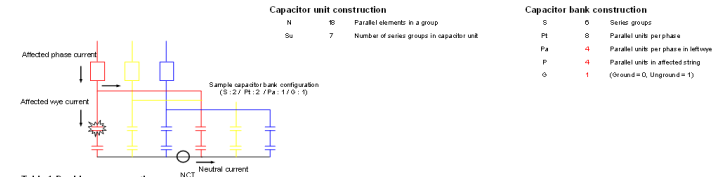


Table 1. Double wye connection

Item	Internal group per unit capacitance	Group capacitor unit of per unit capacitance	Capacitor unit per unit capacitance	Parallel group per unit capacitance	Affected string capacitance	Per unit capacitance phase with affected unit	Neutral to ground voltage per unit (V)	Voltage on affected phase	Voltage on affected phase	Voltage on affected element	Current through affected capacitor	Current in affected string	Current in affected phase	Ground current change	Neutral current balance value	Difference current value	Aib rms value
0	1.000	1.000	1.000	1.000	1.000	1.000	0.000000	1.000000	1.000	1.000	1.000	1.000	1.000	1.000	0.000000	0.000000	0.0
SE	Short circuit	0.000	1.167	1.042	1.007	1.003	-0.00112	0.99989	0.965	0.000	1.125	1.005	1.002	0.000	-0.00199	0.0	0.1
1	0.944	1.000	0.962	0.998	1.000	1.000	0.000000	1.000000	1.002	1.002	0.999	1.000	0.999	0.000	0.000000	0.0	0.0
2	0.889	1.100	0.982	0.996	0.996	1.000	0.000012	1.00012	1.004	1.100	0.995	0.999	0.999	0.000	0.000010	0.0	0.0
3	0.833	1.167	0.972	0.993	0.990	0.990	0.000019	1.00019	1.006	1.172	0.992	0.996	0.996	0.000	0.000019	0.0	0.0
4	0.778	1.225	0.961	0.991	0.986	0.986	0.000026	1.00026	1.012	1.244	0.987	0.990	0.990	0.000	0.000026	0.0	0.0
5	0.722	1.313	0.948	0.990	0.980	0.980	0.000033	1.00033	1.018	1.346	0.988	0.989	0.989	0.000	0.000033	0.0	0.0
6	0.667	1.400	0.933	0.989	0.976	0.976	0.000040	1.00040	1.024	1.478	0.989	0.988	0.988	0.000	0.000040	0.0	0.0
7	0.611	1.500	0.917	0.988	0.968	0.968	0.000047	1.00047	1.030	1.640	0.988	0.986	0.986	0.000	0.000047	0.0	0.0
8	0.556	1.616	0.897	0.987	0.956	0.956	0.000054	1.00054	1.036	1.842	0.987	0.984	0.984	0.000	0.000054	0.0	0.0
9	0.500	1.750	0.875	0.986	0.940	0.940	0.000061	1.00061	1.042	2.084	0.986	0.980	0.980	0.000	0.000061	0.0	0.0

Standard table for Shunt power capacitor

ITEM		IEC 6087 1-1 (2005)	IEEE 5.11																											
Scope	Voltage condition	[kV]	Also vs 1000V																											
	Frequency	[Hz]	50 / 60																											
	Capacity	[kvar]	Also vs 2.5kvar																											
Standard condition	Temperature condition	Maximum ambient temperature	<table border="1"> <tr> <th>System</th> <th>Maximum</th> <th>Minimum</th> <th>Storage</th> </tr> <tr> <td>A</td> <td>40</td> <td>10</td> <td>25</td> </tr> <tr> <td>B</td> <td>40</td> <td>10</td> <td>25</td> </tr> <tr> <td>C</td> <td>40</td> <td>10</td> <td>25</td> </tr> </table> <p>NOTE: These temperature values can be found in the meteorological temperature table covering the installation site.</p>	System	Maximum	Minimum	Storage	A	40	10	25	B	40	10	25	C	40	10	25	<table border="1"> <tr> <th>Mounting arrangement</th> <th>Maximum air temperature - °C</th> </tr> <tr> <td>Indoor capacitor</td> <td>40</td> </tr> <tr> <td>Single row of capacitor</td> <td>40</td> </tr> <tr> <td>Multiple row and tier of capacitor</td> <td>40</td> </tr> <tr> <td>Manufactured or repaired equipment</td> <td>40</td> </tr> </table>	Mounting arrangement	Maximum air temperature - °C	Indoor capacitor	40	Single row of capacitor	40	Multiple row and tier of capacitor	40	Manufactured or repaired equipment	40
		System	Maximum	Minimum	Storage																									
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Manufactured or repaired equipment	40																													
Minimum ambient temperature	-40 °C	-40 °C																												
Overload	Maximum relative humidity	[%]	100%																											
	Altitude	[m]	1000																											
Overload	Maximum voltage	[kV]	<table border="1"> <tr> <th>Type</th> <th>Voltage factor (1.25)</th> <th>Maximum</th> <th>Minimum</th> <th>Observation</th> </tr> <tr> <td>Capacitor</td> <td>1.25</td> <td>Continuously</td> <td>1.25</td> <td>Higher average value during one year of operation is permitted only if the capacitor is designed for continuous operation at 1.25 times the rated voltage and the manufacturer's instructions are followed.</td> </tr> <tr> <td>Capacitor</td> <td>1.25</td> <td>30 min. at 1.25 times</td> <td>1.25</td> <td>Capacitor voltage regulation and fluctuations.</td> </tr> <tr> <td>Capacitor</td> <td>1.25</td> <td>1.0 sec.</td> <td>1.25</td> <td>Capacitor voltage regulation and fluctuations.</td> </tr> <tr> <td>Capacitor</td> <td>1.25</td> <td>1.0 sec.</td> <td>1.25</td> <td>Capacitor voltage regulation and fluctuations.</td> </tr> </table>	Type	Voltage factor (1.25)	Maximum	Minimum	Observation	Capacitor	1.25	Continuously	1.25	Higher average value during one year of operation is permitted only if the capacitor is designed for continuous operation at 1.25 times the rated voltage and the manufacturer's instructions are followed.	Capacitor	1.25	30 min. at 1.25 times	1.25	Capacitor voltage regulation and fluctuations.	Capacitor	1.25	1.0 sec.	1.25	Capacitor voltage regulation and fluctuations.	Capacitor	1.25	1.0 sec.	1.25	Capacitor voltage regulation and fluctuations.	110% of rated rms voltage 120% of rated peak voltage (ex: 1.24 (2.4kV) including harmonics but excluding transients)	
	Type	Voltage factor (1.25)	Maximum	Minimum	Observation																									
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Capacitor	1.25	1.0 sec.	1.25	Capacitor voltage regulation and fluctuations.																										
Maximum current	[A]	Rated current X 1.3	120% of nominal rms current based on rated kvar and rated voltage																											
Maximum capacity	[kvar]	---	120% of rated kvar																											
			<table border="1"> <tr> <th>Tab. no (rated-kvar)</th> <th>kvar</th> <th>Number of phases</th> <th>IEEE*</th> </tr> <tr> <td>26</td> <td>5710, 8100, 26400</td> <td>3ph</td> <td>3^φ</td> </tr> <tr> <td>26</td> <td>15570, 21, 53, 25, 40, 5</td> <td>3ph</td> <td>3^φ</td> </tr> </table>	Tab. no (rated-kvar)	kvar	Number of phases	IEEE*	26	5710, 8100, 26400	3ph	3 ^φ	26	15570, 21, 53, 25, 40, 5	3ph	3 ^φ															
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IEC 60871-1 Ed. 3.0 b	2005	Shunt capacitors for a.c. power systems having a rated voltage above 1000 V - Part 1: General
IEC/TS 60871-2 Ed. 2.0 b	1999	Shunt capacitors for a.c. power systems having a rated voltage above 1 000 V - Part 2: Endurance testing
IEC/TS 60871-3 Ed. 1.0 b	1996	Shunt capacitors for a.c. power systems having a rated voltage above 1000 V - Part 3: Protection of shunt capacitors and shunt capacitor banks
IEC 60871-4 Ed. 1.0 b	1996	Shunt capacitors for AC power systems having a rated voltage above 1000 V - Part 4: Internal fuses
IEC 60831-1 Ed. 2.1 b	2002	Shunt power capacitors of the self-healing type for a.c. systems having a rated voltage up to and including 1000 V - Part 1: General - Performance, testing and rating - Safety requirements - Guide for installation and operation
IEC 60831-2 Ed. 2.0 b	1995	Shunt power capacitors of the self-healing type for a.c. systems having a rated voltage up to and including 1000 V - Part 2: Ageing test, self-healing test and destruction test
KS : Korean Industrial Standard		
KS C 4801	2003	Low-voltage power condenser
KS C 4802	1997	HIGH-VOLTAGE POWER CONDENSER
JIS : Japanese Industrial Standard		
JIS C 4901	2000	Low-voltage power capacitors
JIS C 4902	1998	High voltage power capacitors and attached apparatus
NEMA : National Electrical Manufacturer Association		
NEMA CP 1	2000	Shunt capacitors
NEMA CP 9	1992	External fuses for shunt capacitors
IEEE : Institute of Electrical and Electronics Engineers		
IEEE 18	2002	Shunt power capacitors
IEEE 1036	1992	Guide for application of shunt power capacitors
IEEE C 37.99	2000	Guide for the protection of shunt capacitor banks

- **Provide Perfect System Engineering Service to customers**

- ✓ **Provide Best Power Quality Solution**

- ❖ **Measurement reporting & Simulations**

Load flow

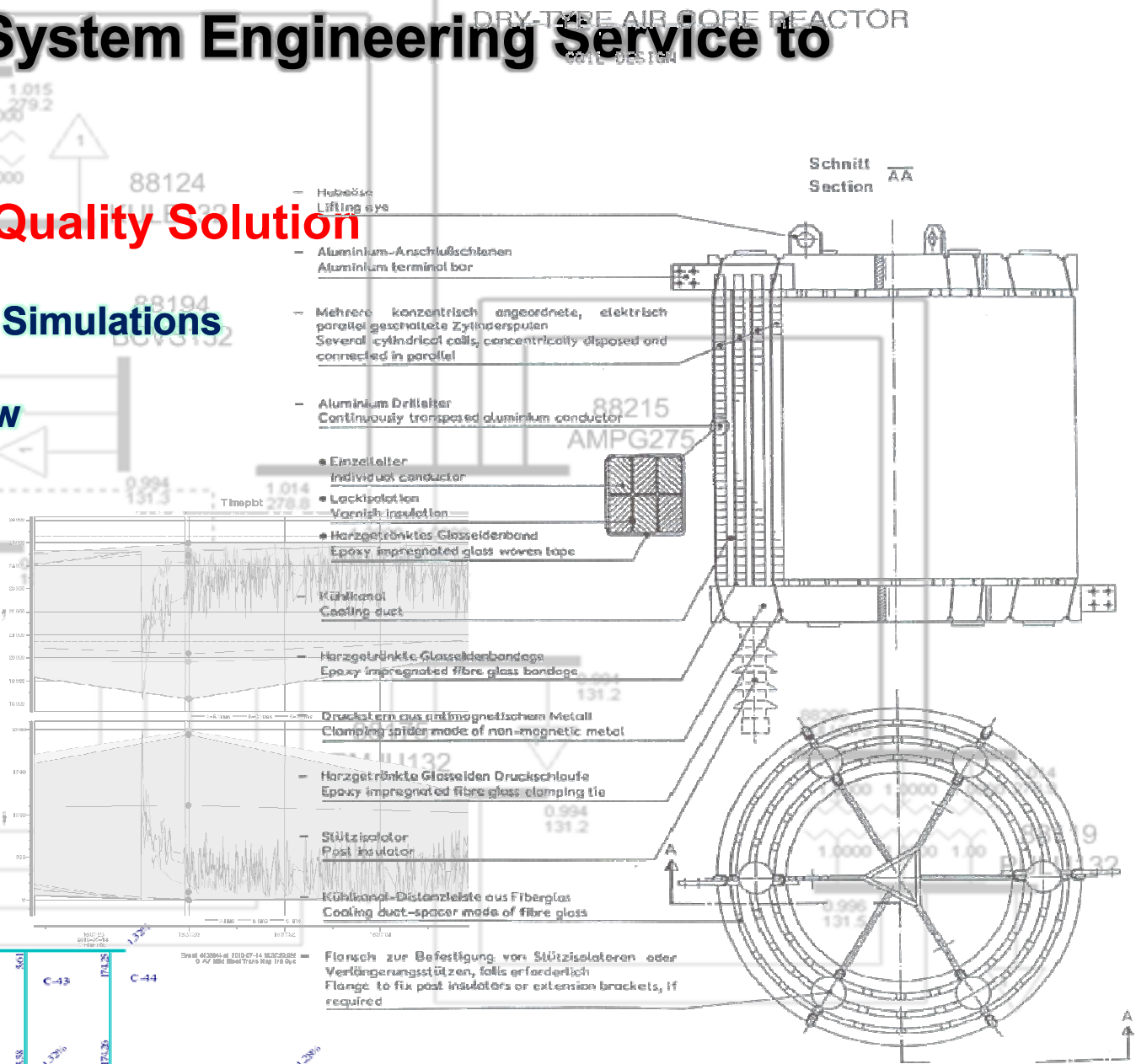
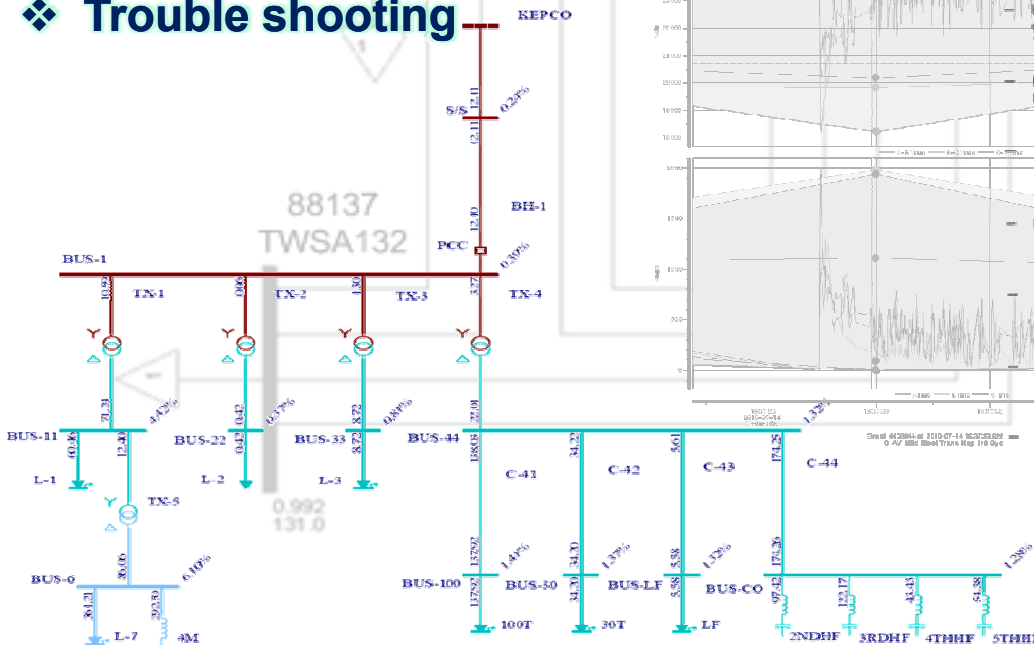
Harmonic current flow

Transient analysis

Event analysis

- ❖ **Optimum Filter design**

- ❖ **Trouble shooting**



Constant Innovation in Techniques becomes Market Leader





Smart Grid Field testing in Jeju Island

- Smart Grid [Renewable]
- Smart Grid [Transportation]
- Smart Grid [Power Grid]
- Smart Grid [Electricity Service]
- Smart Grid [Smart Place]



Name	Product	Application
<h2>Shunt Capacitor</h2>		
<h2>DCC</h2> <p>(Disc Ceramic Capacitor)</p>		
<h2>MLCC</h2> <p>(Multi-Layer Ceramic Capacitor)</p> <h2>Leaded MLCC</h2>		

Product Range of Heavy Electric Div.

Name	Range	Application
<p>Capacitor</p>	<p>Low Volt. [Oil, Dry]</p> <p>Medium Volt.</p> <p>High Volt.</p>	
<p>Bank System</p>	<p></p> <p>< PF Compensation Bank ></p>	<p></p> <p>< Static Var Compensator ></p> <p></p> <p>< Harmonic Filter ></p>

Power Capacitor

The capacitors are designed for power factor correction and harmonics filtration in power network.
 They are all-film dielectric and impregnated with an environmentally **Non-PCB biodegradable insulation oil**.
 Each capacitor is provided with an **internal discharge resistor**.

Benefits

- Improve Power Factor
- Reduce Line Losses
- Decrease Voltage Drop

Product Scope

Type	Volt Range	Power Range	Type	Standard
High	1P : 1 ~ 22kv 3P : 1 ~ 11kv	1P : 25 ~ 1000kvar 3P : 50 ~ 500kvar	Internal Fuse Fuseless	IEC, ANSI, IEEE, NEMA
Low	Oil : 220 ~ 1000v Dry : 220 ~ 1000v	Oil : 0.2 ~ 150kvar Dry : 0.2 ~ 50kvar	Protected (overpressure disconnected)	

Application

- Electricity Authority (Utility Company)
- Panel Builder
- Heavy Industrial Plant (Steel, Paper, Chemical, Automobile, Cement etc.)

Capacitor Bank

Capacitor Bank is an economical method of reducing the reactance of high voltage lines. And it controls the level of voltage supplied by reducing or eliminating the voltage drop and increase power transfer in network.

Benefits

- Increase power transmission capability
- Improve system stability
- Reduce system losses
- Improve voltage profile on the lines

Bank Type

① Cubicle Capacitor Bank :

- The product range consists of indoor and outdoor solutions, which can be single step fixed or other multi-step switched.
- It will automatically compensate the network to maintain a preset level of power factor.

② Open-Rack Capacitor Bank :

- This is the most common capacitor bank and available with internally fused capacitor or fuseless capacitor units.

③ Pole Mounted Capacitor Bank(Fix type, Switch type) :

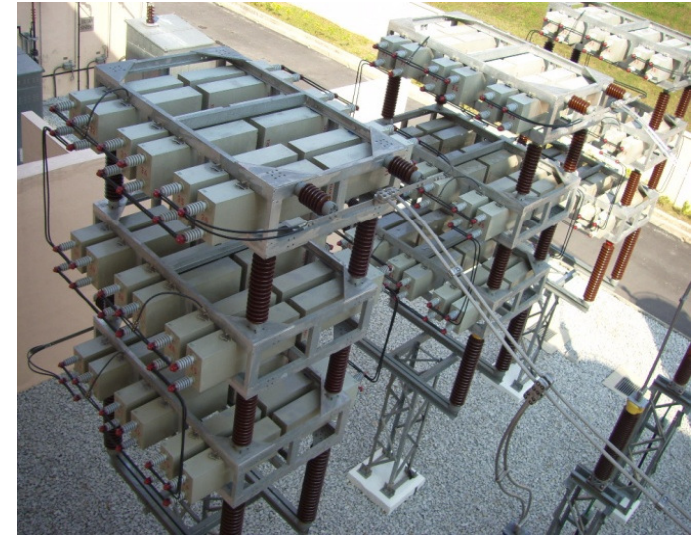
- It provides voltage support, reducing system losses, improving power factor in the network.
- The installation is in a distribution network.

Application

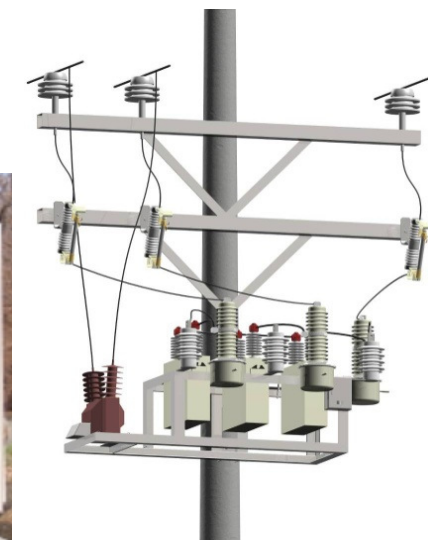
- Electricity Authority (Utility Company)
- Electrical Contractor
- Heavy Industrial Plant (Steel, Paper, Chemical, Automobile, Cement etc.)

Capacitor Bank (Open Structure, Enclosure, Pole Mounted)

55/66/115/138/150/230kV etc./ Transmission Line



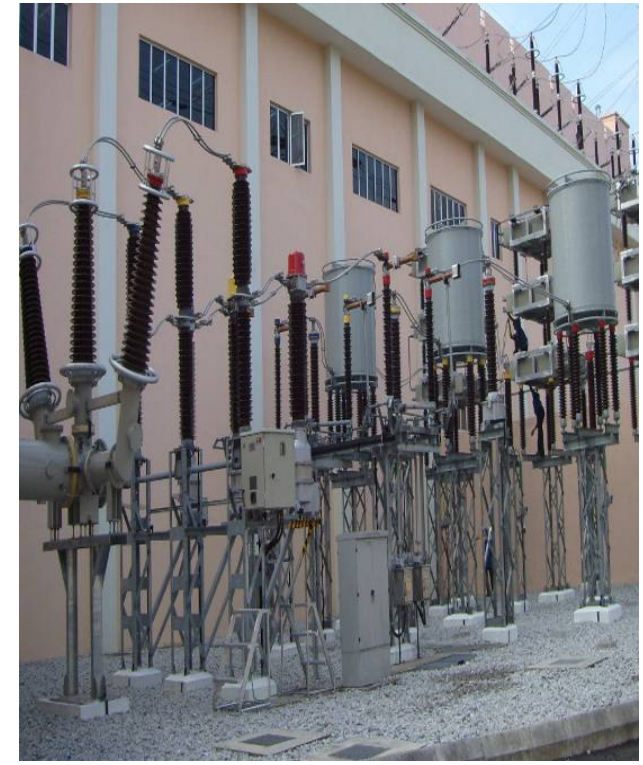
12.5/24/34.5kV etc./ Distribution Line



Reference

TNB(Malaysia)

Volt (kV)	Mvar	Country	Electricity	Site
132	60	Malaysia	TNB	Kuala Lumpur Ampang Substation



Reference

EGAT(Thailand)

Volt (kV)	Mvar	Country	Electricity	Site
115	36	Thailand	EGAT	Bangkok Samphan Substation



Reference

KEPCO(Korea)

Volt (kV)	Mvar	Country	Electricity	Site
154	50	Korea	KEPCO	Cheong-Ha Cheong-Ha Substation



Reference

PT.PLN(Indonesia)

Volt (kV)	Mvar	Country	Electricity	Site
150	25	Indonesia	PT.PLN	Sumatera Duri Substation



Reference

Moscow Electric Power Grid(Russia)

Volt (kV)	Mvar	Country	Electricity	Site
110	25	Russia	MEPG	Astrahan Substation



◎ Export: 35 Countries

Moscow Electric Power Grid



MEA(Thailand)



TENAGA NASIONAL BERHAD
(2009E-W)



PT PLN (Persero)



TẬP ĐOÀN ĐIỆN LỰC VIỆT NAM
VIETNAM ELECTRICITY



FESCO
Faisalabad Electric Supply Company



◎ Domestic: M/S 80%



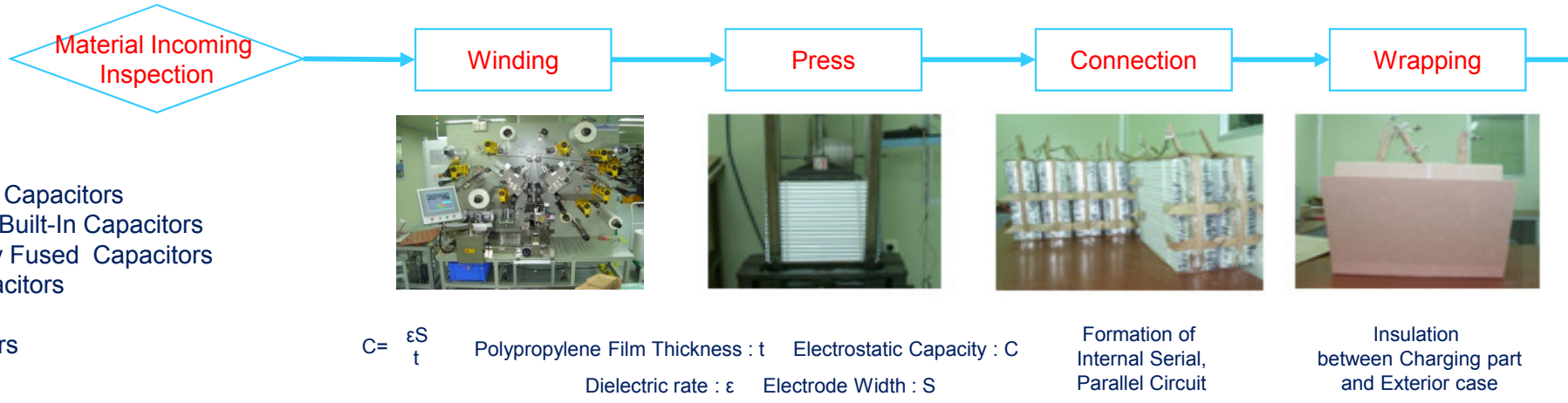
소리없이 세상을 움직입니다
www.posco.co.kr



NH (Non-Self Healing) Capacitor Mfg. Process

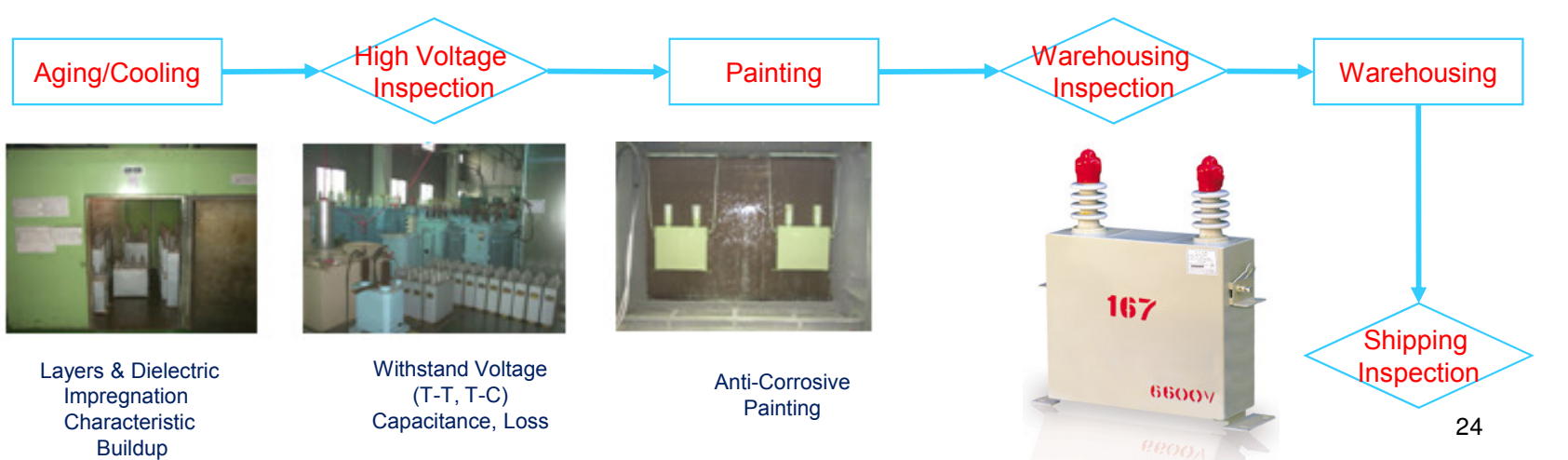
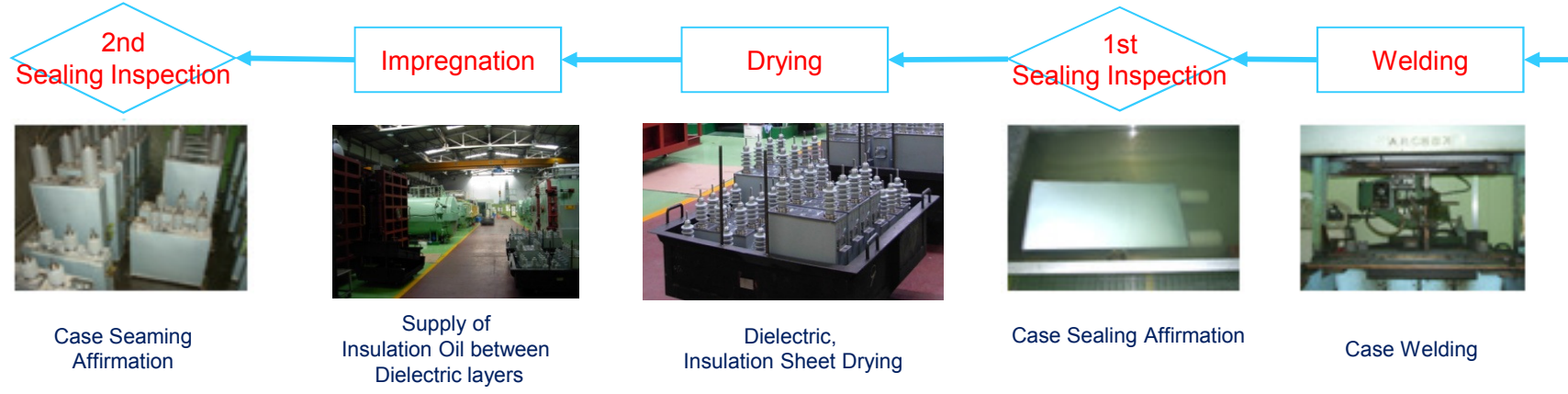
<< Products >>

- ◆ Extra High Voltage 1P Capacitors
- ◆ High Voltage 3P NCS Built-In Capacitors
- ◆ High Voltage Internally Fused Capacitors
- ◆ Surge Absorbing Capacitors
- ◆ Grounding Capacitors
- ◆ Pulse Power Capacitors

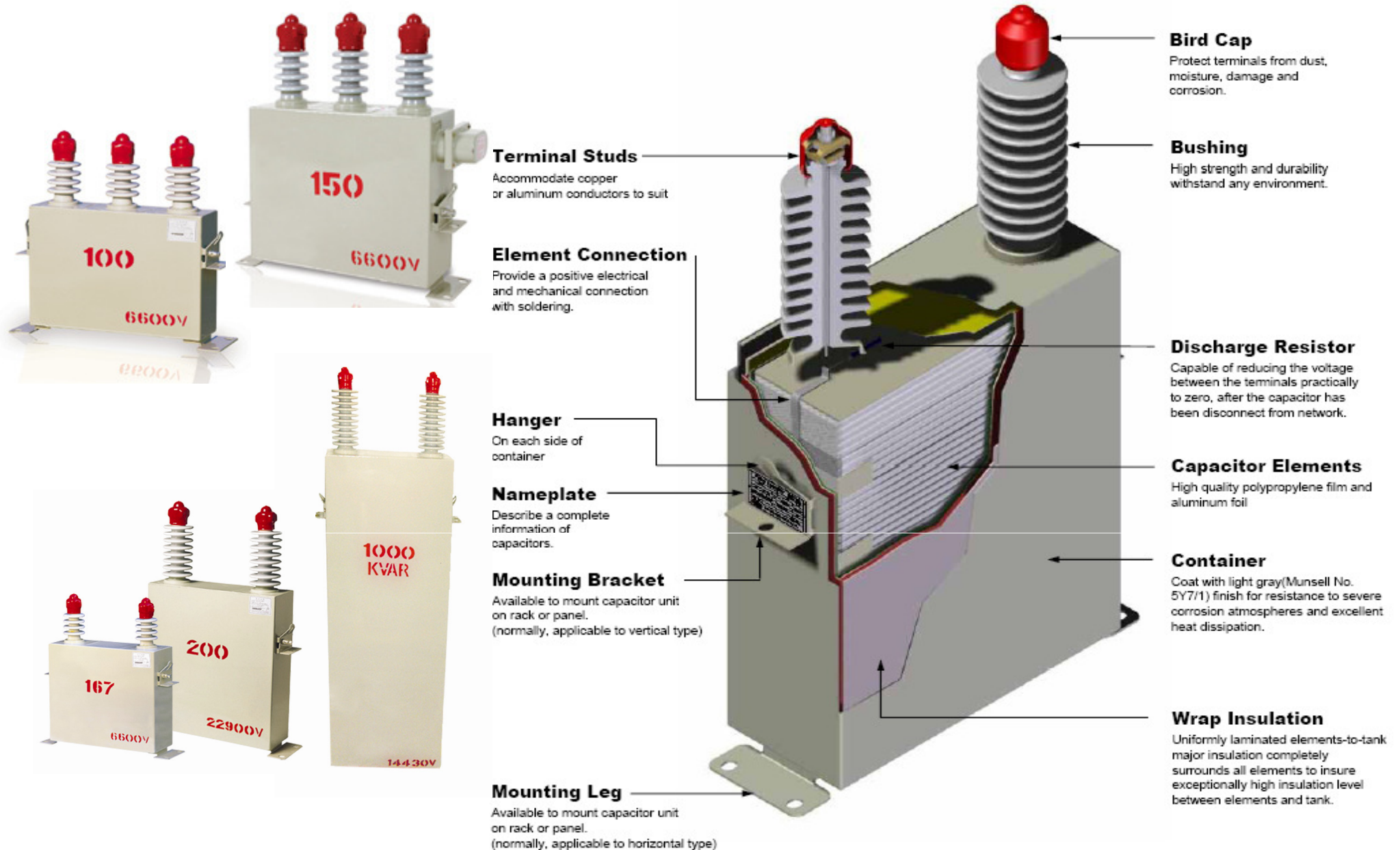


<< Major Materials >>

- ◆ Dielectric : Polypropylene Film (Roughness Type)
- ◆ Electrode : Aluminum Foil
- ◆ Insulation Oil : Jarylec C D101-Oil
- ◆ Case : Stainless Steel or Electrolytic galvanized Iron Sheet



Cutaway View of NH type Single Phase Unit





Thank You !