



The power behind competitiveness

Delta PQC Series Power Quality Solution

Active Power Filter (APF)

Static VAR Generator (SVG)

www.deltapowersolutions.com



DELTA
Smarter. Greener. Together.

About Delta Group

Delta Group is the world's leading provider of power management and thermal management solutions, as well as a major source for components, visual displays, industrial automation, networking products, and renewable energy solutions. Delta Group focuses on three main businesses: power electronics, energy management, and smart green life. Delta Group has sales offices worldwide and manufacturing plants in Taiwan, China, Thailand, Japan, Mexico, India, Brazil, and Europe.

As a global leader in power electronics, Delta's mission is, "To provide innovative, clean and energy-efficient solutions for a better tomorrow." Delta is committed to environmental protection and has implemented green, lead-free production and recycling and waste management programs for many years.

More information about Delta Group can be found at www.deltaww.com

Delta's Quality

Products - Delta's quality ensures customer satisfaction

Delta insists on the strictest quality control and management in various phases from development to manufacturing to ensure customer satisfaction by embracing the philosophy "Do things right the first time." Maintaining and exceeding the highest quality standards makes Delta the first-choice supplier of many world-leading enterprises.



2010
Panasonic Electric Networks
Certificate of Appreciation



2010
Cisco
Partner Collaboration
Excellence Award



2008
Fujitsu Siemens
Computers Preferred
Supplier Award



2008
Nokia Siemens
Outstanding Performance
Award



2007-2008
Fabulous 50
Award



2007
Intel
Supplier Achievement Award



2007
Rockwell
Outstanding Performance
Award



2005
Siemens Communications
Supplier of the Year Award



2004
Cisco
Supplier of the Year Award



2004
Microsoft
Vendor of the Year Award



Delta's Manufacturing

Delta in China has 23 R&D Centers with over 2,000 R&D engineers and 22 plants with a total manufacturing area of over 7,000,000 sq. ft. (680,000 m²).

Delta's Green Business

Delta was nominated as one of the “Global Top 100 Low-Carbon Emission Enterprises” by the CNBC European Business Magazine.

Delta has won the “Corporate Social Responsibility Award and Honorary Award” from Global Views Magazine for four consecutive years.

Delta has won the “Corporate Citizenship Award” from Common Wealth Magazine for three consecutive years.

Delta Group’s mission statement, “To provide innovative, clean and energy-efficient solutions for a better tomorrow”, focuses on social responsibility and represents Delta’s confidence in putting advanced technology into practice on behalf of sustainability.

Delta Group’s president has said, “If Delta’s power efficiency is improved by just 1%, there can be fewer power plants in the world.”

Delta's Technology

Global Top 500 in Research and Development

Investing 5% of its annual operating revenues in R&D, Delta Group ranked No. 431 in a world ranking by the Department of Trade and Industry, United Kingdom.

The IEEE selects the three best theses every year to honor outstanding contributions to the academic fields of electrical and electronics engineering.

In September 2009, Delta’s thesis “Performance Evaluation of Bridgeless PFC Boost Rectifiers” stood out from 313 other theses and won the best thesis award issued by Prof. Deepak Divan, the IEEE Chairman, who presented the best thesis award to Milan M. Jovanovi, the manager of Delta’s R&D center in USA.



Power Quality and Harmonics

Power Quality Issues Overview

Power quality determines the suitability of electric power for consumer devices. There are three main contributors to low voltage and poor power quality problems:

- Harmonic Pollution causes extra stress on a power supply system and reduces reliability.
- Reactive Power loads the power supply system unnecessarily.
- Load Imbalance increases neutral current and neutral to earth voltage.

Harmonics

Normally, power system generators produce a clean sinusoidal voltage waveform at their terminals. However, a lot of modern electronic equipment such as VFDs, UPSs, LEDs, battery chargers, and other equipment powered by switched-mode power supply (SMPS) equipment, generates non-sinusoidal current injected into the power system, which causes electrical harmonic pollution.



Harmonics Standard

Based on “IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems” (IEEE 519-2004) , the grid voltage distortion limits:

Bus Voltage at (kV)	Total Voltage Distortion (%)	Individual Voltage Distortion (%)
69 kV and below	5.0	3.0
69.001 kV through 161kV	2.5	1.5
161.001kV and above	1.5	1.0

Current Distortion Limits for General Distribution Systems (120V-69000V)

Maximum Harmonic Current Distortion in Percent of IL						
Individual Harmonic Order (Odd Harmonics)						
Isc / I	< 11	11 ≤ h < 17	17 ≤ h < 23	23 ≤ h < 35	35 ≤ h	TDD
<20*	4.0	2.0	1.5	0.6	0.3	5.0
20<50	7.0	3.5	2.5	1.0	0.5	8.0
20<50	10.0	4.5	4.0	1.5	0.7	12.0
100<1000	12.0	5.5	5.0	2.0	1.0	15.0
>1000	15.0	7.0	6.0	2.5	1.4	20.0

Even harmonics are limited to 25% of the odd harmonic limits above.

Current distortion that results in a DC offset, such as half-wave converters, are not allowed.

* All power generation equipment is limited to these values of current distortion, regardless of actual Isc/IL.

where

Isc = maximum short-circuit current at PCC.

IL = maximum demand load current (fundamental frequency component) at PCC.

Reactive Power

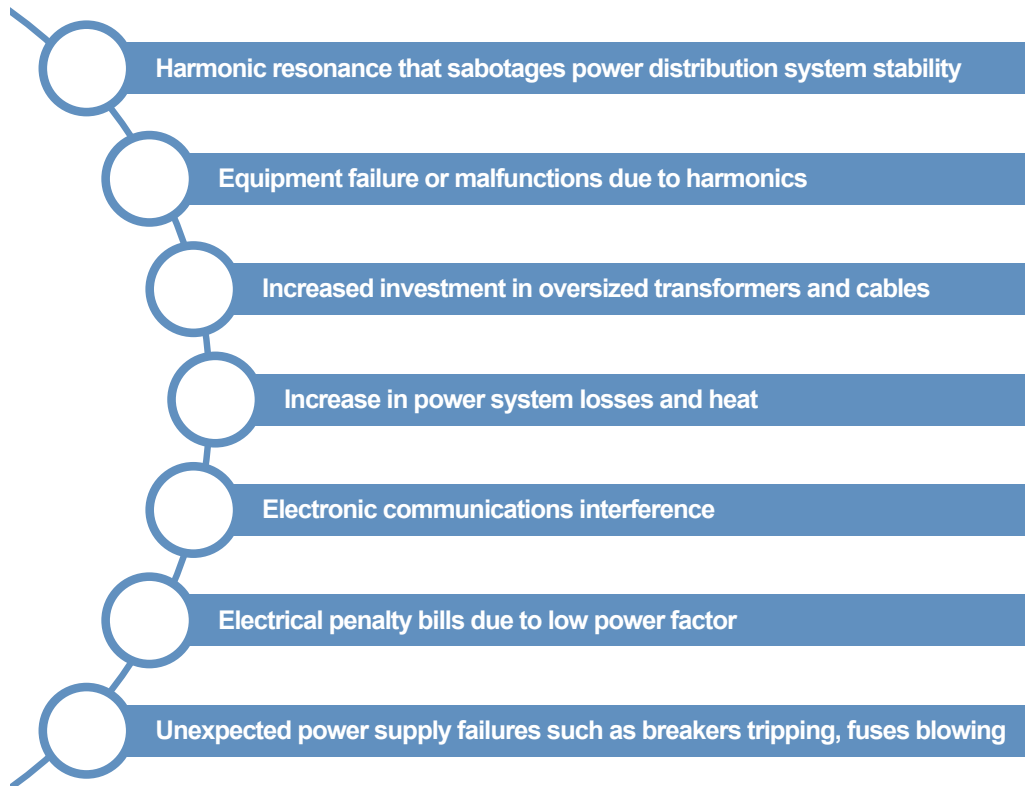
In most cases, reactive power is the power that magnetic equipment such as transformers, motors and relays, needs to produce magnetizing flux, which is inductive. In some cases, long distance power cables and some loads generate capacitive reactive power. Both inductive and capacitive reactive power will increase the apparent power (kVA), demanding larger transformers and cable size.

Load Imbalance

Every three-phase current can be divided into positive, negative and zero sequences. Negative and zero sequences cause load imbalance.

Power Quality Problems

Poor Power Quality can be described as any event related to the electrical network that ultimately results in a financial loss. Possible consequences of poor Power Quality include:



Delta Power Quality Solution Evolution

Delta PQC series power quality solution consists of the Active Power Filter (APF) and Static VAR Generator (SVG). Both provide an active compensation solution based on power electronics technology.

Compared with conventional passive compensation solutions such as capacitor banks, an active compensation solution improves the reliability and quality of the power distribution system.



Comparison between Capacitor Bank, SVG and APF

Item	Capacitor Bank	SVG	APF
Harmonic Filtering	Unavailable	Unavailable	Eliminate 2nd~50th harmonics (selectable)
Reactive Power Compensation	Discretely compensate inductive reactive power only	Steplessly compensate both inductive and capacitive reactive power	Steplessly compensate both inductive and capacitive reactive power
Imbalance Correction	Unavailable	Available	Available
Response Speed	slow, can't track dynamic reactive power (20ms~5s)	fast, can track dynamic reactive power (<0.1ms)	fast, can track dynamic harmonic & reactive loads (<0.1ms)
Harmonic Resonance Problem	Potential resonance between capacitor and transformer sabotages power system stability.	Active compensation technology avoids harmonic resonance from the principle.	Active compensation technology avoids harmonic resonance from the principle.
Output Ability	Actual output capacity is less than the rated capacity.	Actual output capacity is the same as rated capacity.	Actual output capacity is the same as rated capacity.

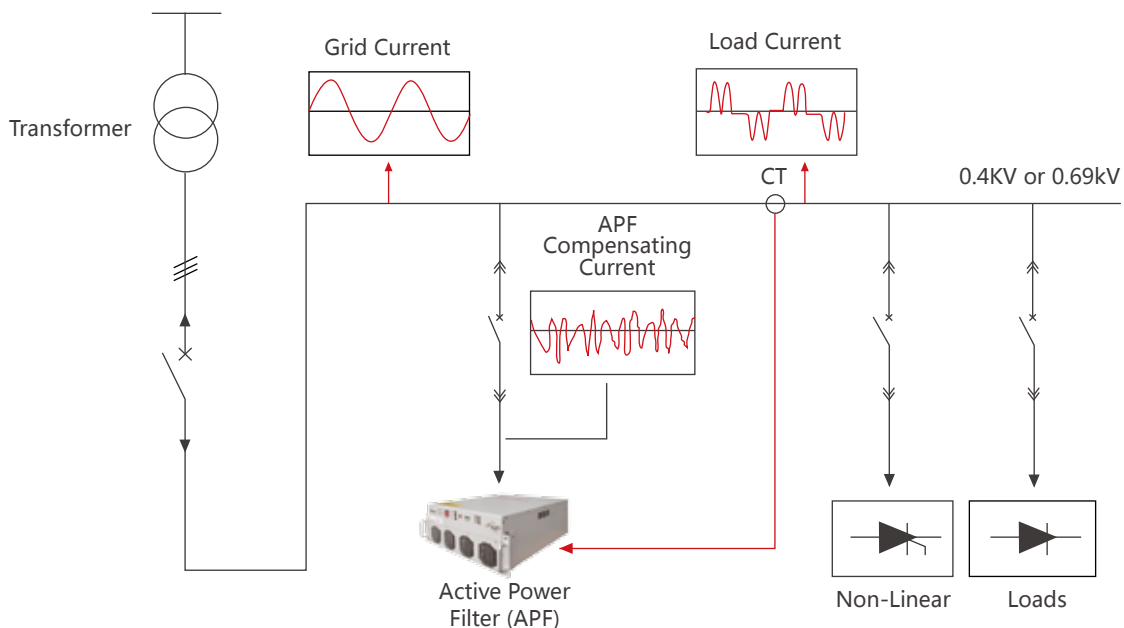
Delta PQC Series Active Power Filter (APF)

APF Principle

Delta's PQC Series APF is connected in parallel with non-linear loads, and uses one set of current transformers (CT) to detect the load current. It calculates each order harmonic current by FFT algorithms in its DSP microchips, and then generates a compensating current with the same amplitude but opposite phase angles to the detected harmonic current, which cancels out the original load harmonics.

The PQC series APF not only eliminates harmonic current from the load side, but it also mitigates harmonic voltage caused by harmonic currents. The APF system can also improve power factor (PF) and correct load imbalances in the power system.

Note: CT is a critical part of the APF system, and it can be purchased by users themselves, following Delta's suggestions on CT specification.



APF Structure

Delta PQC Series APF has a modular design. Usually the Delta active power filter system consists of one or several APF modules and an optional Liquid Crystal Monitor & Control Panel (LCM). Each APF module is an independent harmonic filtering system, and users can change the harmonic filtering system rating by adding or removing APF modules.

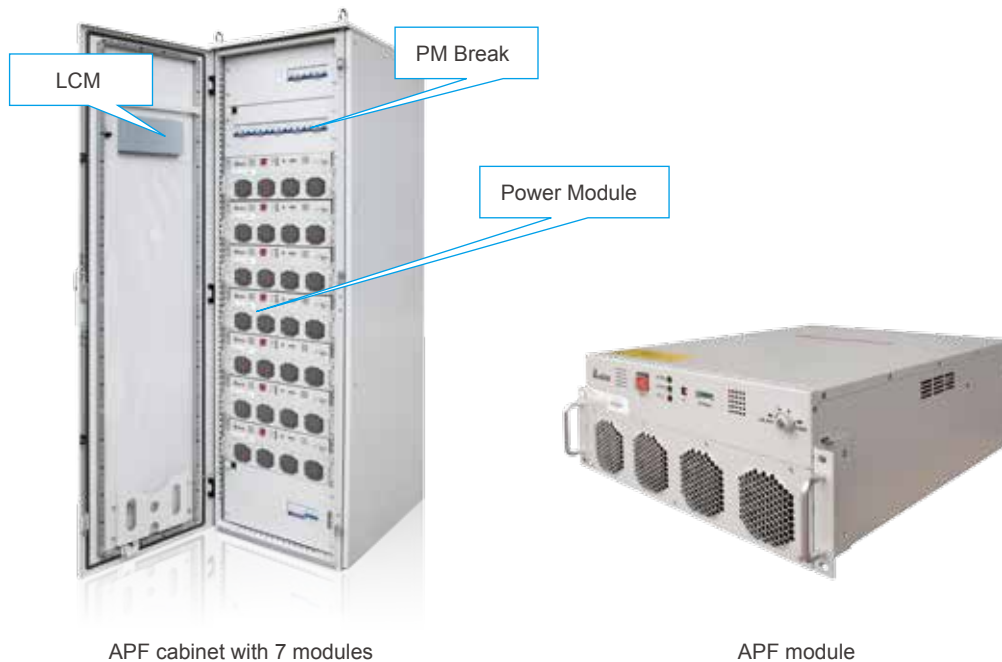
According to the mounting type, Delta PQC series APF can be divided into Modular APF and Wall-mounted APF.

Modular APF

APF modules and an LCM panel can be embedded in Delta's standard APF cabinet or a customized cabinet. There are breakers, cable terminals and Surge Protection Device (SPD) in the APF cabinet.

According to cable terminal type, a modular APF can be divided into two types:

- Draw type modular APF (hot-swappable)
- Fixed type modular APF (not hot-swappable)



Wall-mounted APF

Delta's Wall-mounted APF can be installed on a wall, which is suitable for low rating applications, and an optional LCM panel can be fixed on the wall-mounted APF according to customer requirements.



Wall-mounted APF without LCM



Wall-mounted APF with LCM

APF Compensation Performance

Delta's PQC Series APF can perfectly mitigate harmonic current, and suppress harmonic voltage caused by the harmonic current. When the APF capacity is sufficient and background harmonic voltage is low, the APF ensures excellent compensation performance at full load condition, as below.

- THDu (Total Harmonic Distortion of Voltage) < 3%
- THDi (Total Harmonic Distortion of Current) < 5%
- PF (Power Factor) ≥ 0.99 (improves both leading and lagging PF)
- Neutral Current Attenuation Ratio ($\frac{I_{N(\text{Before})} - I_{N(\text{After})}}{I_{N(\text{Before})}}$) > 95%

Delta's PQC Series APF Actual Compensation Performance



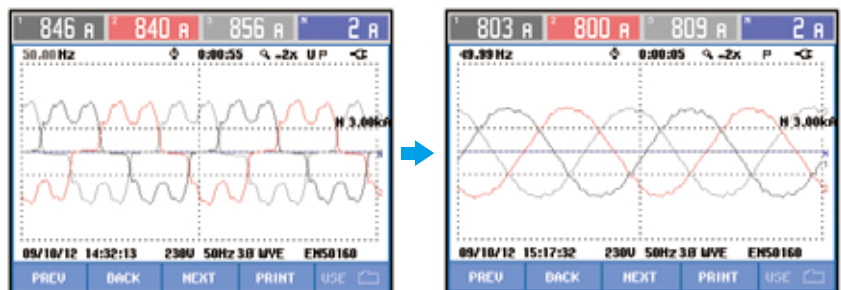
Application: Textile Industry

Non-linear Loads: Variable Frequency Drive (VFD).

Compensation Result: Current harmonic distortion (THDi) was reduced from 32.5% to 2.9%.

Current waveform and spectrum are recorded by Fluke 435, as below.

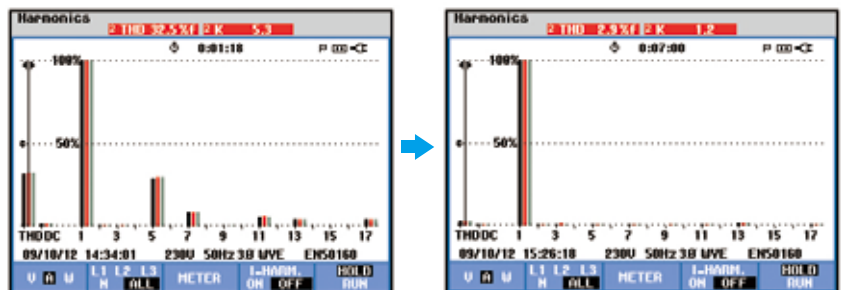
Current Waveform



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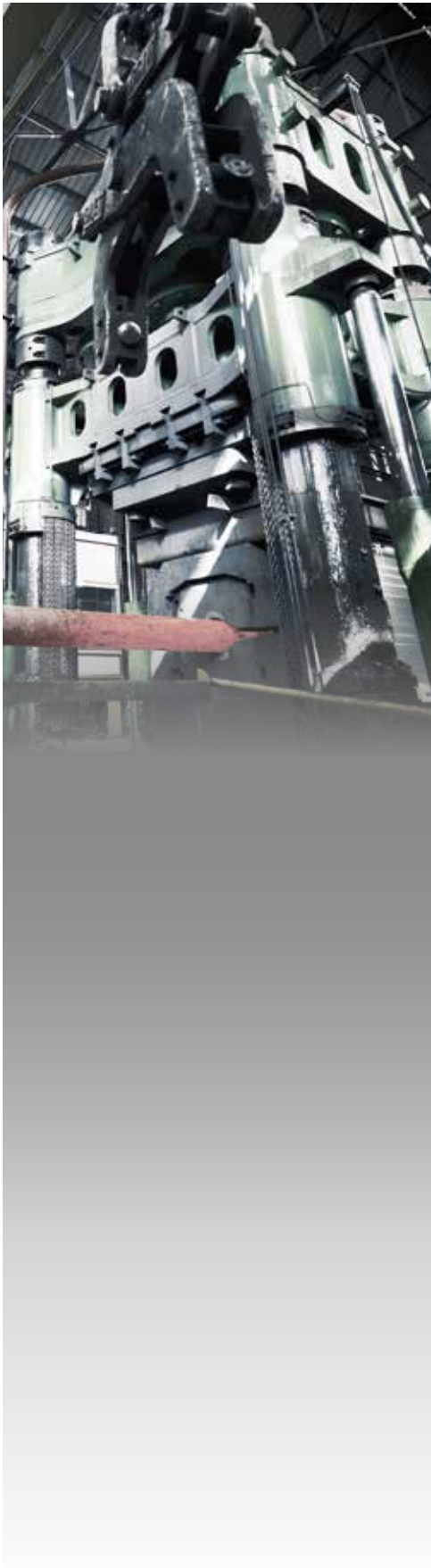
AFTER

Current Spectrum



BEFORE

AFTER



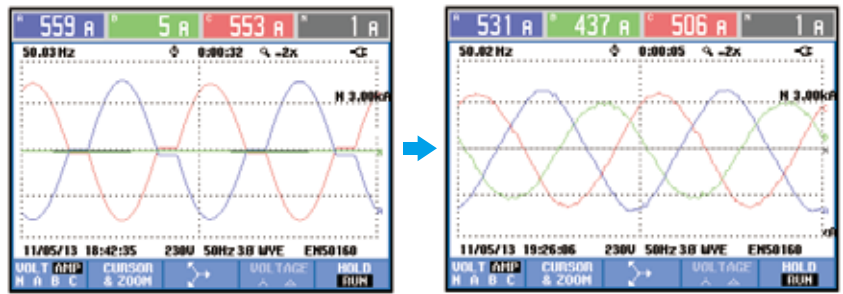
Application: Foundry Industry

Non-linear Loads: Electric Welder

Compensation Result: Current harmonic distortion (THDi) was reduced from 70% to 4.4%, load imbalance was reduced from 102% to 6.1%.

Current waveform and spectrum are recorded by Fluke 435, as below.

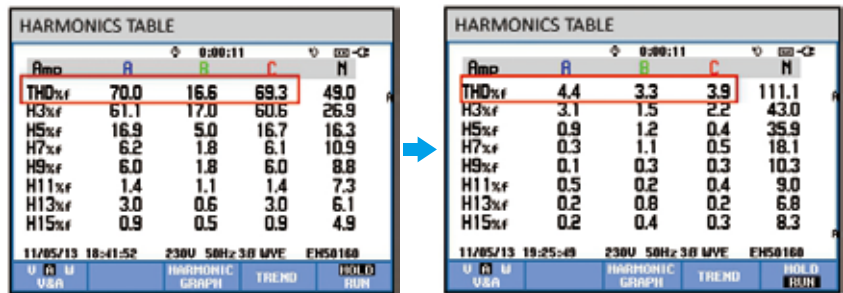
Current Waveform



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AFTER

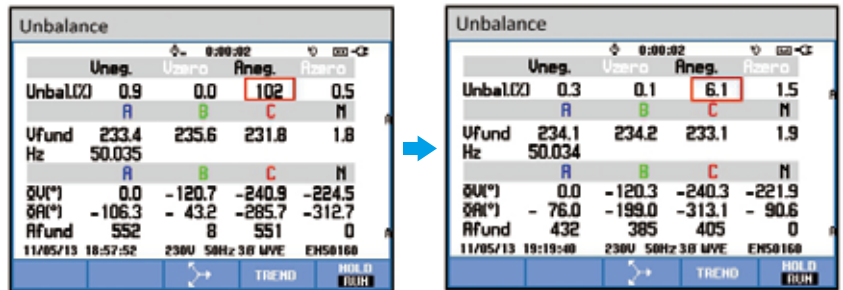
Current Spectrum



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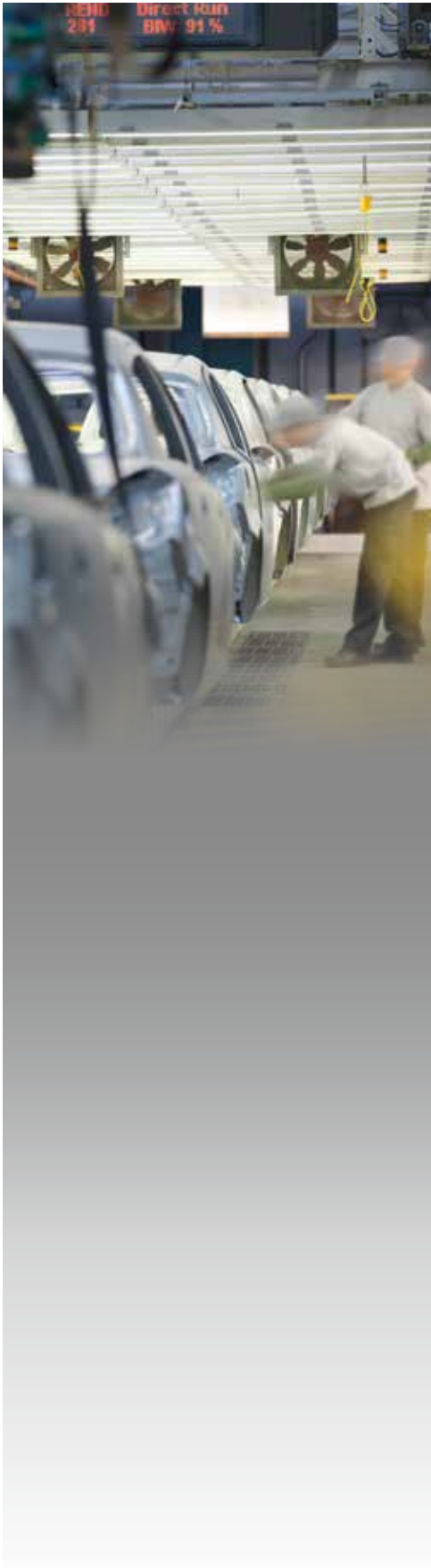
AFTER

Load Unbalance



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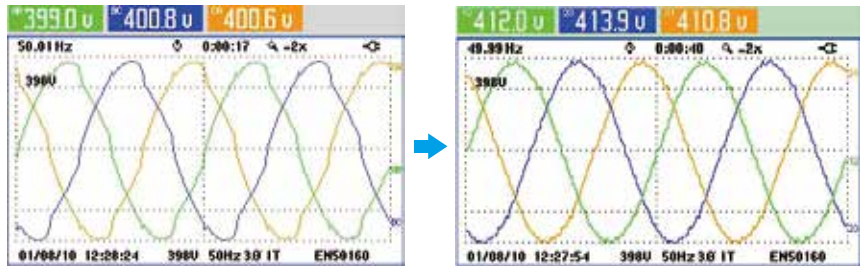
Application: Automobile Industry

Non-linear Loads: Thyristor driven heater

Compensation Result: Voltage harmonic distortion (THDu) was reduced from 5.5% to 1.3%.

Voltage waveform and spectrum are recorded by Fluke 435, as below.

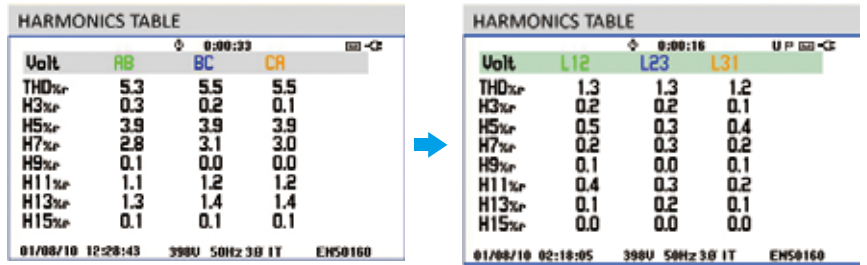
Voltage Waveform



BEFORE

AFTER

Voltage Spectrum

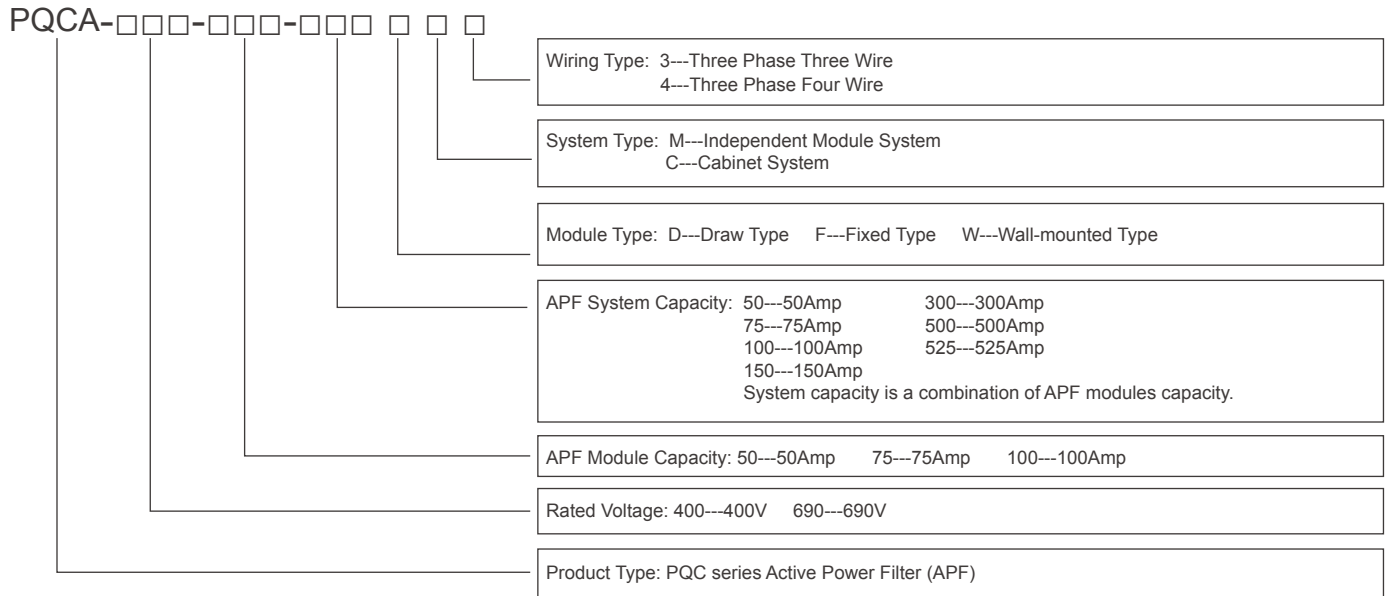


BEFORE

AFTER

Delta PQC Series APF System Selection

PQC Series APF Naming Rule



Delta PQC Series APF Features

- Multifunctional: Harmonic, reactive power and imbalance compensation
- High harmonic filtering rate: Up to 98%
- Excellent reactive compensation: High speed, Precise ($-0.99 \leq PF \leq 0.99$), Step-less, Bi-directional (capacitive and inductance) compensation
- Excellent imbalance correction: Both negative and zero sequence, mitigates neutral current
- Wide input voltage & frequency range, adapts to tough electrical environments
- Low thermal loss ($\leq 3\%$ of rated APF kVA), efficiency $\geq 97\%$
- High stability: Infinite impedance to grid, avoids harmonic resonance problems
- Flexible application: Modular design, embedded in standard or customized cabinet
- Easy installation and maintenance: Plug-in installation for APF module replacement and expansion
- Wide capacity range: 50A~525A for a single cabinet, up 10 cabinets in parallel
- Environmental adaptability: $-10 \sim 50^\circ\text{C}$ temperature, compatible with diesel generator
- Complete protection: Grid Over/Under voltage, APF over current, over temperature, and more. All faults are recorded in the event log, which is convenient for failure analysis

PQC Series APF Model

APF System Type	Structure	Model Name	APF Capacity	Dimension (W×D×H)	Weight (kg)
Independent Module System	Wall-mounted	PQCA-400-50-50-WM4	50A	440×174×600mm	30
	Draw Type Modular	PQCA-400-50-50DM3(4)	50A	440×522×174mm	40
		PQCA-400-75-75DM3(4)	75A	440×522×174mm	42
	Fixed Type Modular	PQCA-400-50-50FM3(4)	50A	440×522×174mm	30
		PQCA-400-75-75FM3(4)	75A	440×522×174mm	42
		PQCA-400-100-100FM3(4)	100A	605×728.2×220mm	65
		PQCA-690-100-100FM3	100A	605×728.2×270mm	78
Cabinet System (Multiple Modules)	Draw Type Cabinet	PQCA-400-50-50DC3(4)	50A	600×800×2000mm	208
		PQCA-400-75-75DC3(4)	75A	600×800×2000mm	210
		PQCA-400-75-150DC3(4)	150A	600×800×2000mm	260
		PQCA-400-75-225DC3(4)	225A	600×800×2000mm	309
		PQCA-400-75-300DC3(4)	300A	600×800×2000mm	359
		PQCA-400-75-375DC3(4)	375A	600×800×2000mm	408
		PQCA-400-75-450DC3(4)	450A	600×800×2000mm	458
	Fixed Type Cabinet	PQCA-400-75-525DC3(4)	525A	600×800×2000mm	507
		PQCA-400-50-50 FC3(4)	50A	600×800×2000mm	200
		PQCA-400-75-75FC3(4)	75A	600×800×2000mm	203
		PQCA-400-50-100FC3(4)	100A	600x800x2000mm	235
		PQCA-400-100-100FC3(4)	100A	800×1000×2000mm	265
		PQCA-400-50-150FC3(4)	150A	600x800x2000mm	270
		PQCA-400-75-150FC3(4)	150A	600×800×2000mm	245
		PQCA-400-50-200FC3(4)	200A	600x800x2000mm	320
		PQCA-400-100-200FC3(4)	200A	800×1000×2000mm	330
		PQCA-400-75-225FC3(4)	225A	600×800×2000mm	287
		PQCA-400-50-250FC3(4)	250A	600x800x2000mm	360
		PQCA-400-50-300FC3(4)	300A	600x800x2000mm	395
		PQCA-400-100-300FC3(4)	300A	800×1000×2000mm	395
		PQCA-400-50-350FC3(4)	350A	600x800x2000mm	430
		PQCA-400-75-375FC3(4)	375A	600×800×2000mm	371
		PQCA-400-100-400FC3(4)	400A	800×1000×2000mm	460
		PQCA-400-75-450FC3(4)	450A	600×800×2000mm	413
		PQCA-400-100-500FC3(4)	500A	800×1000×2000mm	522
		PQCA-400-75-525FC3(4)	525A	600×800×2000mm	455
		PQCA-690-100-100FC3	100A	800×1000×2000mm	280
		PQCA-690-100-200FC3	200A	800×1000×2000mm	360
		PQCA-690-100-300FC3	300A	800×1000×2000mm	440
		PQCA-690-100-400FC3	400A	800×1000×2000mm	520
PQCA-690-100-500FC3	500A	800×1000×2000mm	600		

Delta PQC Series APF Technical Specification

Electrical Specification	Rated Voltage	AC 400V		AC 690V	
	Input Voltage Range	AC 308V~480V		AC 432V~880V	
	Electric Connection	3P3W / 3P4W		3P3W	
	Rated Frequency	50(60)Hz \pm 10%			
	Input Voltage THD Range	\leq 15%			
	Rated Current per Module	50Amp	75Amp	100Amp	100Amp
	Rated Current per Cabinet	50~525Amp (module combination)			100~500Amp (module combination)
	Redundancy	Each module is an independent filtering system			
	Harmonic Elimination Range	2rd ~ 50th order (Selectable)		2rd ~ 31st order (Selectable)	
	Harmonic Filtering Degree	0 ~ 100% programmable per harmonic in Ampere value			
	Harmonic Filtering Performance	Filter up to 98% harmonics at rated load, THDv<3%, THDi<5% after filtering			
	Reactive Power Compensation Capability	Both inductive and capacitive reactive power			
	Reactive Power Compensation Performance	PF \geq 0.99 after compensation (if the APF capacity is sufficient)			
	Imbalance Correction Capability	Mitigate negative and zero sequence			Mitigate negative sequence
	Full Response time	<20ms			
	Instant Response time	<100us			
	Thermal Loss	\leq 3% of APF rated capacity (kVA)			
	Output Current Limitation	Automatic (100% rated capacity)			
	Control Technology	Parallel Expansion(System)	Up to 10 Racks(7 modules per cabinet)		Up to 10 Racks(5 modules per cabinet)
		MTBF	>100,000 hours		
Switching Frequency		60kHz	30kHz	20kHz	
Physical Specification	Controller	DSP control			
	Communication	Modbus Protocol, RS232/485			
	Monitoring	PQC Monitor Software (Optional)			
	IP Grade of Cabinet	IP20, IP30 or customization			
	Cooling method	Intelligent forced air cooling			
	Noise Level	< 65dB(A) @1m (Module)		< 70dB(A) @1m (Module)	
	Dust Filter	Optional			
Environmental Requirement	Dimension	Refer to APF Model table			
	Weight	Refer to APF Model table			
	Ambient Temperature	-10~50°C			
Relative Humidity	0~95%				
Altitude	\leq 1000m rated capacity, 1000~2000m(derating 1% per 100m)				

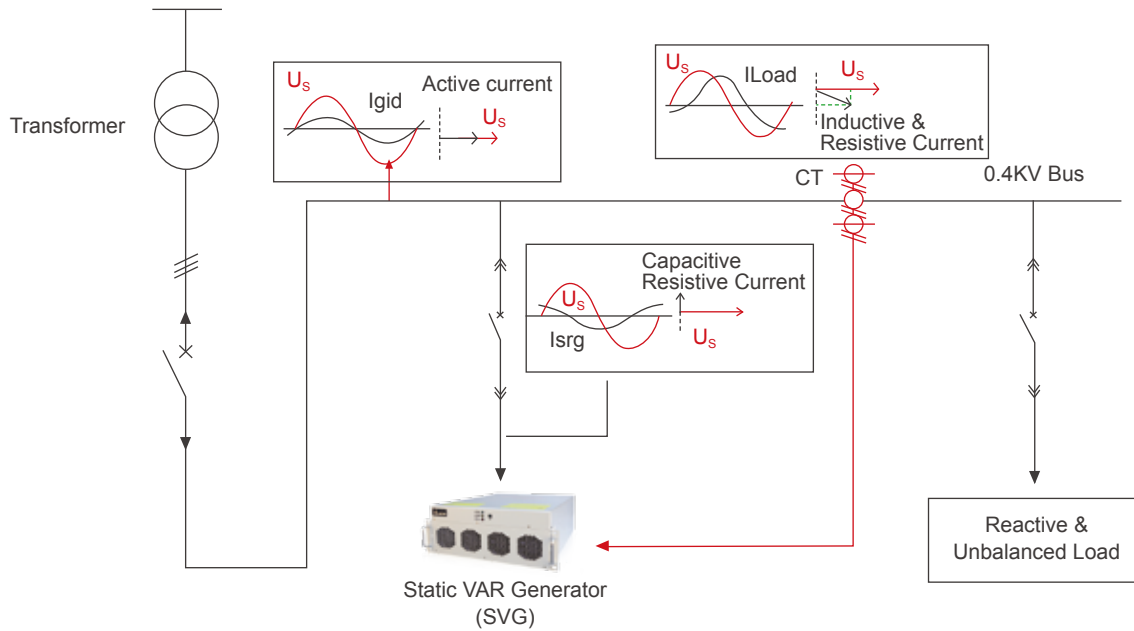
Delta PQC series Static Var Generator (SVG)

SVG Principle

The principle of the SVG is very similar to that of Active Power Filter, as demonstrated in the picture below. When the load is generating inductive or capacitive current, it makes load current lagging or leading the voltage. SVG detects the phase angle difference and generates leading or lagging current into the grid, making the phase angle of current almost the same as that of voltage on the transformer side, which means fundamental power factor is unit.

Delta's PQC series SVG is also capable of correcting load imbalance.

Note: CT is a critical part of the SVG system, and it can be purchased by users themselves, following Delta's suggestions on CT specification.



SVG Operating Mode	Waveform and Vector	Remark
No Load Mode	<p>SVG Outputs on Current (a) $U_i = U_s$</p>	$U_i = U_s$, $I_{svg} = 0$, SVG outputs no reactive current.
Capacitive Mode	<p>Leading Current (b) $U_i > U_s$</p>	$U_i > U_s$, I_{svg} is leading the voltage, and its amplitude is continuously adjustable.
Inductive Mode	<p>Lagging Current (c) $U_i < U_s$</p>	$U_i < U_s$, I_{svg} is lagging the voltage, and its amplitude is continuously adjustable.

SVG Structure

Delta PQC Series SVG is also modular in design, and the Delta SVG system consists of one or several SVG modules and an optional Liquid Crystal Monitor & Control Panel (LCM). Each SVG module is an independent reactive power compensation system, and users can change the SVG rating by adding or removing SVG modules.

SVG modules and LCM panel can be embedded in Delta's standard SVG cabinet or in a customized cabinet. There are usually breakers, cable terminals and Surge Protection Device (SPD) in the SVG cabinet.



SVG Module

SVG Compensation Performance

Delta's PQC Series SVG can rapidly and continuously compensate both inductive and capacitive reactive power, and correct load imbalance. With sufficient capacity, the SVG ensures excellent fundamental power factor improvement performance.

- Fundamental Power Factor ($\text{Cos}\phi$) ≥ 0.99 (improves both leading and lagging PF)

Delta's PQC Series SVG Actual Compensation Performance



Application: Harbor

Loads: Inductive Motors.

Compensation Results: Fundamental Power Factor (Cos ϕ) was improved from 0.82 to 0.99, current RMS value was reduced from 1335A to 1116A (around 16%).

Power and Energy were recorded by Fluke 435, as below.

Power and Energy

Power & Energy				
FUND	A	B	C	Total
kW	254.8	253.6	256.3	764.8
kVA	307.8	310.9	313.4	932.1
kVAR	(172.7)	(179.8)	(180.3)	(532.8)
PF	0.81	0.80	0.80	0.81
Cos ϕ	0.83	0.82	0.82	
A rms	1335	1349	1362	
A B C				
U rms	233.23	233.06	232.90	
08/19/12 14:21:28 230V 50Hz 3Ø WYE EMS0168				
PREV	BACK	NEXT	PRINT	USE

BEFORE

Power & Energy				
FUND	A	B	C	Total
kW	258.2	260.3	263.2	781.7
kVA	261.3	264.1	266.7	792.1
kVAR	(40.2)	(44.7)	(43.2)	(128.1)
PF	0.97	0.97	0.97	0.97
Cos ϕ	0.99	0.99	0.99	
A rms	1116	1128	1142	
A B C				
U rms	236.72	236.68	236.49	
08/19/12 16:14:31 230V 50Hz 3Ø WYE EMS0168				
VOLTAGE	ENERGY	TREND	HOLD	

AFTER



Application: Petrochemical Industry

Loads: Inductive Motors

Compensation Result: Fundamental Power Factor (Cos ϕ) was improved from 0.44 to 0.98, current RMS value was reduced from 2436A to 1289A (around 47%).

Power and Energy were recorded by Fluke 435, as below.

Power and Energy

Power & Energy				
FUND	L1	L2	L3	Total
kW	248.6	241.7	253.9	744.2
kVA	533.2	544.9	548.9	1627
kVAR	(471.8)	(488.3)	(486.7)	(1447)
PF	0.47	0.45	0.47	0.46
Cos ϕ	0.47	0.44	0.46	
A rms	2385	2418	2436	
L1 L2 L3				
U rms	223.80	225.55	225.48	
04/14/13 16:53:01 230V 50Hz 3Ø WYE EMS0168				
VOLTAGE	ENERGY	TREND	HOLD	

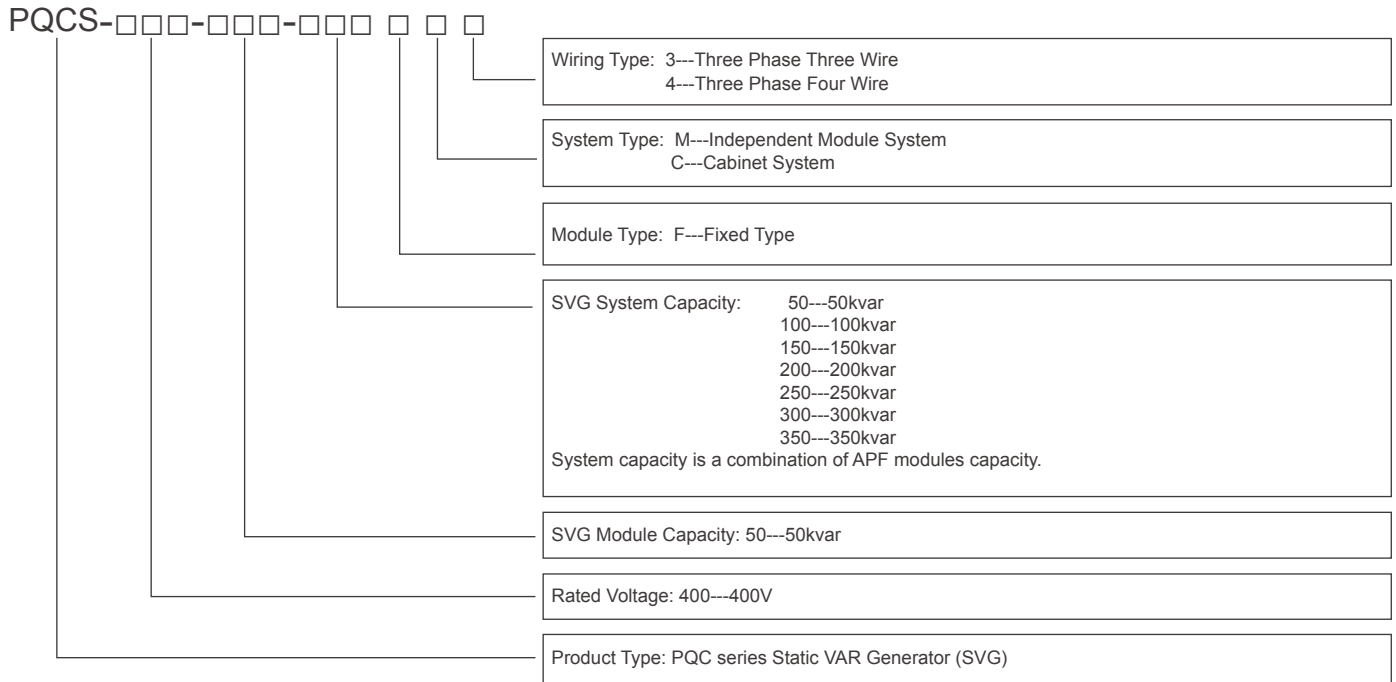
BEFORE

Power & Energy				
FUND	L1	L2	L3	Total
kW	273.2	276.2	282.8	832.3
kVA	281.5	283.1	290.4	854.9
kVAR	(67.6)	(61.8)	(65.9)	(195.3)
PF	0.97	0.97	0.97	0.97
Cos ϕ	0.97	0.98	0.97	
A rms	1251	1267	1289	
L1 L2 L3				
U rms	225.33	223.80	225.62	
04/17/13 00:48:05 230V 50Hz 3Ø WYE EMS0168				
VOLTAGE	ENERGY	TREND	HOLD	

AFTER

Delta PQC Series SVG System Selection

PQC Series SVG Naming Rule



PQC Series SVG Model

SVG System Type	Structure	Model Name	SVG Capacity	Dimension (W×D×H)	Weight (kg)
Independent Module System	Wall-mounted	PQCS-400-50-50WM4	50kvar	440×174×600mm	30
	Fixed Type Modular	PQCS-400-50-50FM3(4)	50kvar	440×522×174mm	30
Cabinet System (Multiple Modules)	Fixed Type Cabinet	PQCS-400-50-50FC3(4)	50kvar	600×800×2000mm	200
		PQCS-400-50-100FC3(4)	100kvar	600×800×2000mm	240
		PQCS-400-50-150FC3(4)	150kvar	600×800×2000mm	280
		PQCS-400-50-200FC3(4)	200kvar	600×800×2000mm	320
		PQCS-400-50-250FC3(4)	250kvar	600×800×2000mm	360
		PQCS-400-50-300FC3(4)	300kvar	600×800×2000mm	400
		PQCS-400-50-350FC3(4)	350kvar	600×800×2000mm	440

Delta PQC Series SVG Features

- Multifunctional: Reactive power and imbalance compensation
- Excellent reactive compensation: High speed, Precise ($-0.99 \leq \cos\phi \leq 0.99$), Step-less, Bi-directional (capacitive and inductance) compensation
- Excellent imbalance correction: Both negative and zero sequence, mitigates neutral current
- Wide input voltage & frequency range, adapts to tough electrical environment
- Low thermal loss ($\leq 3\%$ of rated SVG capacity), efficiency $\geq 97\%$
- High stability: Infinite impedance to grid, avoids harmonic resonance problem
- Flexible application: Modular design, embedded in standard or customized cabinet
- Easy installation and maintenance: Easy installation for APF module replacement and expansion
- Wide capacity range: 50kvar~350kvar for a single cabinet, up to 10 cabinets in parallel
- Environmental adaptability: $-10 \sim 50^{\circ}\text{C}$ temperature, compatible with diesel generators
- Complete protection: Grid over/under voltage, SVG over current, over temperature, and others. All faults recorded in event log, convenient for failure analysis



Delta PQC Series SVG Technical Specification

Electrical Specification	Rated Voltage	AC 400V
	Input Voltage Range	AC 308V~480V
	Electric Connection	3P3W / 3P4W
	Rated Frequency	50(60)Hz \pm 10%
	Rated Capacity per Module	50kvar
	Rated Current per Cabinet	50~350kvar (module combination)
	Redundancy	Each module is an independent reactive compensation system
	Reactive Power Compensation Capability	Both inductive and capacitive reactive power
	Reactive Power Compensation Performance	$\text{Cos}\phi \geq 0.99$ after compensation (if the SVG capacity is sufficient)
	Imbalance Correction Capability	Mitigate negative and zero sequence
	Full Response time	<20ms
	Instant Response time	<100us
	Thermal Loss	$\leq 3\%$ of SVG rated capacity
	Output Current Limitation	Automatic (100% rated capacity)
	Parallel Expansion(System)	Up to 10 Racks(7 modules per cabinet)
Control Technology	MTBF	>100,000 hours
	Switching Frequency	30kHz
	Controller	DSP control
	Communication	Modbus Protocol, RS232/485
Physical Specification	Monitoring	PQC Monitor Software (Optional)
	IP Grade of Cabinet	IP20, IP30 or customization
	Cooling method	Intelligent forced air cooling
	Noise Level	< 60dB(A) @1m (Module)
	Dust Filter	Optional
	Dimension	Refer to SVG Model table
Environmental Requirement	Weight	Refer to SVG Model table
	Ambient Temperature	-10~50°C
	Relative Humidity	0~95%
	Altitude	$\leq 1000\text{m}$ rated capacity, 1000~2000m(derating 1% per 100m)

Special Features of Delta Power Quality Solution

High Adaptability

- **Wider range of operating temperatures**

Delta PQC series APF & SVG can normally work without any derating from -10°C~ 50°C, which is suitable for most applications

- **Withstands extreme electrical condition**

Delta's PQC series APF & SVG can withstand severe harmonic distortion of voltage, they can work normally under conditions with THDu (total harmonic distortion of voltage) up to 15%

- **Compatible with diesel generators**

Simple and Flexible Application

- The Delta PQC series APF & SVG's modular structure makes it easy for installation, maintenance and capacity expansion.
- APF & SVG modules can be embedded in Delta's standard cabinets or third-party cabinets, making it possible to customize cabinets for special requirements.

Excellent Compensation Capability

- Delta's PQC series APF & SVG applies 3-level inverter topology and up to 60 kHz switching frequency, which provide excellent power quality compensation accuracy, response speed and output ability.

High Reliability

- Module redundancy technology
- Intelligent air cooling technology
- Top brand electronic components
- Advanced production technology



2007~ 2008 Forbes Asia's Fabulous 50



2009 Frost & Sullivan Green Excellence Award for Corporate Leadership



Delta's Manufacturing System is Certified by ISO 9001 and ISO 14001 Standards



IECQ Certificate of Hazardous Substance Process Management



The **PQC series APF** protects electrical equipment for a leading petrochemical company in Taiwan.



The **PQC series APF** protects the power distribution system of one of India's top three textile companies.



The **PQC series APF** boosts the power supply stability for a global automobile parts provider in India.



The **PQC series APF** protects the power distribution system from harmonics interference for the largest telecom company in India.



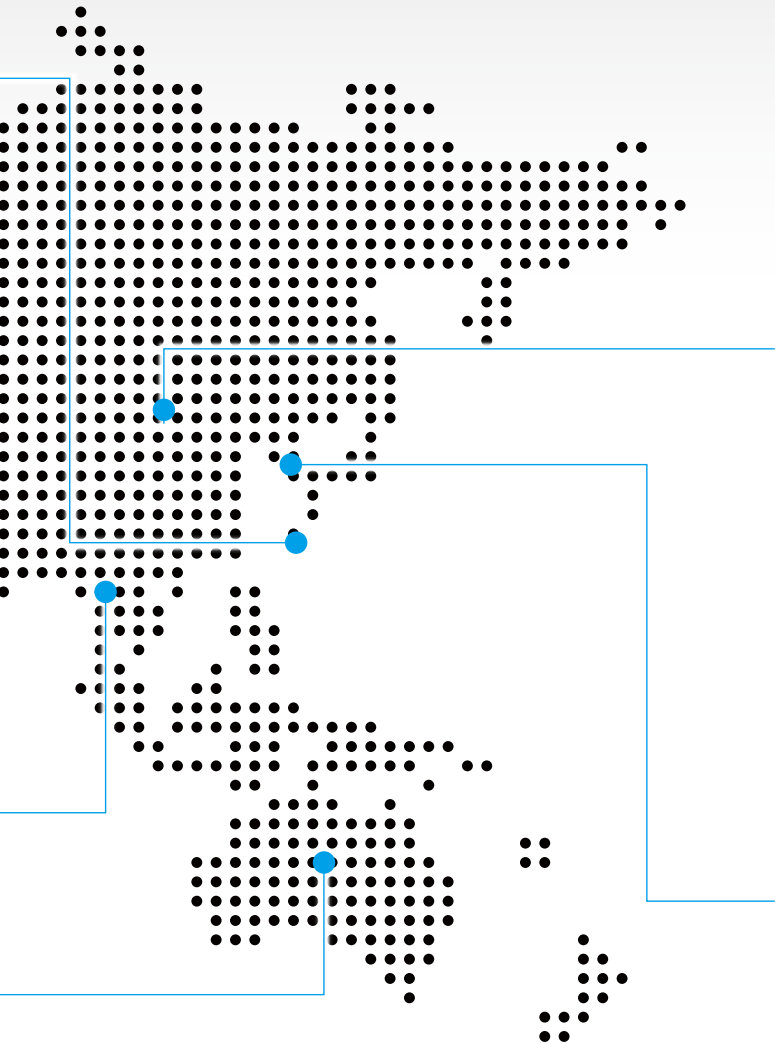
The **PQC series APF** helps to reduce the electricity bills for an international rubber & tire company in Thailand.



The **PQC series APF** protects the power distribution system for a public sports facility in Australia.



Critical Operations 24/7



The **PQC series APF** protects the power distribution system from harmonics for Asia's largest chemical fiber company in China.



The **PQC series APF** protects the power distribution system for a top petrochemical company in China



The **PQC series APF** boosts power supply stability for public metro system in three different cities of China.



The **PQC series APF** protects the power distribution system from harmonics interference for the largest telecom company in China.



The **PQC series APF** protects the power distribution system for a public water supply company in South Korea.



The **PQC series APF** boosts the power supply stability for an electronic components & battery material company in South Korea.

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