HOTEAM

HOTEAM™ HTQF ACTIVE POWER FILTER

POWER QUALITY ULTIMATE SOLUTION

SHANDONG HOTEAM ELECTRIC CO., LTD

HOTEAM ACITVE POWER FILTERS: ACTIVELY IMPROVE YOUR POWER QUALITY

THE HOTEAM ELECTRIC SOLUTION FOR ACTIVE HARMONIC FILTERING IN INDUSTRIAL INSTALLATIONS

Highly efficient and reliable, the HTQF active power filters are designed for heavy industrial applications where subject to harmonic distortion. The HTQF APFs are available in free standing cubicle format and maximum compensation current up to 600A.

ABOUT US

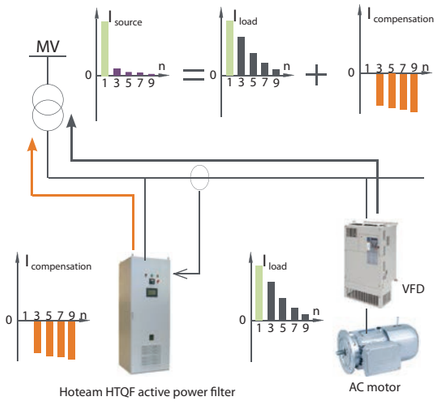
Hoteam Electric is the leading company specializing in providing power quality solutions for utility and industry customers to ensure efficient and reliable operation of electrical systems. The company's broad range of products includes active power filters (APFs), SVGs (also known as STATCOMs), capacitor banks, MCRs and many other customized solutions.

Hoteam Electric plays a key role in the rapid growing market of active power filters. In order to cater for different requirements for both industrial and commercial applications, Hoteam Electric offers a wide range of active power filters (APFs) available in different forms, dimensions and ratings. The whole Hoteam APF family includes HTQF APF with free standing installation, and rackmount/ wallmount HTQF R-Series with modular design.

CONTENTS

WORKING PRINCIPLE

Hoteam HTQF active power filter (APF) provides a truly effective harmonic solution with the advanced active harmonic compensation technology. Hoteam HTQF APF behaves like a harmonic current generator. It measures the harmonic current generated by nonlinear loads and cancels the harmonics by generating an opposite phase harmonic current with the same amplitude and injecting it to the line, making source current sinusoidal.

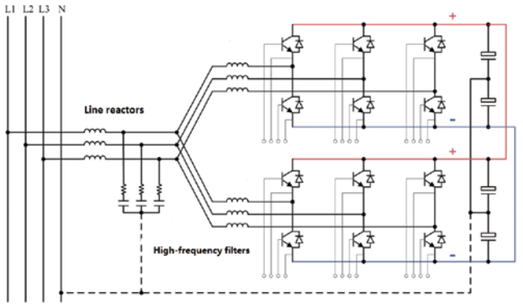


TYPICAL APPLICATIONS

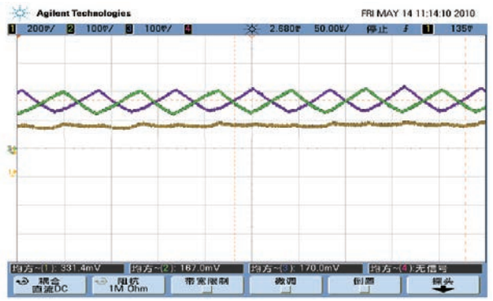
- Steel plants
- Oil and gas exploration
- Automotive industry
- Pulp and paper industry
- Chemical industry
- Mining industry
- Ports and shipyards
- Textile industry
- Rubber and plastic industry
- Water treatment industry
- Printing and package industry
- Datacenters and IT facilities
- Metro stations and rail transport
- Medical facilities
- Office buildings and banks
- Theme parks and shopping malls

KEY PRODUCT FEATURES

- Patented ripple cancellation technology



Electrical diagram of the Hoteam HTQF active power filter (APF)



Ripple current waveforms of individual inverter ripple current as well as the overall ripple current

Individual inverter Ripple Current A

Individual inverter Ripple Current B

Overall Ripple Current

Hoteam HTQF active power filters (APFs) utilize double interleaved inverter topology to ensure dynamic response time, reduced ripple current and lower heat loss.

In detail, the high-frequency components of the two inverters' output currrents are staggered by 180 degrees in order to cancel each other. As a result, the overall ripple current is reduced by 80% and the power loss decreases by 30% without compromising the response time and the need to rising the switching frequency.

- Powerful controller based on dual-DSP architecture allowing for ultra-fast and precise compensation
- Amorphous alloy reactors allowing for low noise and more importantly, enhanced energy efficiency
- Broad spectrum of cancellation (from 2nd to 50th harmonics)
- Superior filtering efficiency of no less than 97% and industry leading compensation capacity with 600A or 400kvar per unit for 400V system

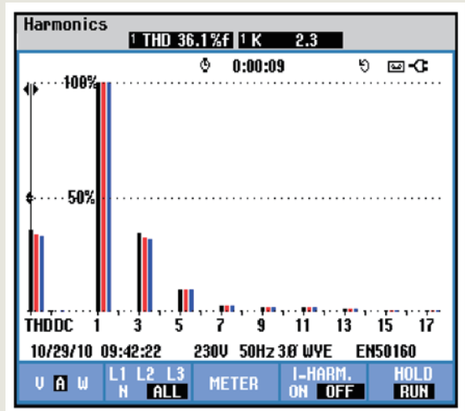
- Selectable harmonic compensation allowing the user to choose the harmonic components needed to be filtered freely according to their frequencies
- Four programmable task-priority modes offering the most flexible power quality solution for harmonic filtration as well as power factor correction (PFC), including:
  - » Harmonic Filtration First Mode
  - » Reactive Power Compensation First Mode
  - » Harmonic Filtration Only Mode
  - » Reactive Power Compensation Only Mode

One-stop solution

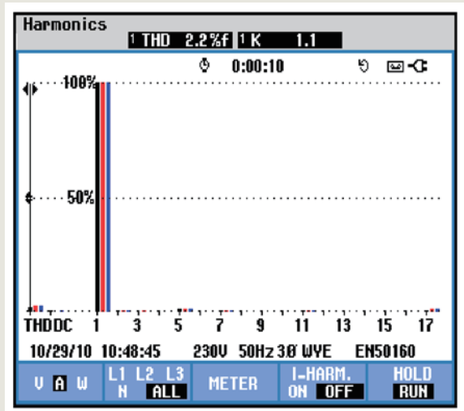
More functionalities

More flexibility

- Load balancing function making Hoteam HTQF APFs highly desirable for industrial grids dominated by single phase loads such as spot welding machines.
- In addition, the 3-phase 4-wire model (HTQF 4L) can offer neutral current compensation in commercial facilities subject to overloaded neutral cable due to triplen harmonics.



Harmonic spectrum without HTQF 3-phase 4-wire active power filter

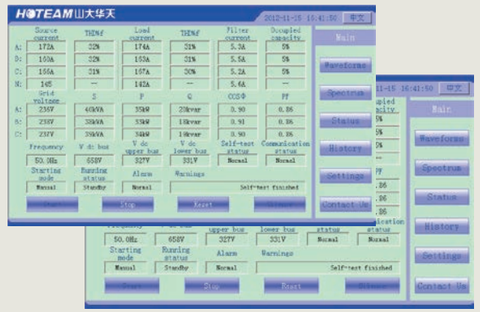


Harmonic spectrum with HTQF 3-phase 4-wire active power filter

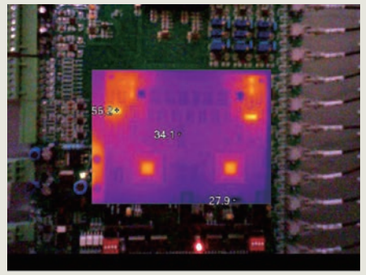
HOTEAM HTQF APF : NEW LEVEL OF RELIABILITY AND USER-FRIENDLINESS

- User-friendly LCD control and display panel featuring a intuitive 7-inch menu-based LCD touch-screen

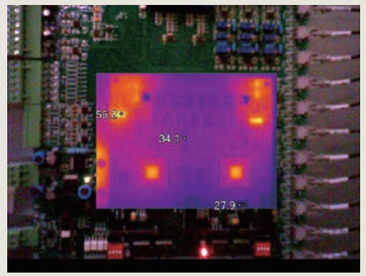
  Commissioning as well as the selection and setting of parameters can be conveniently done on the touch-screen. Moreover, the LCD panel features waveforms as well as harmonic spectrum graphic display.



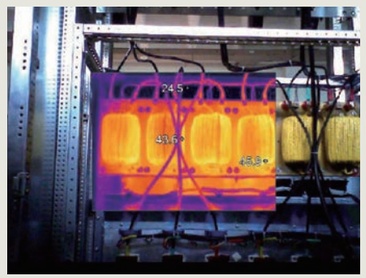
- Well-thought-of protections ensuring the maximum safety of the filter system in case of abnormal working conditions, which includes:
  - AC overvoltage & undervoltage on the mains
  - DC overvoltage on the DC bus
  - Inverter overcurrent & over temperature
  - IGBT, reactors, capacitors overtemperature
- Automatic current limitation without risk of overload
- Optical fiber link between the main controller board and individual power modules to provide complete galvanic isolation and EMI immunity.
- Remote PC monitoring with RS485 interface (MODBUS RTU protocol)
- Fault self-diagnosis as well as fault & event logging in real-time
- Rigorous thermal control allowing enhanced operation reliability for the active power filter system



Thermal image of the main control board



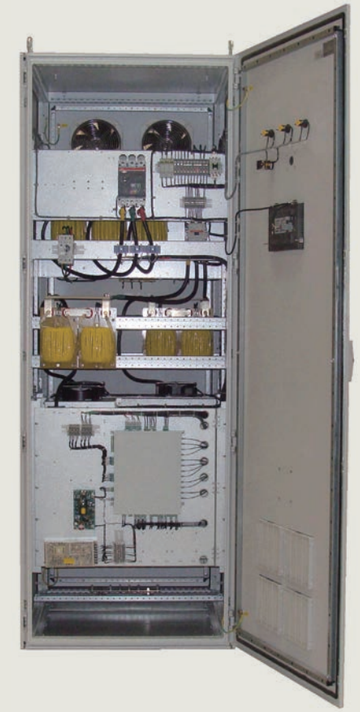
Thermal image of reactors



Thermal image of power modules

HOTEAM HTQF APF : ADAPTABILITY MEANS EASY SELECTIONV

- Up to ten units of HTQF APFs can operate in parallel for various capacity demands.
- Advanced control algorithm providing maximum reliability and adaptability to various site conditions without calculation of system impendence, along with the capability of parallel operation with the existing capacitor banks.
- The current transformers (CTs), as well as being installed on the supply side of the grid for close-loop control, can also be located on the load side alternatively for open loop control, which allows for easy installation in retrofitting projects such as energy-efficiency improvement.



MODEL DESCRIPTION SYSTEM

HTQF 3L – 0.4 /100A/ S / C

Product Name	
HTQF	Hoteam HTQF active power filter

Connection Method	
3L	3-phase, 3-wire system
4L	3-phase, 4-wire system

Nominal Voltage	
0.4	0.4KV
0.48	0.48KV
0.6	0.6KV
0.69	0.69KV

Installation	
C	Free standing
W	Wallmounting
R	Rackmounting

CT Location	
S	Supply Side
L	Load's Side
P	Programmable on site

Comepnsation Current	
50A	50A
……	……
600A	600A

HOTEAM

SPECIFICATIONS

Model name	HTQF 3L-0.4 3-phase 3-wire APF	HTQF 4L-0.4 3-phase 4-wire APF	HTQF 3L-0.69 3-phase 3-wire APF
General electrical parameters			
Nominal voltage	400V -20/+15%(1)		690V -20/+15%(1)
Nominal frequency	50/60Hz ±5%		
Performance specifications			
Compensation current	30A ~ 600A(2)	30A ~ 400A(2)	50A ~ 250A(2)
Compensation efficiency	Up to 97%		
Harmonic spectrum	2nd to 50th harmonics		
Harmonic compensation selection	2nd to 50th harmonics all can be selected individually, Up to 20 harmonics can be compensated simultaneously		
Response time	Instantaneous response time < 0.1ms Full response time < 20ms		
Neutral current compensation	N/A	3 times of the compensation current ratings, capable of zero-sequence harmonic compensation	N/A
Power factor correction	Power factor programmable from 0.6 (inductive) to 0.6 (capacitive)		
Load balancing	Programmable load balancing between phases	Programmable load balancing between phases as well as between phase and neutral	Programmable load balancing between phases
Inverter topology	Double interleaved inverter topology for ripple current cancellation		Multi-level inverter technology for ripple current reduction and higher rated voltage
Overload current	100% of compensation current ratings		
Power loss	Less than 3% of rated power		
HMI & Communication			
Display	7-inch English language menu-based touch screen (10-inch version available on request)		
Indicators	Green : Normal Orange : Overcurrent / Overload Red : System shutdown / alarm		
Communication interface	RS485 (Modbus RTU)		
Digital I/O	4 digital inputs , 2 digital outputs		
Operation configuration			
Parallel operation	Up to 10 units		
CT requirement	3 CTs required (class0.2 or better) Secondary rating: 5A		
CT Location	Source side or Load side, please specify when placing orders		
Cable entry	Bottom entry or top entry		
Color	RAL 7035, other color on request		
Environmental Conditions			
Operation environment	Indoor		
Protection class	IP3X, higher protection classes available on request		
Operation temperature	-10 ~ 50°C (higher operation temperature allowed with derating)		
Storage temperature	-25 ~ 70°C		
Cooling type	Forced air cooling		
Humidity	Maximum 95% non-condensation		
Altitude	1000m (higher operation altitude allowed with derating)		

(1) Other nominal voltages available on request. For 1140V, 6KV, 10KV applications, a step-up transformer is required.
(2) For more details, please refer to the following product selection tables.

PRODUCT SELECTION TABLES

Hoteam HTQF 3L-0.4 3 phase 3 wire APF											
Model	30A	50A	75A	100A	150A	200A	250A	300A	400A	500A	600A
Compensation current A	30	50	75	100	150	200	250	300	400	500	600
Var compensation kvar	20	33	50	66	100	133	165	200	266	330	400
Approx. weight kg	140	160	210	330	370	390	460	520	640	740	880
Panel	Nonstandard			MNS or GGD							
Installation	Floor standing or wall mounting			Floor standing							
Width mm	600			600		800	1000				
Depth mm	400			800				1000			
Height mm	1500	1800		2200							

Hoteam HTQF 4L-0.4 3 phase 4 wire APF									
Model	30A	50A	75A	100A	150A	200A	250A	300A	400A
Compensation current A	30	50	75	100	150	200	250	300	400
Var compensation kvar	20	33	50	66	100	133	165	200	266
Approx. weight kg	150	180	230	350	390	410	490	560	700
Panel	Nonstandard			MNS or GGD					
Installation	Floor standing or wall mounting			Floor standing					
Width mm	600			600		800	1000		
Depth mm	400			800				1000	
Height mm	1500	1800		2200					

Hoteam HTQF 3L-0.69 3 phase 3 wire APF					
Model	50A	100A	150A	200A	250A
Compensation Current A	50	100	150	200	250
Var compensation kvar	60	120	180	240	300
Approx. weight kg	310	470	490	620	760
Panel	MNS or GGD				
Installation	Floor standing				
Width mm	600	800		1000	
Depth mm	800		1000		
Height	2200				

KEY PRODUCT FEATURES

- Hot-swappable modular design
- Stunning power density and compact size
- Directly compatible with 19" racks
- Easy installtion and maintenance
- Powerful controller based on dual-DSP architecture
- Advanced 3-level IGBT inverter topology
- Compensation efficiency > 97%
- Cancel up to 50th harmonic
- Amorphous alloy reactors for low noise and enhanced energy efficiency
- Power loss<3%
- EMC design by industrial grade standard
- CE marking
- Harmonic selection compensation and four programmable task-priority modes
- Load balancing function
- 4.3 inch menu-based LCD touch-screen
- Close/Open loop control programmable on site

TYPICAL APPLICATIONS

- Data centers and telecom facilities
- Medical facilities
- Shopping malls and theme parks
- Culture and performance centers
- High-rise office buildings
- Large HVAC installation and tunnel ventilation
- Food processing industry
- Water/wastewater treatment
- Automotive industry with many single phase loads
- Automated production&assembly lines
- Logistic centers with large conveyor systems

CE

POWER QUALITY CHALLENGES IN MISSION-CRITICAL FACILITIES AND MODERN BUILDINGS… WHICH WE CLEARLY UNDERSTAND

INCREASING POWER AVAILABILITY AND ENERGY EFFICIENCY REQUIREMENTS

Mission continuity is always a crucial aspect in infrastructures like data centers, telecom facilities as well as hospitals, where power availability must be ensured 24/7/365 to avoid data losses and downtime of business operations. On the other hand, along with many other modern architectures, these mission-critical facilities are faced with constant evolutions in energy demands, both in terms of power rating and energy efficiency.

DILEMMA BETWEEN NON-LINEAR LOADS INTRODUCED FOR POWER DEMANDS AND POWER QUALITY

To ensure the power availablity and energy efficiency, commercial applications are making an increasing use of UPS, variable frequency drives (VFDs) for ventilation, switching mode power supply (SMPS), fluorescent lamps.
All these loads are non-linear and inject considerable harmonics back into the grid. Consequently,the widespread use of those non-linear loads backfires and pose serious thread to power availability.

TRIPLEN HARMONICS AND RELATED NEUTRAL CURRENT ISSUE

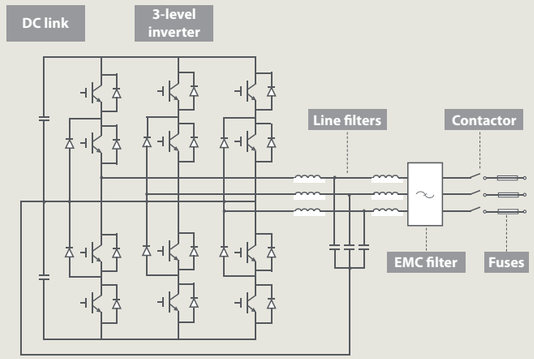
Prevailing single phase loads in modern buildings, like computers and lightings, by their nature, can generate considerable triplen harmonics. The triplen harmonics are defined as the odd multiples of the 3rd harmonic (3rd, 9th, 15th, etc). They are of particular concern because triplen harmonics add up in the neutral conductor and can overload power supply cables, and unless the neutral is sufficiently oversized, this can present a serious fire hazard to the building.

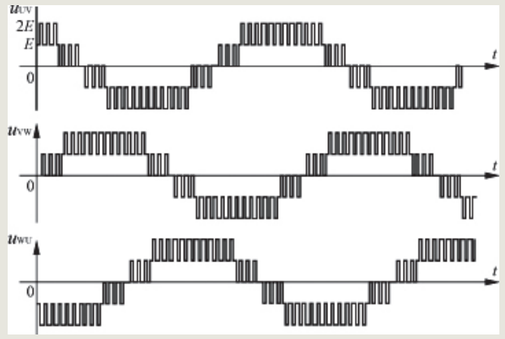
NO TRADE-OFF BETWEEN PERFORMANCE AND COMPACT SIZE

The technology behind no-compromise harmonic compensation...

CLEANER AND SAFER GRIDS, AS SIMPLE AS HTQF R-SERIES

Easy installation | Hot-swappable | Scalability | Cost-effective





The Hoteam HTQF R-Series are active power filters designed for applications where simplicity is the key requirement. When you need a compact APF solution that does its job without extra hassle, the HTQF R-Series is the one you should be taking a closer look at.

PROVEN TECHNOLOGY INHERITED FROM HOTEAM HTQF APF FAMILY

The HTQF active power filter family is based on a unified control platform and a consistent design concept. As an integral member of the Hoteam HTQF APF family, HTQF R-Series, although highly compact, features the same cutting-edge performance as its big brothers.

Our engineers have successfully extended all the standard functions in the freestanding HTQF APF systems to the compact R-Series, including harmonic selection compensation according to harmonic frequency, as well as four programmable task-priority modes for harmonic filtration and var compensation. These two features allow users to squeeze the R-Series active power filter performance to the last drop according to every possible power quality site conditions.

3-LEVEL IGBT INVERTER TOPOLOGY

At the heart of the R-Series APF is the 3-level IGBT inverter, which can be considered as an innovation that has huge impact on efficiency and footprint in mudular active power filters.

In general, compared with the conventional 2-level inverter which comprises of six IGBTs, the 3-level topology utilizes 12 IGBTs. The doubled number of IGBTs and the split DC link significantly lower the ripple current of the output current and therefore, improve the efficiency and downsize the EMC filter and line filters for a smaller footprint.

STUNNING POWER DENSITY UP TO 1.12W/CM^{3}T

hanks to the 3-level topology, Hoteam HTQF R-Series APF can achieve 100A harmonic compensation in compact dimensions of 440mm*575mm*232 mm.

EASY HANDLING AND INSTALLATION

HTQF R-Series rackmount models are equipped with slot adapter sockets to facilitate quick installation in all kinds of enclosures. Additionally, the well-thought-out fool-proofing mechanisms, like the self-positioning terminal connectors, are used to guarantee correct connection and significantly simplify the commissioning, which used to be complicated.

Also, whether wall mounted or placed on a rack, the HTQF R-Series, with its compact size and the flexible installation methods, is perfectly fit in a restricted space where freestanding APF cannot access. As a result, in a retrofit project, no damage or modification to the building is needed.

HOT-SWAPPABLE AND REDUCED MTTR (MEAN TIME TO REPAIR)

The current transformers can be automatically short-circuited and disconnected when a HTQF R-Series module is removed. The R-Series APF system decentralizes the control units in each APF module and a module can be extracted from the rack via front access. As a result, a module can be easily added or replaced in a few minutes while the whole APF system is still in operation, to minimize service time on site.

"PAY AS YOU GO" SCALABILITY AND LOWER COST OF OWNERSHIP

Each rackmount module is a fully independent 60A or 100A APF system and the APF system expansion is extremely easy. With the evolving power demands, the scalability allows the user to invest only for the compensation capacity required in the short-term and plug in new modules whenever the harmonic compensation capacity needs to be upgraded.

PANEL BUILDERS ELECTRICAL SYSTEM INTEGRATORS

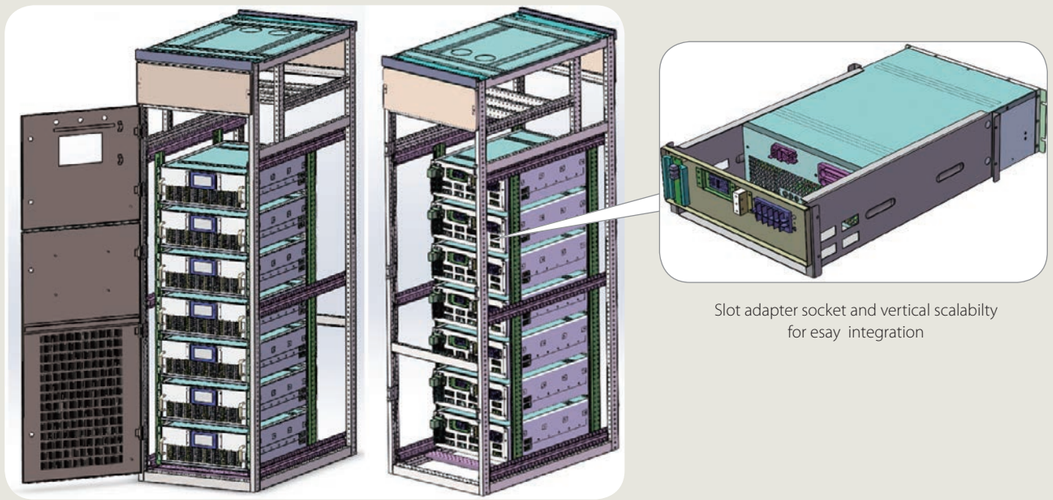
Solving Harmonic Issues Whatever The Integration Restriction Is

UNIVERSAL COMPATIBILITY WITH ENCLOSURES OF ALL KINDS

HTQF R-Series rackmount modules are directly compatible with the existing 19" racks in data centers without additional expense. For centralized compensation applications in switchgear rooms, the rackmount modules can be integrated in MNS metal-enclosed drawout switchgears to operate in parallel with other distribution switchgears.

BETTER INTEGRATION TO VARIOUS OPERATION ENVIRONMENTS THROUGH LOCAL CUSTOMIZATION

No matter what the local preference for switchgears or the protection class requirement is, HTQF R-Series rackmount module can always be integrated in a customized sub-distribution board by local panel makers or electrical system integrators to keep appearance consistency in the distribution switchgear room and meet local regulations.



Slot adapter socket and vertical scalabilty for esay integration

SPECIFICATIONS

Name	HTQF 3L-0.4 R-Series 3-phase 3-wire APF	HTQF 4L-0.4 R-Series 3-phase 4-wire APF
General electrical parameters		
Nominal voltage	400V -20/+15%	
Nominal frequency	50/60Hz ±5%	
Performance specifications		
Compensation current	35A, 60A, 75A, 100A	
Compensation efficiency	Up to 97%	
Harmonic spectrum	2nd to 50th harmonics	
Harmonic compensation selection	2nd to 50th harmonics all can be selected individually, up to 20 harmonics can be filtered simultaneously	
Response time	Instantaneous response time < 0.1ms Full response time < 20ms	
Neutral current compensation	N/A	3 times the RMS line current, capable of zero-sequence harmonic compensation
Power factor correction	Power factor programmable from 0.6 (inductive) to 0.6 (capacitive)	
Load balancing	Programmable load balancing between phases	
Overload current	100% of compensation current ratings	
Power loss	Less than 3% of rated power	
HMI & Communication		
Display	4.3-inch English language menu-based touch screen	
Communication interface	Modbus RTU (RS232/485) capable of multi-module communication	
Operation configuration		
Parallel operation	Up to 10 units	
CT requirements	3 CTs required (class 0.2 or better), Secondary rating: 5A	
CT Location	Source side or Load side, please specify when placing orders	
Color	RAL9004 Black, other color on request	
Environmental Conditions		
Protection class	IP20, higher protection class available on request	
Operation environment	Indoor, cleaning environment	
Operation temperature	-10 ~ 40°C (higher operation temperature allowed with derating)	
Storage temperature	-25 ~ 70°C	
Humidity	Maximum 95% non-condensation	
Altitude	1000m (higher operation altitude allowed with derating)	

CE

HTQF R-Series 4L 60A Active Power Filters Have Passed CE Certification

EMC

LVD

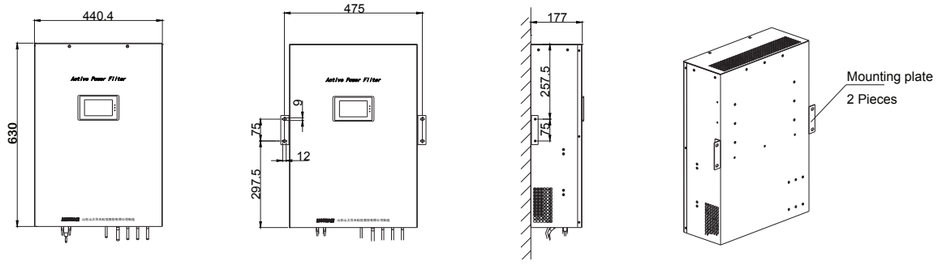
PRODUCT SELECTION TABLES

HTQF 3L-0.4/■■■A P-R	HTQF 4L-0.4/■■■A P-R			
Model	**35**	**60**	**75**	**100**
Wire system	3 phase 3 wire system / 3 phase 4 wire system			
Compensation current A	35	60	75	100
Var compensation kvar	23	40	50	66
Approx. weight kg	20	28	48	60
Panel	Compatible with 19" rack			
Installation	Rackmount			
Width mm	440	440	440	440
Depth mm	630	630	575	575
Height mm	176	176	232	232
Cable entry	Bottom entry			

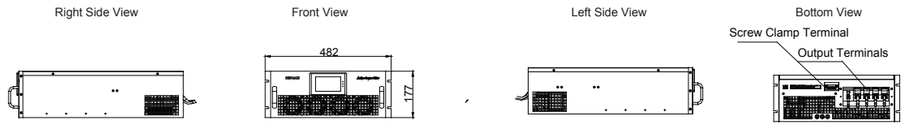
HTQF 3L-0.4/■■■A P-W	HTQF 3L-0.4/■■■A P-W			
Model	**35**	**60**	**75**	**100**
Wire system	3 phase 3 wire system / 3 phase 4 wire system			
Compensation current A	35	60	75	100
Var compensation kvar	23	40	50	66
Approx. weight kg	20	28	48	60
Panel	Compatible with 19" rack			
Installation	Wallmount			
Width mm	440	440	440	440
Depth mm	176	176	232	232
Height mm	630	630	575	575
Cable entry	Top entry			

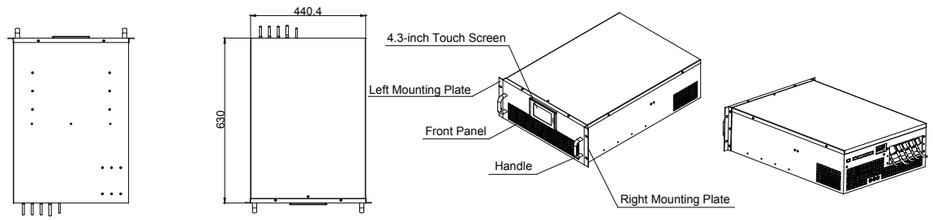
DIMENSIONS DRAWING

60A WALLMOUNT MODEL

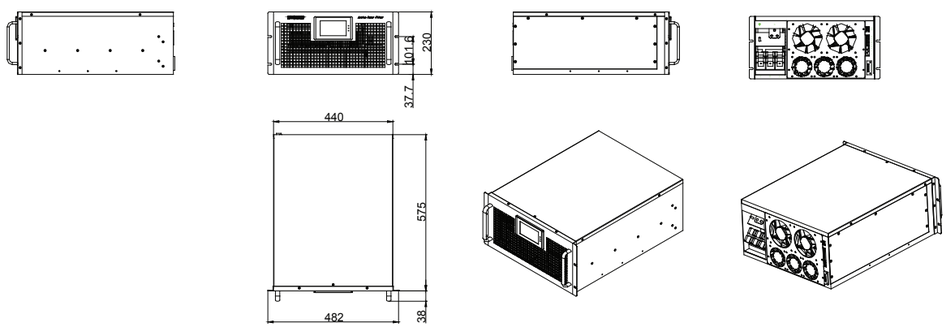


60A RACKMOUNT MODEL



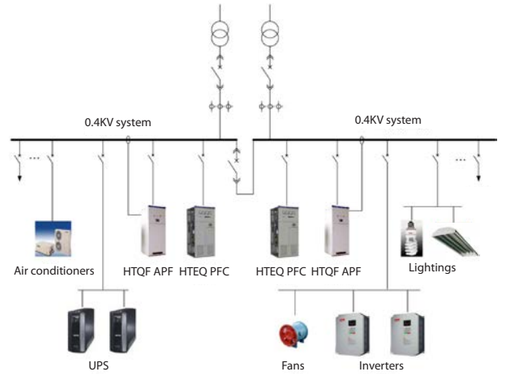


60A RACKMOUNT MODEL



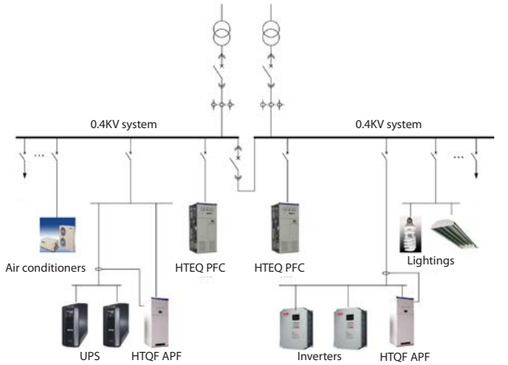
HTQF APF SOLUTIONS IN REAL-WORLD SITUATION

Depending on the site conditions, such as the load profile and distribution network configuration, as well as the desired compensation effect, there are various kinds of compensation solutions to obtain the most cost-effectiveness. According to the location of APF in the network, the harmonic compensation solutions can categorized as centralized compensation, group compensation and local compensation.



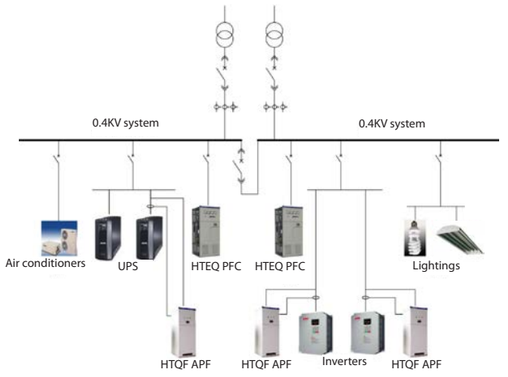
CENTRALIZED HARMONIC COMPENSATION

Centralized compensation is suited for distributed power distribution network where the large number of nonlinear loads with small rated power are well spread out. As a result, Hoteam HTQF active power filters are preferably installed on the secondary side of transformers to compensate harmonics globally.



GROUP HARMONIC COMPENSATION

Group compensation, on the other hand, is suitable for the power distribution network where the nonlinear loads are mainly located at certain branches. For example, a Hoteam HTQF active power filter is fitted in a branch with multiple sets of high-power rated industrial UPS.



LOCAL HARMONIC COMPENSATION

For power distribution network in which the nonlinear loads, such as high-power rated inverters, thyristor power supplies and induction furnaces, are located closely, a set of Hoteam HTQF active power filter can compensate locally.

HOTEAM

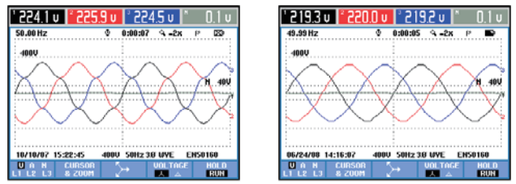
CASE STUDY

HOTEAM HTQF APF IN A GOLD MINE

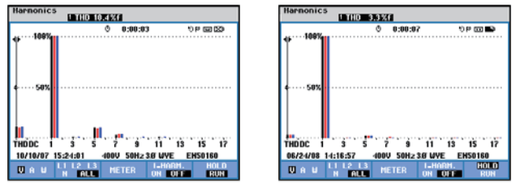
Mining industry has a unique load portfolio where mining hoists, pumps and ventilation fans, crushers, conveyor systems and ball mills are the predominant loads and good power qulaity is an essential aspect for reliable operation for the whole site. However, whether driven by variable frequency drives (VFDs), rectifiers or just cycloconverters, drive system in the mining industry would generate considerable harmonic distortions which are characterized by the significant 5th and 7th harmonics.

As a result, the process shops of the Jinchiling Gold Mine suffered from high level of harmonic distortion which in turn cause extensive damage to the VFDs as well as harmonic resonance with capacitors. Our company was chose to do a power quality improvement project in those poverty stricken shops and finally HTQF active power filters were installed on site as most effective solution.

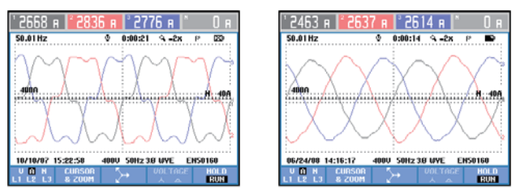
After the installation, the current and voltage waveforms have been improved significantly and the harmonic content dropped considerably. Most importantly, the THDv dropped from 10.4% to 3.3% , which was lower than the national standard of 5% set by the Chinese regulation Quality of electric energy supply-Harmonics in public supply network (GB/T 14549-1993).The drop in the THDv of the busbar means rised performance, reliablility and efficiency of electrical equipment. It also protects the reactive power compensators from overloading. As for harmonic currents, the THDi decreased from 20.6% to 4.7%, which in turn significantly reduced the resonance caused by the switching of reactive power compensation capacitors .



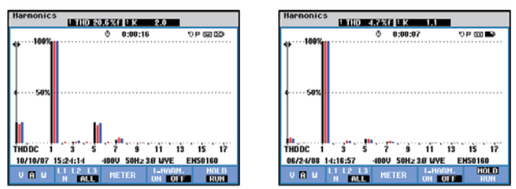
Waveforms and RMS values of phase voltages before and after HTQF APFs were installed



Harmonic spectrum of phase voltages before and after HTQF APFs were installed



Waveforms and RMS values of phase currents before and after HTQF APFs were installed



Harmonic spectrum of phase currents before and after HTQF APFs were installed

OUR CLIENTS

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中国石化 SINOPEC
CNOOC
国家电网公司 STATE GRID CORPORATION OF CHINA
中国移动通信 CHINA MOBILE
China Unicom 中国联通
GM
Ford
CHANA
潍柴动力 WEICHAI POWER
中国重汽 SINOTRUK
Great Wall
中国农业银行 AGRICULTURAL BANK OF CHINA
中国建设银行 China Construction Bank
中国铁路总公司 China Railway Corporation
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苏州地铁 SU ZHOU METRO
青岛地铁 QINGDAO METRO
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新华制药 XINHUA PHARM.
山东钢铁 SHAN STEEL
youser 陕西有色 JDC 金堆城钼业集团有限公司 JINDUICHENG MOLYBDENUM GROUP CO.,LTD.
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