









Power Quality Products

APF · SVG

NANCAL
Electric

Power Quality Products

Shanghai Nancal Electric Co., Ltd.

specializes in the research, development, production, and sales of power electronics products. This includes Medium Voltage AC drives, Low Voltage Industrial AC Drives, Medium Voltage Soft Starters, Power Quality Products such as Active Power Filters (APF) and Static Var Generators (SVG).

Glories

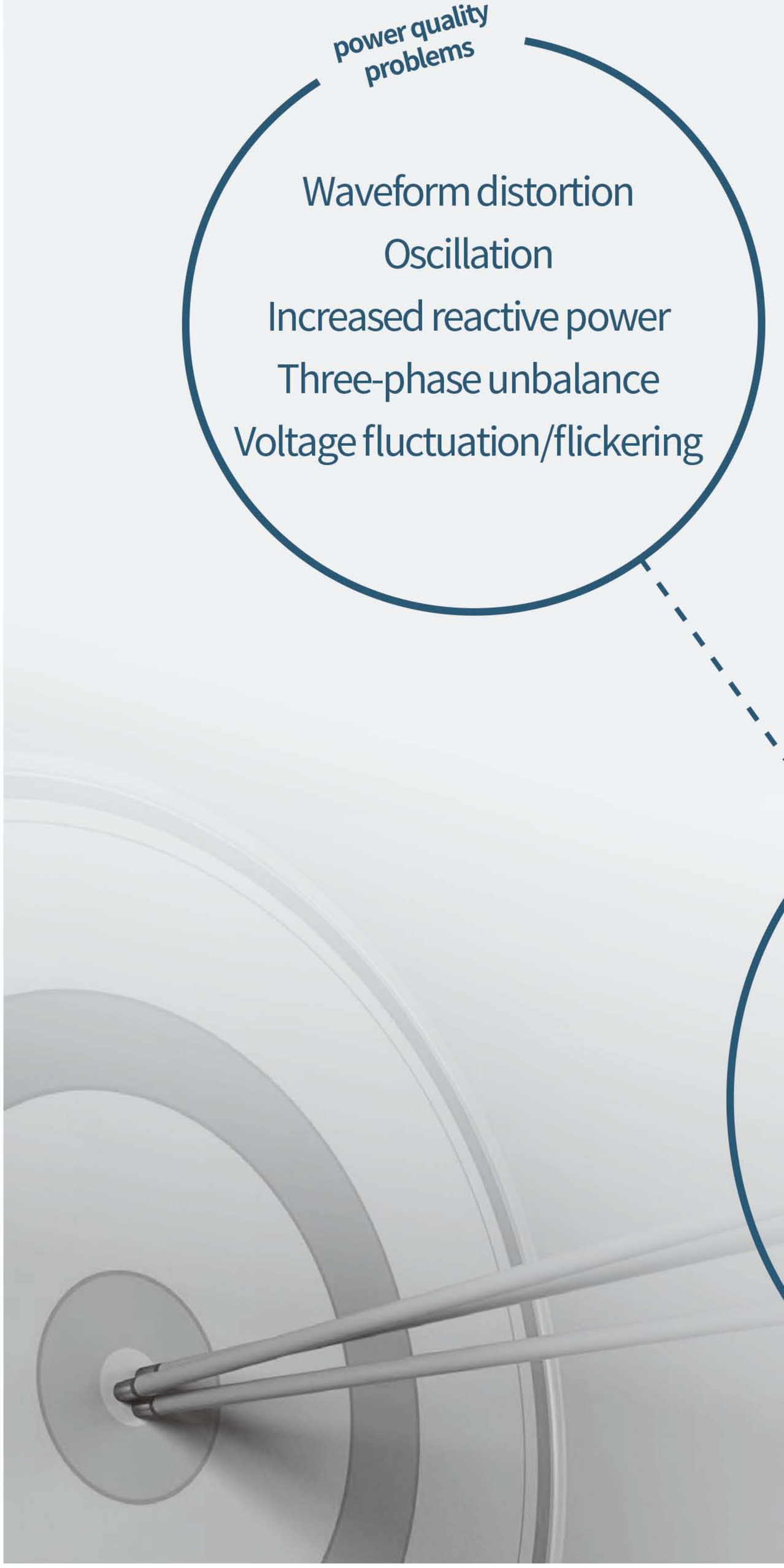
National Specialized and Sophisticated Key "Little Giant" Enterprise
High-Tech Enterprise
Member of the National Technical Committee 518 on Variable Frequency Regulating Speed Equipment of Standardization Administration of China
Shanghai Center for Enterprise Technology
Shanghai Manufacturing Single Item Champion Demonstration Enterprise

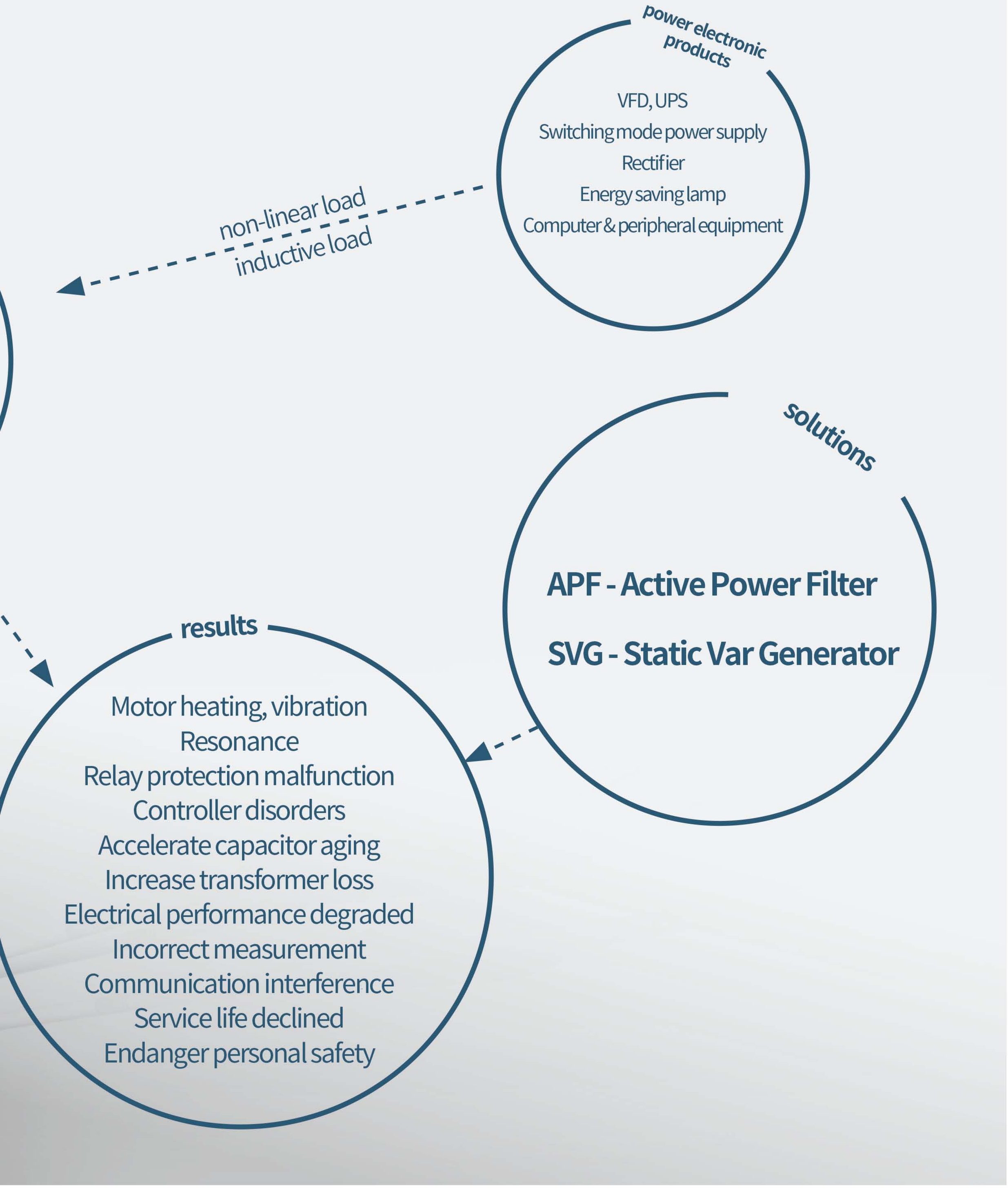
High-performance power quality technology

DSP+FPGA digital control
3-level IGBT topology structure
Current harmonics compensation, reactive compensation, three-phase unbalance compensation
Harmonic elimination rate＞97%, PF≥0.99, three-phase unbalance< 3%

Service

Technical proposal, project plan, on-site testing, data analysis, customized solution, construction guidance, regular inspection, quick maintenance
7/24 technical support, full lifecycle guarantee
Offer module, cabinet and other customized products
For non-standard products, please contact us




power electronic products
VFD, UPS
Switching mode power supply
Rectifier
Energy saving lamp
Computer & peripheral equipment
non-linear load
inductive load
solutions
APF - Active Power Filter
SVG - Static Var Generator
results
Motor heating, vibration
Resonance
Relay protection malfunction
Controller disorders
Accelerate capacitor aging
Increase transformer loss
Electrical performance degraded
Incorrect measurement
Communication interference
Service life declined
Endanger personal safety

Power Quality Products

APF — Active Power Filter

APF (Active Power Filter) is a new type power electronic product with functions of dynamic harmonic elimination (varying amplitude and frequency) and reactive power compensation (leading or lagging).

SVG — Static Var Generator

SVG (Static Var Generator) detects load current through external current transducer (CT) and analyzes reactive component of the load current by DSP controller, then controls IGBT inverter to generate reactive current and compensates the load reactive current to meet the target of line power factor. It also has function of harmonic compensation.



Applications

Hospital	Auto industry
School	Semiconductor manufacturing
Bank	Offshore
Rail transportation	Shipping
Cable car	Oil
Building	Metallurgy
Communication	Mining
Data center	Chemical
Powersystem	Sewage
HVAC	Water

Certifications

ISO 9001/ISO 14001/OHSAS 18001
CE certification
ETL certification
BV certification
Type test reports
CCS certification



Keys to superior performance

Two Core Technologies of NC Series Power Quality Products

Advanced Power Electronics Technology

Based on high-performance 3-level IGBT topology, using high efficiency IGBT drive circuit and safety protection mechanism.

Control Method

Intelligent closed-loop control algorithm



high speed semiconductor



high speed data processor

High-Performance Control

On the strength of DSP+FPGA high speed control platform, achieving harmonic and reactive calculation, realizing closed-loop current control through advanced control algorithm.

- harmonic elimination: 2-61 order
- 97% elimination rate
- PF⩾0.99
- three-phase balancing



NC AH
Active Power Filter

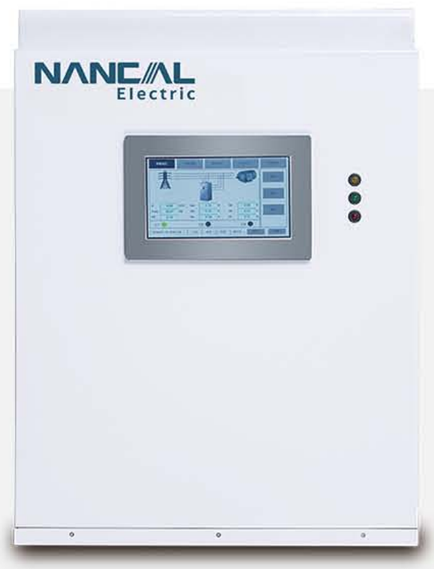
NC AH series Active Power Filter (APF) is a new type power electronic product with functions of dynamic harmonic elimination (varying amplitude and frequency) and reactive power compensation (leading or lagging).

APF

Technical Features

Abundant compensation functions

- Whole compensation or selectable
- Reactive compensation (capacitive & inductive)
- Three-phase unbalance compensation
- Harmonic elimination rate＞97%
- PF≥0.99



* Wall-mounted

Advanced system performance

- 3-level topology structure
- DSP+FPGA, high speed digital control
- Automatic resonance avoiding, automatic limiter without overload
- Protection: overvoltage, overcurrent, over-temperature. etc.
- Communication: Ethernet, RS485. etc.

Flexible application

- Modular design, small size, expandable, easy installation and maintenance, maximum 16 modules in parallel
- Multiple types: wall-mounted/cabinets
- Line structures: three-phase three-wire/ three-phase four-wire
- Maximum 10 cabinets in parallel

Safety and reliability

- Adopt reliable low-voltage IGBT modules
- Texas Instrument DSP chip, high speed and reliable performance
- Perfect protection

User-friendly

- Standard 7-inch color touch screen
- Graphic interface, display various power quality parameters
- Easy operation



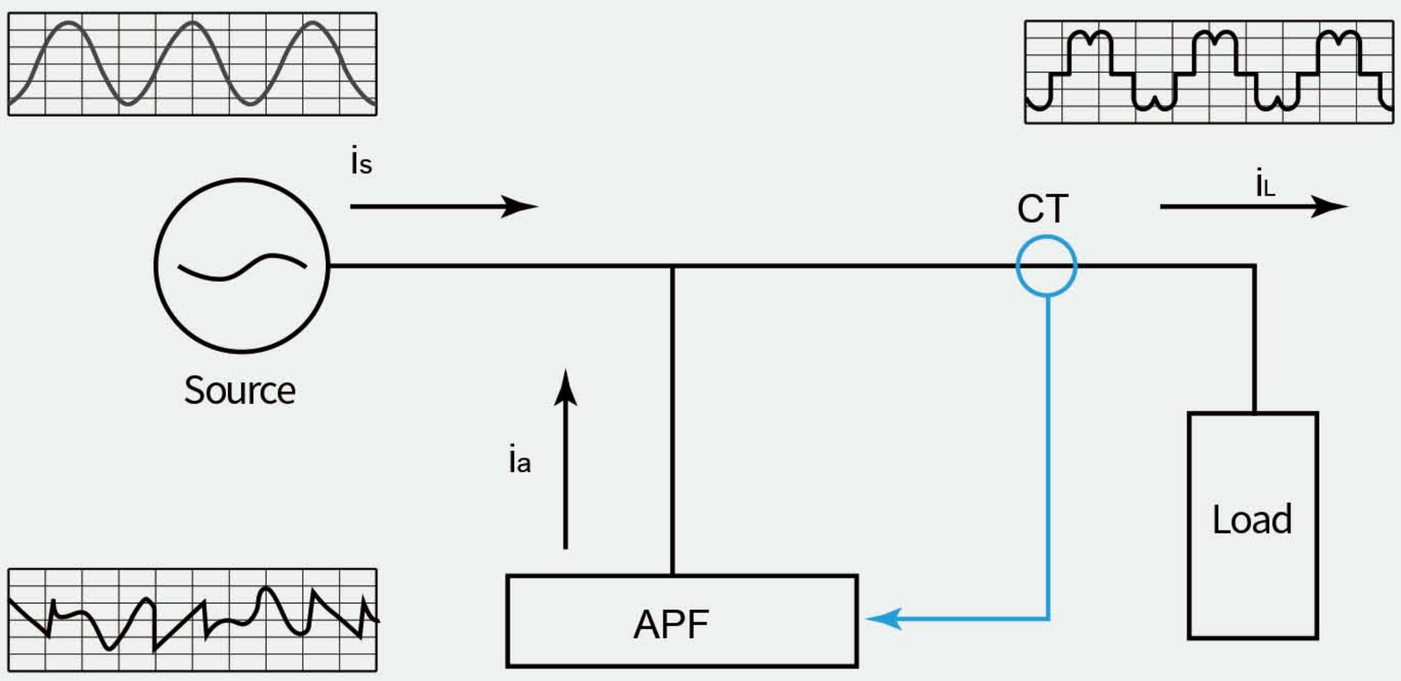
Energy saving

- Low loss: automatic hibernation/awakening
- Low noise: intelligent variable speed cooling fan

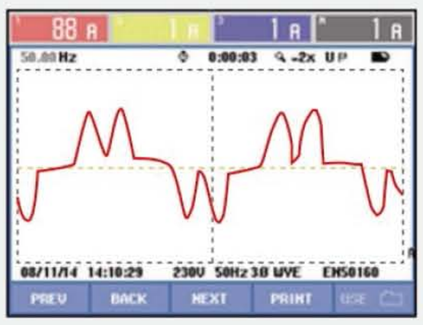
APF

Working Principles

APF detects load current through external current transducer (CT) on-line and analyzes harmonic component of the load current by DSP controller, then generates PWM signal to drive IGBT to turn on and off. Comparing to the load current harmonic, APF will inject a current with same amplitude and opposite direction to source, finally to eliminate current harmonics on line side.

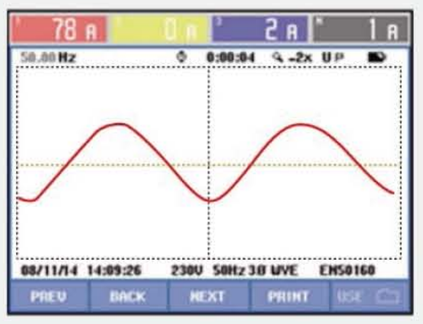


APF Working Principle Diagram



APF turn off ▲

APF turn on ▼



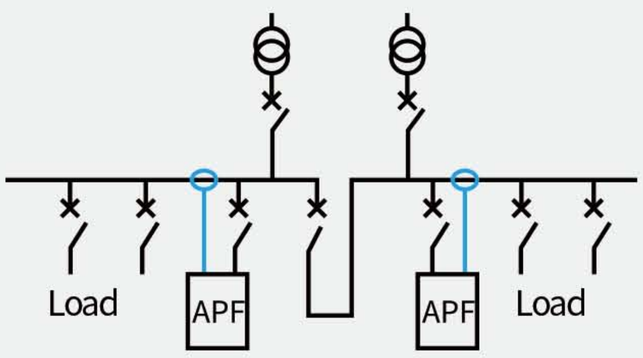
Source Current

Typical Electrical Design

NC AH series APF has different compensation method according to the power distribution system structure. It can provide total compensation, local compensation or on-site compensation.

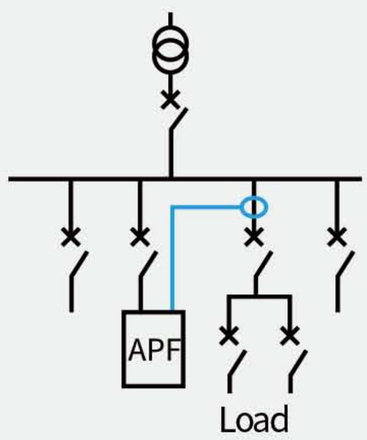
Total Compensation

In the mixed power distribution system, including large number of nonlinear loads, but capacity of single nonlinear load is small.



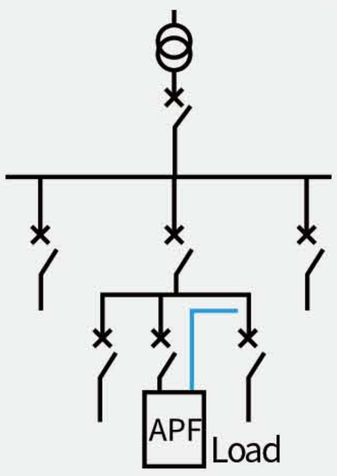
Local Compensation

When nonlinear loads concentrate upon some branches.

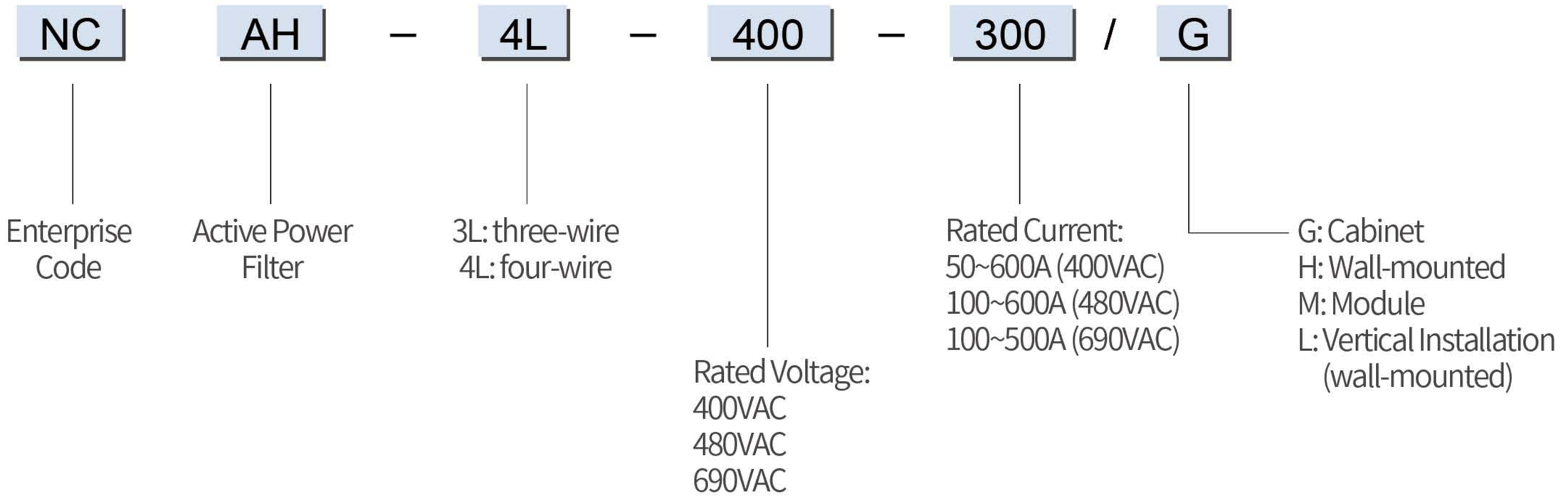


On-site Compensation

When nonlinear loads concentrate upon certain branch, and the capacity of single nonlinear load is large.



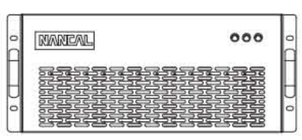
APF Product Model



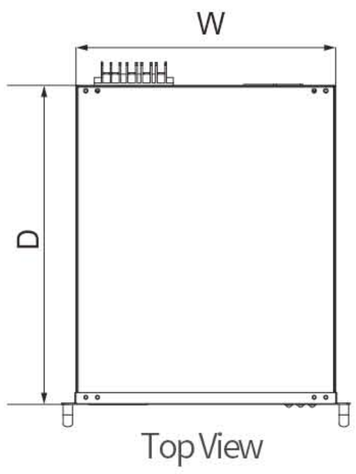
Rated current	50/60A	100A	150A	100~600A	100~600A	100~500A
Rated voltage	400V (220~460V)				480V (384~550V)	690V (550~760V)
Controller	DSP based full-digital control					
Compensation current of neutral line	triple phase current					
Filter capacity	2 ～ 61 order （selectable or whole compensation）					
Harmonic elimination rate	>97%					
Line frequency	50Hz/60Hz ±5%					
Line structure	three-phase three-wire /three-phase four-wire					
Topology	three-level NPC					
Three-phase unbalance compensation capacity	<3%					
Reactive compensation	-1 ～ 1 (adjustable)					
Response time	<5ms complete response ;<25us transient response					
Automatic current limiting	yes					
Switching frequency	20 kHz (adjustable)					
Cooling method	air cooling, speed adjustable					
Noise level	<60dBA					
Efficiency	⩾97%					
Protection function	overvoltage, undervoltage, overcurrent, over-temperature etc.					
HMI	standard 7 inch colorized touch screen or customized					
Communication interface	RS485/CAN/internet access					
Installation	wall-mounted/cabinet			cabinet		
Color	RAL7035(optional)					
Storage temperature	-40~70°C					
Operation temperature	-10~50°C					
Humidity	<95% non-condensing					
Altitude	<1500m (derating when exceed 1500m)					
Enclosure	module IP20, cabinet IP31 (customizable upon request)					

NC AH Outline

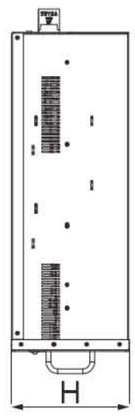
Module



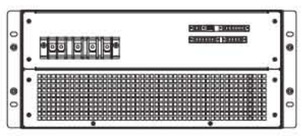
Front View



Top View

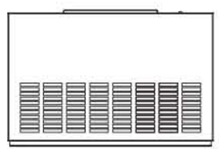


Right View

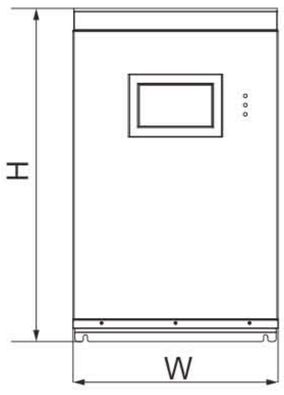


Rear View

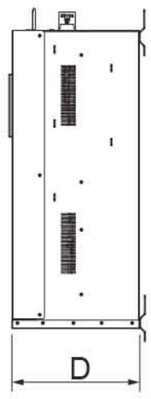
Wall-mounted



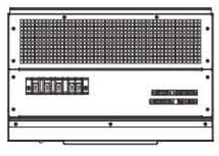
Upward View



Front View

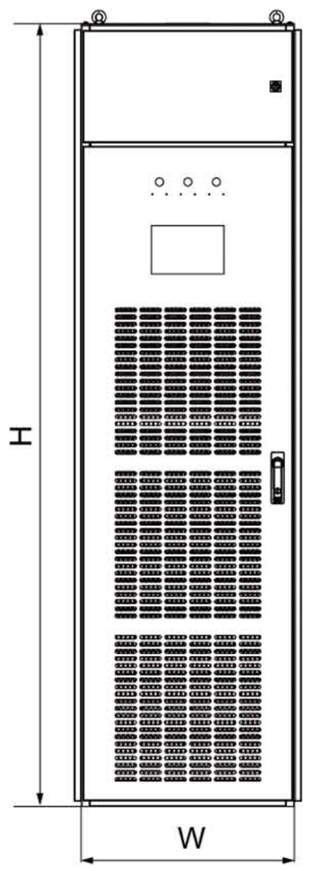


Right View

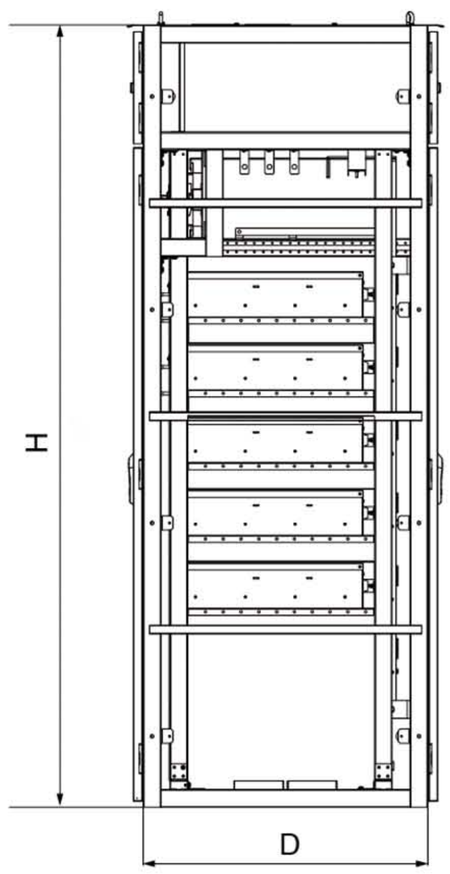


Top View

Cabinet



Front View



Right View

Module & Wall-mounted	Module size (W*D*H mm)	Wall-mounted size (W*D*H mm)	Weight (kg)
50A/60A (400V)	450*545*205	450*265*545	35
100A（400V）	450*645*230	450*290*645	45
150A（400V）	550*645*290	550*350*645	70

Cabinet	Size (W*D*H mm)	Weight (kg)
50-600A (400V)	600*800*2200	200-600
100-600A（480V）	800*1000*2200	200-600
100-500A（690V）	800*1000*2200	200-600

PF⩾0.99

harmonic compensation

three-phase balancing

NC SVG
Static Var Generator

NC SVG series Static Var Generator detects load current through external current transducer（CT）and analyzes reactive component of the load current by DSP controller, then controls IGBT inverter to generate reactive current and compensates the load reactive current to meet the target of line power factor. It also has function of harmonic compensation.



SVG

Technical Features



* Wall-mounted

Abundant compensation functions:

- Reactive compensation range: -1~1（adjustable）no overcompensation, undercompensation, resonance
- Three-phase unbalance compensation
- Harmonic compensation
- Reactive compensation cooperating with TSC
- Harmonic & reactive compensation cooperating with APF

Advanced system performance:

- 3-level topology structure
- DSP+FPGA, high speed digital control
- Automatic resonance avoiding, automatic limiter without overload
- Protection: overvoltage, overcurrent, over temperature. etc.
- Communication: Ethernet, RS485. etc.

Flexible application:

- Modular design, small size, expandable, easy installation and maintenance, maximum 16 modules in parallel
- Multiple types: wall-mounted/cabinets
- Line structures: three-phase three-wire/ three-phase four-wire
- Maximum 10 cabinets in parallel

Safety and reliability:

- Adopt reliable low-voltage IGBT modules
- Texas Instrument DSP chip, high speed and reliable performance
- Perfect protection

User-friendly:

- Standard 7-inch color touch screen
- Graphic interface, display various power quality parameters
- Easy operation

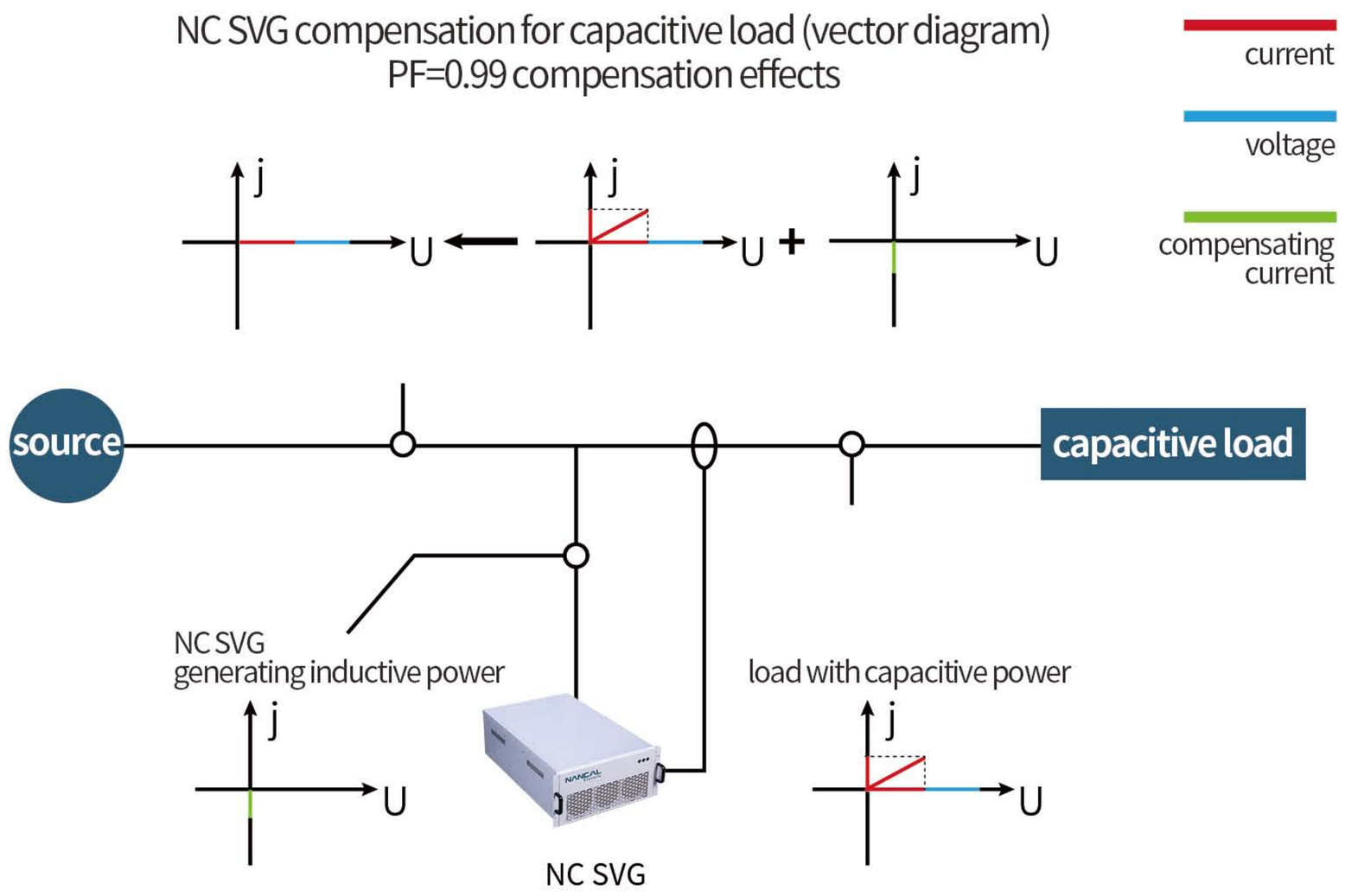


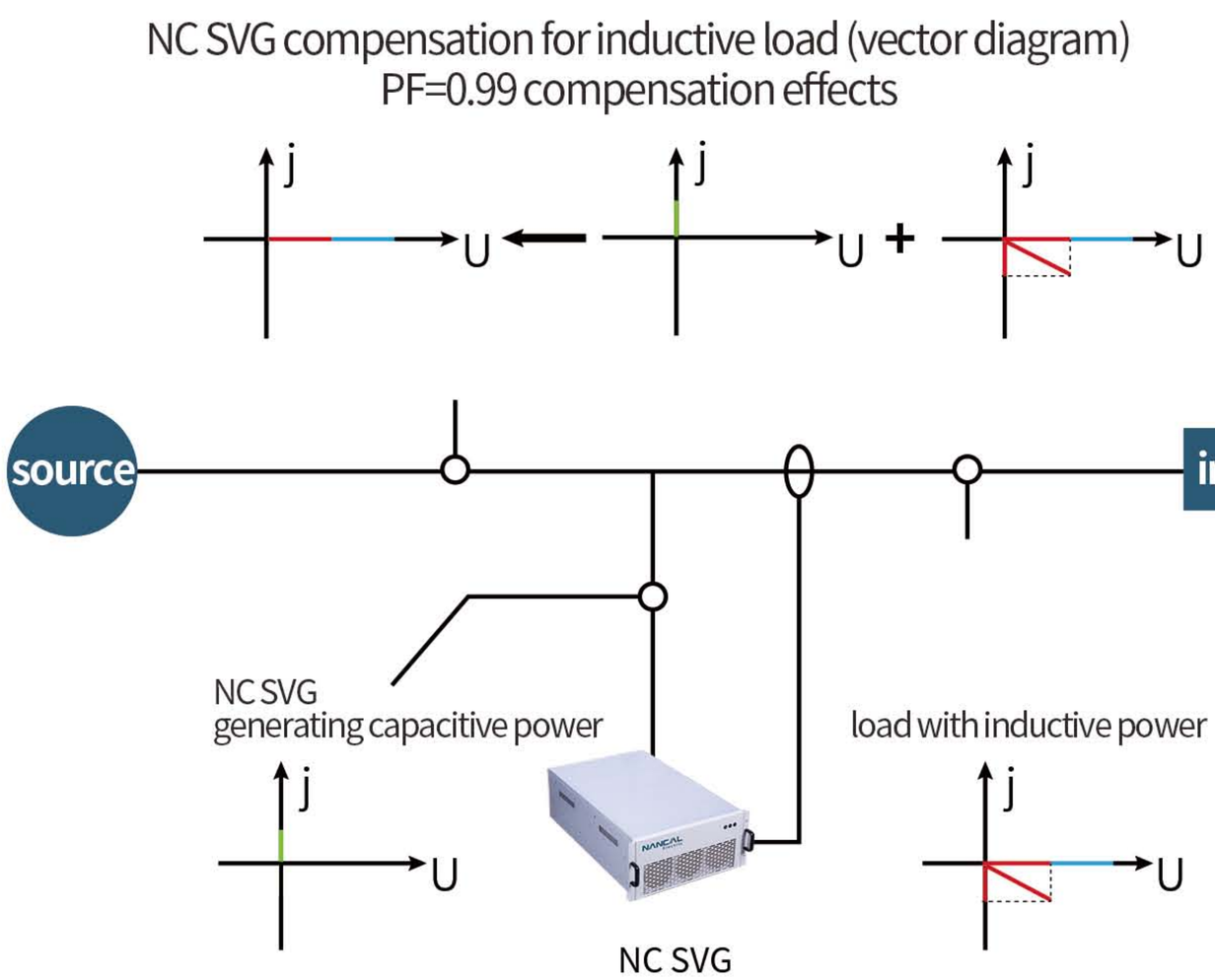
Energy saving:

- Low loss: automatic hibernation/awakening
- Low noise: intelligent variable speed cooling fan

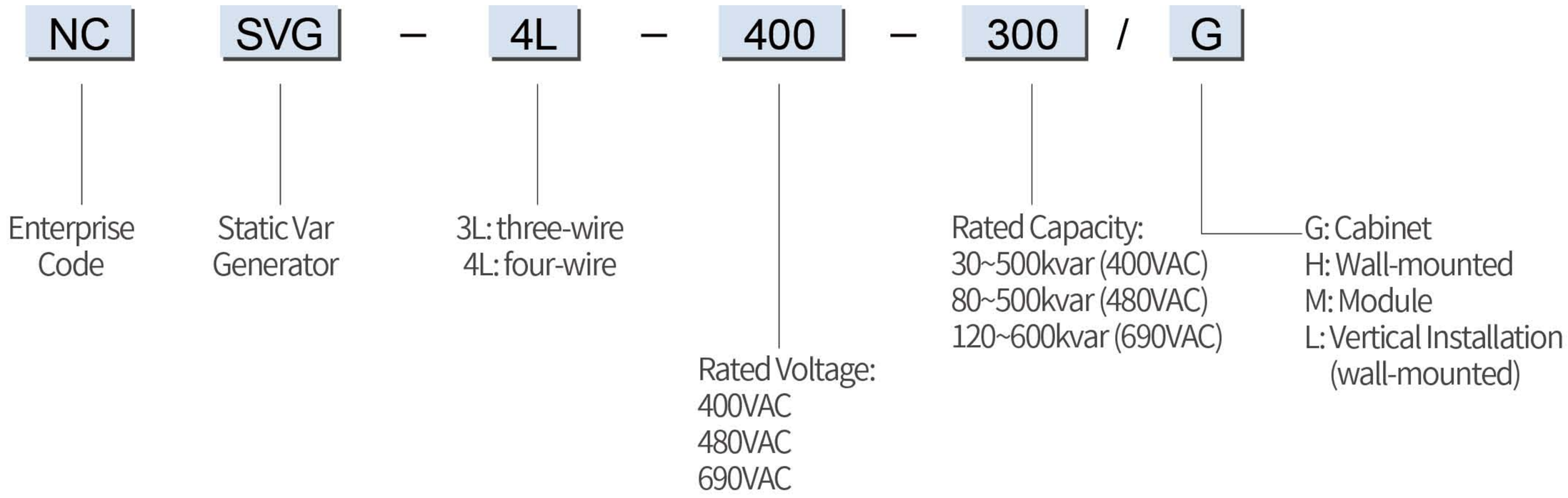
Working Principles

Static Var Generator（SVG）detects load current through external current transducer（CT）and analyzes reactive component of the load current by DSP controller, then generates PWM signal to IGBT inverter to produce reactive current, compensates the load reactive current to meet the target of line power factor.





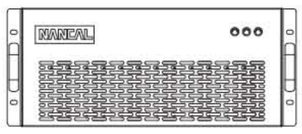
SVG Product Model



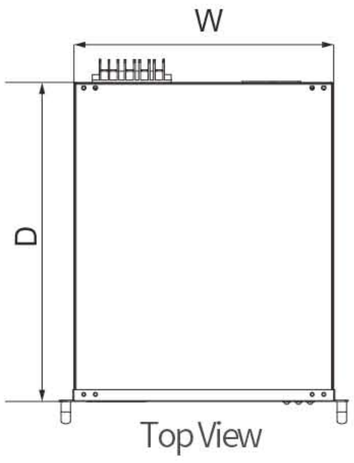
Rated capacity	30/50kvar	75kvar	100kvar	75-500kvar	80-500kvar	120-600kvar
Rated voltage	400V (220~460V)				480V (384~550V)	690V (550~760V)
Controller	DSP based full-digital control					
Line frequency	50Hz/60Hz ±5%					
Line structure	three-phase three-wire/three-phase four-wire					
Topology	three-level NPC					
Three-phase unbalance compensation capacity	<3%					
Reactive compensation range	-1～1 (adjustable)					
Compensation method	target power factor/fixed reactive power/constant voltage					
Reactive compensation rate	⩾99%					
Harmonic compensation	yes					
Response time	<5ms complete response ; <25us transient response					
Automatic current limiting	yes					
Switching frequency	20kHz (adjustable)					
Cooling method	air cooling, speed adjustable					
Noise level	<60dBA					
Efficiency	⩾97.5%					
Protection function	overvoltage, undervoltage, overcurrent, over-temperature etc.					
HMI	standard 7 inch colorized touch screen or customized					
Communication interface	RS485/CAN/internet access					
Installation	wall-mounted/cabinet			cabinet		
Color	RAL7035 (optional)					
Storage temperature	-40~70°C					
Operation temperature	-10~50°C					
Humidity	<95% non-condensing					
Altitude	<1500m(derating when exceed 1500m)					
Enclosure	module IP20, cabinet IP31 (customizable upon request)					

NC SVG Outline

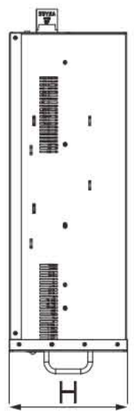
Module



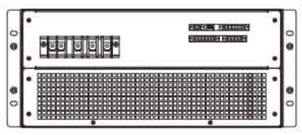
Front View



Top View

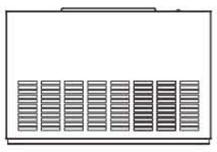


Right View

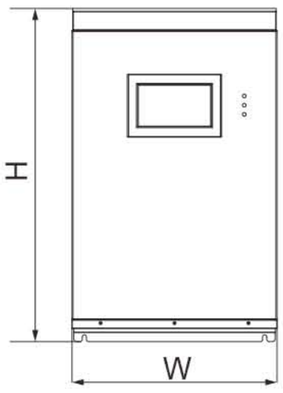


Rear View

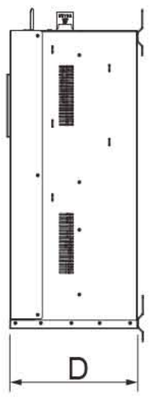
Wall-mounted



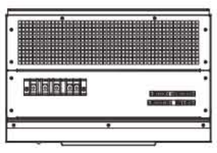
Upward View



Front View

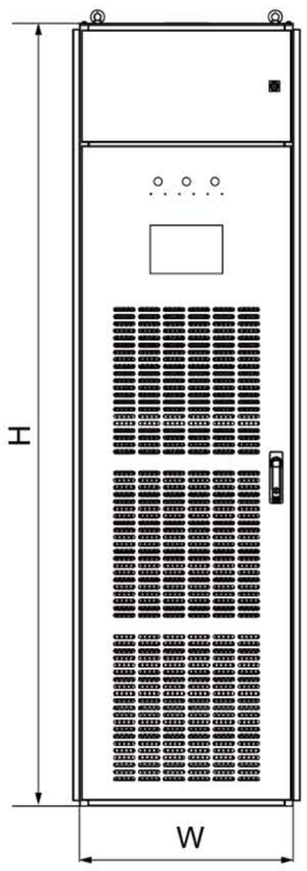


Right View

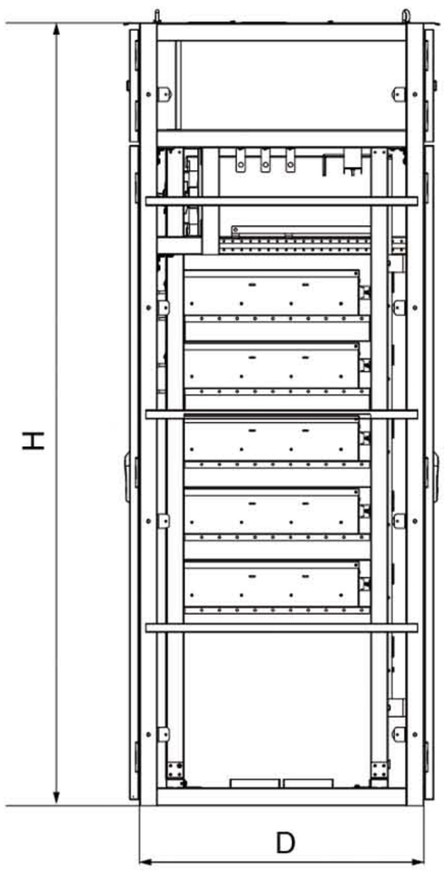


Top View

Cabinet



Front View



Right View

Module & Wall-mounted	Module size (W*D*H mm)	Wall-mounted size (W*D*H mm)	Weight (kg)
30kvar/50kvar（400V）	450*545*205	450*265*545	35
75kvar（400V）	450*645*230	450*290*645	45
100kvar（400V）	550*645*290	550*350*645	70

Cabinet	Size (W*D*H mm)	Weight (kg)
75-500kvar（400V）	600*800*2200	200-600
80-500kvar（480V）	800*1000*2200	200-600
120-600kvar（690V）	800*1000*2200	200-600

FAQ

Q1: How does NC AH Series APF achieve “real-time dynamic compensation”? How does it differ from traditional passive filters?

A: NC AH Series APF operates through the following process to achieve dynamic compensation:
Instantaneous Detection: Precisely isolates harmonic components via high-speed DSP+FPGA chip calculations.
Command Generation: Calculates the harmonic current compensation.
Active Compensation: Controls the IGBT inverter bridge to generate a compensation current equal in magnitude and opposite in phase to the harmonic.
Compared to traditional passive filters, APF offer advantages such as fast response, wide filtering range, strong adaptability, and no resonance with the power grid. They are the preferred solution for addressing power quality issues in modern nonlinear loads.

Q2: Our power system currently appears to be operating “normally.” Why use an active power filter?

A: “Normal” operation may conceal hidden costs. Harmonic pollution will lead to increased latent electricity costs, reduced equipment lifespan, and heightened risk of sudden failures. APF represents a preventive investment aimed at proactively eliminating risks, ensuring power continuity and asset safety, and avoiding potential future expenses from maintenance and production losses.

Q3: Beyond harmonic filtering, what other power quality issues can NC AH series APF address?

A: The APF is a multifunctional power quality management platform with multiple capabilities in one unit.
Unbalance Compensation: Automatically compensates for unbalanced currents in three-phase loads, reducing neutral line burden.
Reactive Power Compensation: Enables dynamic reactive power compensation, stabilizing power factor above 0.99.

Q4: Can APF be applied in the photovoltaic industry? Will THDv be effectively improved after using an APF?

A: APF precisely treats harmonic currents generated during PV power plant grid connection, enhancing power quality. By continuously detecting and injecting opposing compensation currents, APF directly neutralizes harmonic currents at the source, producing purer grid voltage waveforms and significantly reducing THDv values.

Q5: Do NC AH Series APF compensate current and reactive power simultaneously, or require priority settings? Can they operate alongside SVG and TSC?

A: Current and reactive power compensation can occur simultaneously, but priority settings are required. APF can be used with SVG and TSC, forming an efficient, mature system solution. APF, SVG, and TSC complement each other functionally, achieving comprehensive power quality management when working together.

Q6: What is the rated current range for the NC AH series APF products? What is the maximum neutral line compensation current?

A: The rated current of NC AH series APF products ranges from 50A to 600A. It features robust neutral line compensation capability, supporting up to 3 times the phase current compensation. With a harmonic elimination rate exceeding 97%, it effectively safeguards grid power quality. The product integrates comprehensive protection mechanisms, including overvoltage, overcurrent, and overtemperature safeguards, ensuring stable and reliable system operation. It is suitable for various industrial and commercial power distribution environments.

Q7: How should we determine the required capacity of an APF? What issues arise from oversizing or undersizing?

A: Nancal Electric recommends conducting a professional power quality analysis to obtain total harmonic current and harmonic spectrum data. The APF rated current should be based on measured peak values with adequate margin. Undersizing leads to insufficient compensation and equipment overload; Oversizing results in wasted initial investment. Nancal Electric engineers offer complimentary assessment services to provide precise selection solutions.

Application

Application of NC AH Series APF in a Textile Factory in Pakistan

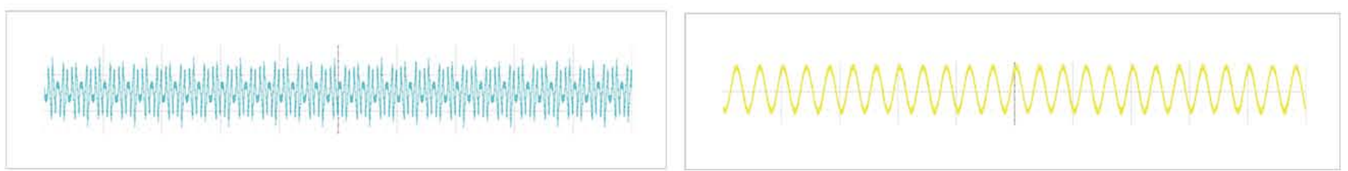
As an important local textile enterprise,this large-scale Pakistani textile factory operates a significant number of textile machines, textile printing and dyeing equipment driven by VFD and high-power compressor systems. In recent years, the factory frequently suffered from voltage fluctuations, equipment malfunction, control system restart and other problems, which seriously affected the production beat and lowered the product quality.

Solutions

Installation of active power filters (APF) for real-time filtering of major harmonics;
Reasonable arrangement of access points for centralized management of key electricity loads.
A total of 4 sets of APF equipment are deployed in this project to realize the precise solution of the workshop.
A-1000A cabinet solution C-450A cabinet solution
B-1100A cabinet solution D-900A cabinet solution

Field data

After the treatment, the harmonic level has been reduced significantly to meet the relevant power quality standards and the power supply environment has been significantly improved. Voltage fluctuation range has been effectively controlled, the power grid operation is more stable. The number of equipment malfunctions has been significantly reduced.



before compensation　　after compensation

Customer value

Upon project completion, the textile factory reported significantly smoother equipment operation, improved fabric quality, and enhanced control system stability.

Application of NC AH Series APF in Offshore Drilling Platform

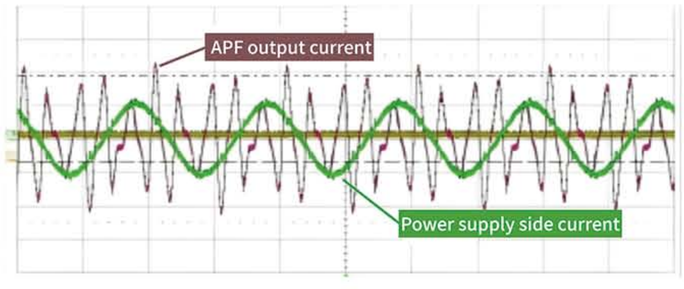
The Penglai offshore drilling platform's drilling module features key equipment including mud pumps, winches, and top drives, all powered by AC variable frequency drives. The inverters employ conventional six-pulse diode rectification, generating significant harmonics primarily at 6n±1 Hz. These harmonics severely compromise electrical equipment safety and cause severe grid voltage distortion. The system experiences reduced power factor, cable and transformer overheating, accelerated insulation aging, and instrument malfunctions leading to power outages, ultimately jeopardizing the stability and safety of the entire platform's power system.

Solutions

The total harmonic current generated by 7 VFD (6 units of 600kW and 1 unit of 920kW) was 581A in actual test, and 594A in high drilling condition. The active power filter with rated current of 600A was selected based on the harmonic current of 594A.

Field data

After the active power filter is put into operation, the total harmonic distortion of the current is reduced from 27.3% to 3.8%, which fully meets the requirements of the relevant standards for harmonic distortion.



Customer value

The active power filter is successfully applied in the offshore platform, which can effectively control the harmonic generated by the VFD of the drilling rig. The APF is small in size, high in reliability, easy to debug, and can meet the special requirements of the offshore drilling platform. Compared with the conventional passive compensation device, the active filter has obvious advantages.

FAQ

Q1: What is the fundamental difference between an SVG and a traditional capacitor compensation cabinet (TSC)?

A: TSC (Thyristor Switched Capacitor): Switches capacitors in groups via contactors, resulting in slow response time (hundreds of milliseconds or more). Output is stepped and discontinuous, prone to inrush currents and over/under compensation, and incapable of suppressing flicker.

SVG (Static Var Generator): Based on power electronics technology, it precisely calculates and outputs the required reactive current in real time. Functioning like a "reactive power generator," it enables continuous, smooth, and instantaneous compensation from rated capacitive to rated inductive conditions. With a full response time ⩽5ms, it represents a true dynamic solution.

Q2: Under what circumstances must we choose SVG over traditional capacitor compensation? Will power factor improve effectively after using SVG?

A: SVG is the efficient choice when power grid faces these "dynamic challenges":

Load fluctuations: Such as arc furnaces, rolling mills, presses, or large crane starts causing voltage flicker and light flickering.

Three-phase unbalanced loads: SVG balances three-phase currents.

Power factor requirements: Need to maintain power factor above 0.99.

Precision equipment and sensitive loads: Applications like data centers, medical devices, and production line robots require stable voltage quality.

NC SVG series product can dynamically, continuously, and rapidly generate or absorb reactive power to improve power factor.

Q3: How much active power does NC SVG series product consume during compensation? Does this loss impact energy savings?

A: SVG itself has extremely low power consumption, and this loss is negligible compared to the benefits it brings. The active power saved through improved power factor and reduced line losses typically exceeds its own losses by tens of times, delivering significant net energy savings. It is never a case of "losing more than you gain."

Q4: Can NC SVG series product be used with APF and TSC?

A: NC SVG series product can be used with APF and TSC, forming an efficient, mature system solution. APF, SVG, and TSC complement each other functionally, achieving comprehensive power quality management when working together.

Q5: What is the capacity range for NC SVG series products?

A: The rated capacity of NC SVG series products ranges from 30kvar to 600kvar. It responds instantaneously within 25 μs, achieving up to 99% reactive power compensation to effectively safeguard grid power quality. The product integrates comprehensive protection mechanisms, including overvoltage, overcurrent, and overtemperature safeguards, ensuring stable and reliable system operation. It is suitable for various industrial and commercial power distribution environments.

Q6: Do the products comply with international standards (e.g., IEEE, IEC)? Can you provide interfaces and services in local languages?

A: Yes, NC SVG series products are designed in accordance with international power quality standards such as IEC specifications. For overseas projects, Nancal Electric offers multilingual human-machine interfaces (English, Russian, etc.), products compliant with local voltage ratings and certification requirements, as well as localized English technical documentation, drawings, and operation manuals.

Q7: How do you ensure the provided solution best fits our site conditions?

A: Before quoting, Nancal Electric typically conducts a professional preliminary power quality analysis to identify your system's reactive power fluctuations, harmonic conditions, and voltage issues through data. Nancal Electric engineers offer complimentary assessment services to deliver precise product selection recommendations.

Application

Application of NC SVG + NC AH Series Products in Hohhot Petrochemical

The primary harmonic source in Hohhot Petrochemical is low-voltage VFD. These devices are predominantly used in diesel hydrotreating device, power stations, wax oil device, sulfur recovery device, and reforming device. The conventional six-pulse diode rectification method employed in VFD generates substantial harmonics, primarily at 6n±1 orders (with 5, 7, 11, and 13rd orders being predominant). These harmonics severely compromise electrical equipment safety and cause significant voltage distortion in the power grid. They lead to reduced system power factor, cable and transformer overheating, accelerated insulation aging, communication interference, and instrument malfunctions that result in power outages, ultimately jeopardizing the safety and stability of the entire power distribution system.

Solutions

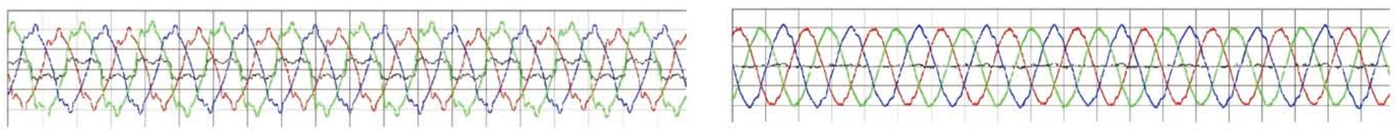
In addition to supplying new active power filter cabinets, Nancal Electric also upgrades existing capacitor cabinets. The upgraded installations now combine harmonic filtering and reactive power compensation functions. Featuring modular installation, the cabinets boast a compact internal design.

Equipment	Specification	Installation	Quantity
APF	200A	New cabinets	2 sets
	150A		2 sets
	100A		6 sets
	50A		2 sets

Equipment	Specification	Installation	Quantity
APF+SVG	300A+240kvar	Old equipment renovation	2 sets
	100A+240kvar		2 sets
	50A+240kvar		2 sets
	200A+300kvar		2 sets
	200A+180kvar		2 sets
	100A+300kvar		2 sets

Field data

After operation, the harmonic distortion rate of the diesel hydrotreating and sulfur recovery device decreased from an initial 31% to 3.3%. The harmonic distortion rate for the power station and reforming device dropped from 28% to 3%. while the wax oil device's harmonic distortion rate decreased from 34% to 3.6%. The power factor at the modified cabinet sections all exceeded 0.98, fully meeting the relevant standards for harmonic distortion and power factor requirements.



before compensation

after compensation

Customer value

The successful application of APF and SVG in petrochemical industry has effectively controlled the harmonic generated by the frequency conversion drive device of the refining equipment, and compensated the reactive power, and the effect of power quality improvement is very significant.

Application of NC SVG Series Products in Project of Natural Gas Transmission from West to East

At a station of the project of natural gas transmission from West to East, the distribution system suffered from a low power factor (below 0.75) due to the failure of the original capacitor reactive power compensation cabinet. This resulted in substantial monthly power regulation fees and excessive power consumption.

Solutions

After measurement, Nancal Electric installed a centralized NC SVG series static var generator (total capacity 400 kvar) on the low-voltage side of the distribution room, achieving dynamic var compensation and power release.

Field data

Power factor before compensation < 0.75 ; Power factor after compensation > 0.99

After operation, the power supply releases its capacity, allowing the circuit to support additional loads such as motors and compressors. Real-time monitoring of electrical parameters via the touchscreen enables data analysis, improving maintenance efficiency by 30%. The power factor stabilizes at 0.99, significantly reducing electricity costs.

Customer value

The successful deployment of SVG in project of natural gas transmission from West to East has effectively addressed reactive power issues in distribution systems. With its rapid response and high-efficiency compensation capabilities, SVG provides a one-stop power quality management solution for the pipeline's power distribution network, establishing itself as the preferred benchmark for green and energy-efficient upgrades in power distribution systems.

Shanghai Nancal Electric Co., Ltd.

R&D center address:
Building 6, 899 Zuchongzhi Rd., Pudong New District, Shanghai, China
Manufacturing base address:
Unit 5, 1881 Zhengbo Rd.,
Lin-gang Special Area of the Shanghai Pilot Free Trade Zone, Shanghai, China
E-mail: sales.sh@nancal.com
Website: www.nancalelectric.com
Customer service: +86 182 1716 5478

Linkedin

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