Automation for a Changing World

Delta Power Quality Solution Success Stories

www.deltaww.com

DELTA

Smarter. Greener. Together.

Table of Contents

Cookware Industry

Active Power Filter
APF2000 Series

Background

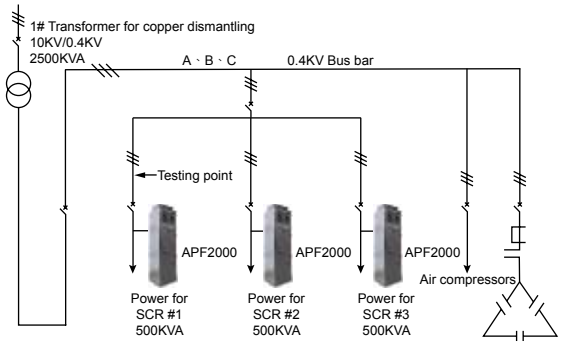
- Supor Co., Ltd. in Zhejiang is China's leading manufacturer of cookware products whose production lines were always heavily loaded.
- Cookware manufacturing requires an electroplating process that forms a metal coating on products.
- Three 500kVA silicon-controlled rectifier (SCR) units adopted for the electroplating process used 70% of the total power loading and created serious harmonic distortion that caused overheating, extreme noise from harmonic oscillation and damage to the existing capacitor cabinets.
- These problems affected manufacturing efficiency and safety, reduced production capacity, and could have possibly led to life threatening accidents.

Harmonic Treatment for Electroplating Process

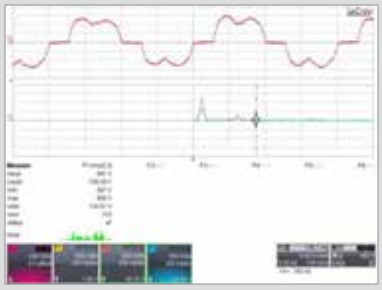
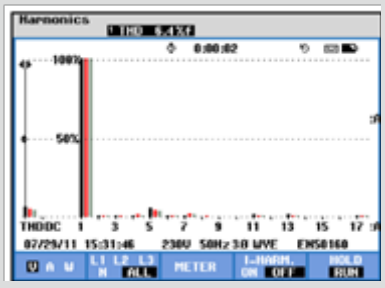
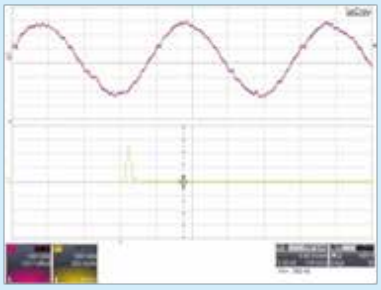
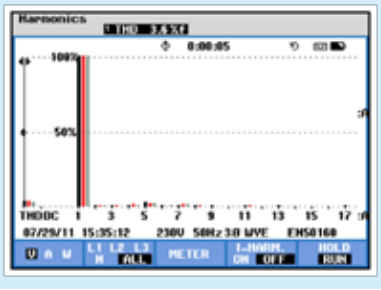
Supor Cookware, Zhejiang, China

Delta's Solution

- Six Active Power Filter APF2000 series (200A) units were deployed by the three major SCRs and connected to the power grid in parallel to filter harmonics.
- System Structure:



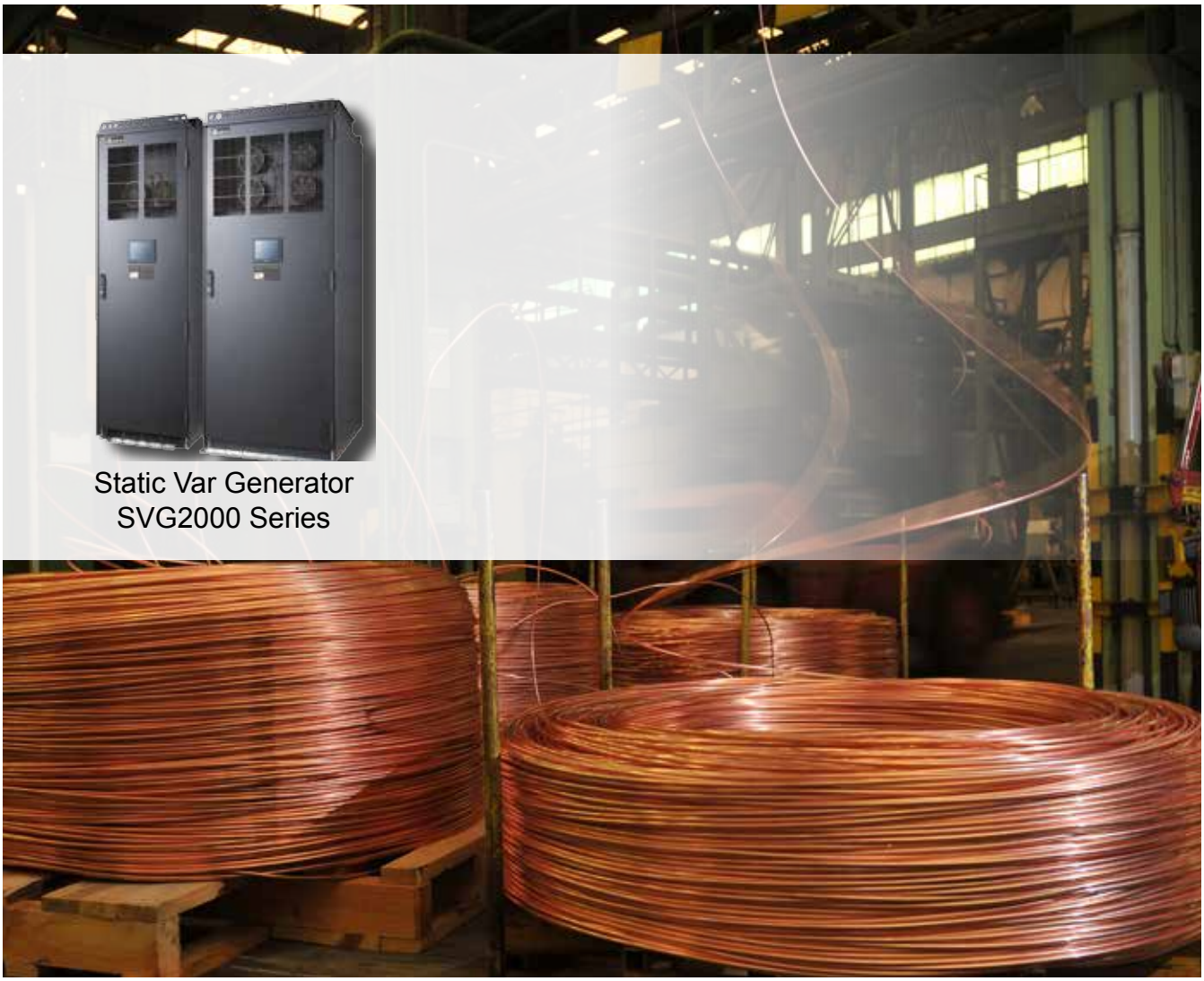
- Performance: The harmonic voltage dropped from 6% ~ 10% to 2% ~ 4%. The harmonic current decreased to below 5%. The current waveform was corrected back to a sinusoidal shape.

	Current Waveform	Harmonic Distortion
Before		
After		

Benefits

Delta's power quality solution solved the overheating and noise problems for the electroplating lines and provided them with more stable facilities, reduced maintenance costs, and lowered safety risks.

Metal Processing Industry



Static Var Generator
SVG2000 Series

Background

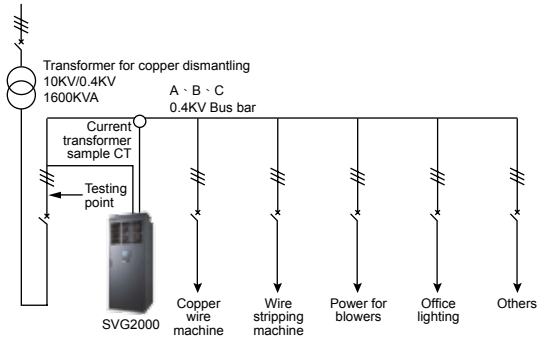
- Jiangxi Copper is China's largest and most modern metal processing manufacturer specializing in copper extraction and processing.
- A copper dismantling project which used wire stripping machines, motor dismantling machines, and many other machines controlled by high-power inverters, was creating significant harmonic distortion, voltage fluctuations, and large amounts of reactive power that reduced the power factor down to 0.6 ~ 0.7.
- Harmonic distortion problems led to system malfunctions and production breakdowns. Reactive power problems led to a huge waste of energy and large power bills.

Harmonic and Reactive Power Treatment for Metal Dismantling

Jiangxi Copper, Jiangxi, China

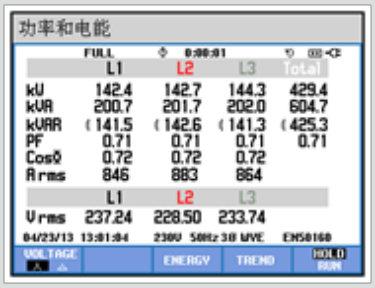
Delta's Solution

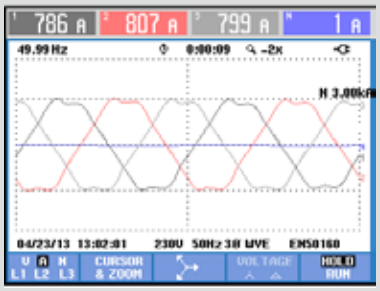
- One Static Var Generator SVG2000 series (500kVar) unit was deployed by the power distribution system for the large dismantling machines to perform bidirectional compensation for reactive power while suppressing harmonics.
- System Structure:



- Performance: The power factor of the power distribution system improved from 0.71 to 0.97. The harmonic current dropped from 11% ~ 15% to 2% ~ 4%.

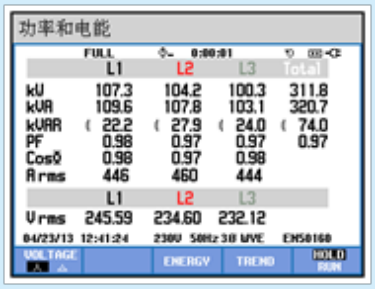
Before

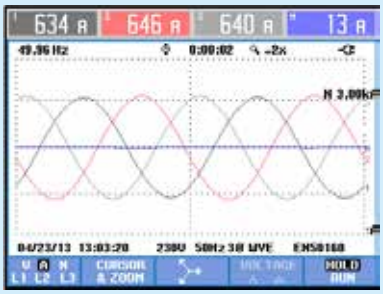




Power | Harmonic Distortion

After





Benefits

While improving the facility's efficiency and stability, Delta's power quality solution also helped Jiangxi Copper with enhanced power efficiency for power savings, and with avoiding penalties from utility companies, making the best usage of a limited resource.

Metallurgy Industry

Static Var Generator
SVG2000 Series

Active Power Filter
APF2000 Series

Background

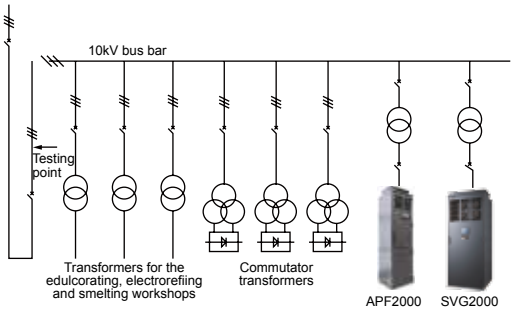
- Jiangxi Copper's Qingyuan Factory in Guangdong was dedicated to copper extraction, including edulcorating, electrorefining, and smelting. The transformer and three commutator transformers of the electrorefining workshop summed up a 10kV electrical load that was borne by one bus bar.
- Using inverters, pumps and blowers in the electrorefining workshop added an extra load burden on the bus bar and created harmonic problems that led to voltage fluctuations, and interference and damage to other equipment.
- The system's low power factor represented an enormous energy waste and resulted in penalties of up to RMB 180,000 per month.

Harmonic and Reactive Power Treatment for Metal Electrolyzing

Jiangxi Copper Qingyuan Factory, Guangdong, China

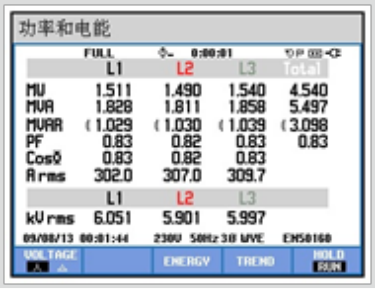
Delta's Solution

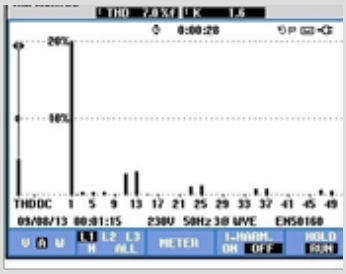
- The 10kV bus bar of the electrorefining workshop adopted
  - Seven Static Var Generator SVG2000 series (500kVar) units paired with a step-up transformer (10kV / 0.69kV)
  - Two Active Power Filter APF2000 series units paired with a step-up transformer (10kV / 0.4kV)
- System Structure:



- Performance: The power factor improved from 0.83 to 0.96. The harmonics distortion dropped from 6% ~ 8% to 3% which met the government regulated standard.

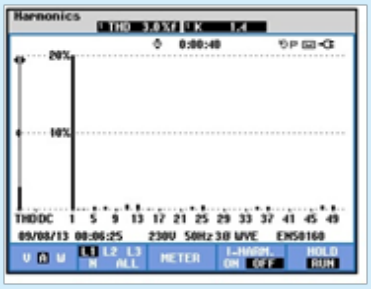
Before





Power | Harmonic Distortion

After



Benefits

By providing a better power factor, Delta's power quality solution helped the factory save big on power bills, avoid penalties charged by utility companies, and earn high power factor rewards. The harmonic treatment effectively solved the facility's interference problems and ensured a longer operational lifespan for cost savings.

Medical Industry

Active Power Filter
APF2000 Series

Background

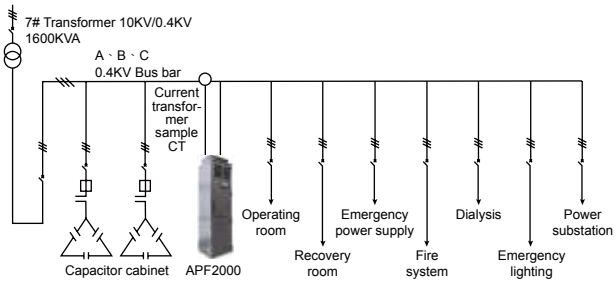
- First Clinical Hospital of Jilin University in Jilin, China, is a large-scale teaching hospital which uses a great number of modern electric medical instruments. While ensuring a stable power supply, many UPSs nevertheless can also cause serious harmonics distortion in the power system.
- Harmonic problems caused interference to the electrical components of other medical instruments and led to equipment malfunctions. Such problems could lead to life threatening medical accidents.

Securing Medical Power Stability

First Clinical Hospital of Jilin University, Jilin, China

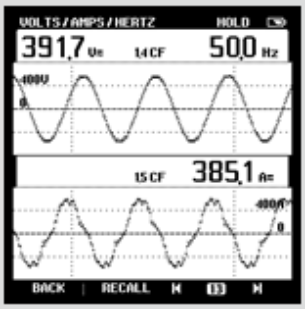
Delta's Solution

- One Active Power Filter APF2000 series (200A) unit deployed by the low-voltage incoming power lines for the four major transformers (1600kVA) through parallel connection to the power grid.
- System Structure:



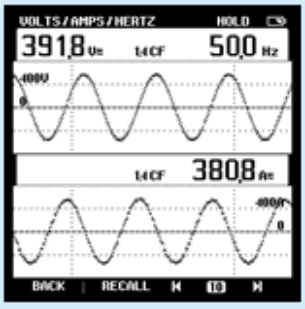
- Performance: The current waveform corrected back to a sinusoidal shape. The harmonic current dropped from 14.2% to 4.3% to meet the government regulated standard.

Before



Voltage/Current Waveform　　Harmonic Current Volume

After



Benefits

Solving the harmonic distortion which caused the electrical interference, Delta's solution ensured proper operation of medical instruments and prevented potential medical risks to patients due to equipment malfunctions.

Automobile Industry

Static Var Generator
SVG2000 Series

Background

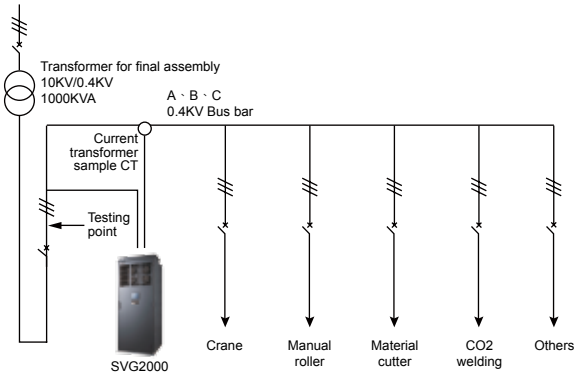
- JAC Motors in Anhui, China adopted a large number of machines with non-linear loads on its welding, stamping and assembly lines that caused serious voltage and current harmonic distortion to the low-voltage power grid.
- Harmonic distortion and reactive power caused enormous energy waste, damage to capacitor cabinets, overheating and excessive oscillation of magnetic components, and voltage fluctuations that led to equipment malfunctions, jeopardized production efficiency and quality, and posed safety risks to the production environment.

Harmonics and Reactive Power Treatment for Automobile Manufacturing

JAC Motors, Anhui, China

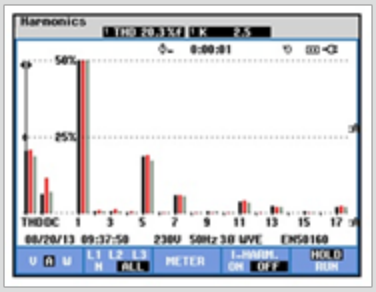
Delta's Solution

- One Static Var Generator SVG2000 series (500kVAR) unit deployed by the incoming power line of the final assembly workshop with 3-phase 3-wire wiring.
- System Structure:



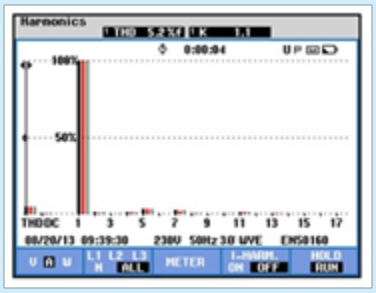
- Performance: The power factor improved from 0.71 to 0.98. The harmonic current dropped from 15% ~ 25% to 3% ~ 5%.

Before



Power | Harmonic Distortion

After



Benefits

Delta's Power Quality Solution solved the harmonic distortion faced by the car assembly lines of JAC Motors and restored operations back to normal. The reduced reactive power also improved energy efficiency for energy savings.

Papermaking Industry

Active Power Filter
APF2000 Series

Background

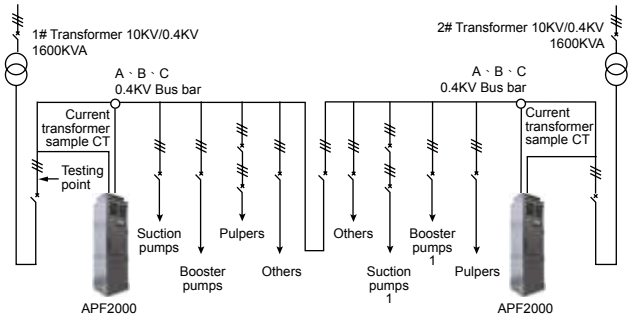
- Hangzhou Liqun Environmental Protection Paper Co., Ltd. in Zhejiang, China specializes in paper and tobacco product processing. The production lines used many inverters for variable frequency control and caused serious harmonic and reactive power problems.
- The problems caused interference to manufacturing facilities that affected product quality and damaged capacitor cabinets, which caused an explosion and fire, and led to a production outage. The large amount of reactive power caused low power factors and resulted in RMB 10,000 ~ 20,000 in penalties every month.

Harmonic and Reactive Power Treatment for Paper / Tobacco Processing

Liqun Environmental Protection Paper Co., Ltd., Hangzhou, China

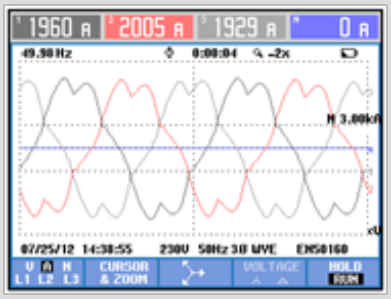
Delta's Solution

- Two Active Power Filter APF2000 series (200A) units deployed by the incoming power line for the two major transformers of the production line.
- System Structure:



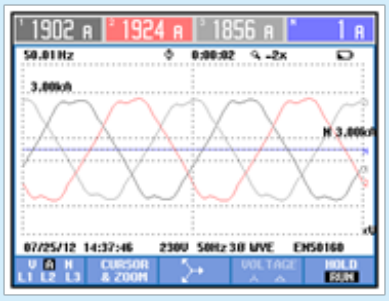
- Performance: The power factor improved from 0.89 to 0.99. The harmonic current decreased from 11% down to 5%.

Before



Power | Harmonic Distortion

After



Benefits

Improving harmonic distortion and reactive power problems, Delta's power quality solution ensured the paper / tobacco production lines for normal facility operation, an extended facility lifespan, better workplace safety, and better energy efficiency which resulted in RMB 2,000 ~ 3,000 of government rewards every month for power savings.

Crane Industry

AFE2000
Active Front End

Background

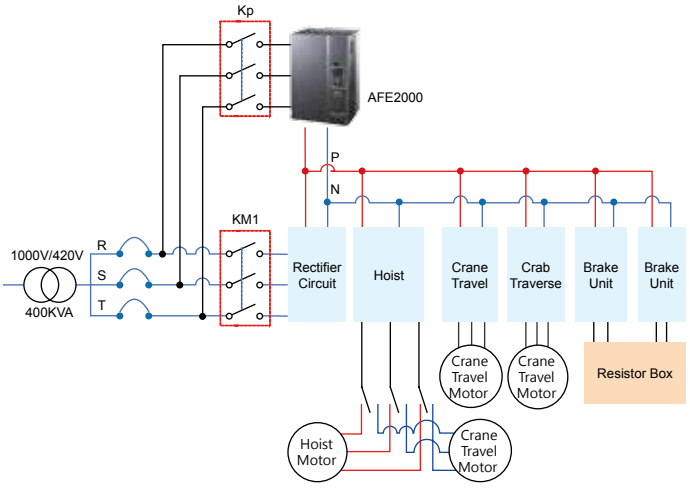
- Ningbo port is one of the five largest ports in China. Its cargo throughput volume reached the top 3 in China for 2013.
- A crane system is a major device used in cargo lifting and transporting at the port. Its rectifier characteristics during operation create harmonics distortion and consume reactive current which cause power quality problems and generates a low power factor of 0.2 ~ 0.9.
- The crane system is located a distance away from the mains power supply and it experienced voltage drops and difficulty in activation. The regenerative energy generated by the crane system was wasted through dissipated heat using the brake resistor.

Refurbishment of Old Crane System for Energy Saving Operation

Ningbo Port, Beilun District, China

Delta's Solution

- One Delta Active Front End unit was deployed to transform the old crane system. It was serially connected in between the crane system and the mains power supply to filter harmonics and convert regenerative energy into reusable electricity for other facilities to use.
- System Structure:



- Performance: The power factor improved from 0.87 ~ 0.94 to 0.99. The harmonic current was reduced from 14.5% to 2%. The power regeneration function provides energy savings of 30.2%.

AFE	Time min	Consumption kWh	Work Quantity (TEU)	Consumption Per UnitkWh	Harmonic Voltage	Harmonic Current	Power Factor
Before	30	28.68	10	2.868	Approx. 7.2%	Approx. 14.5%	Lift 0.94 Down 0.87
After	30	20.02	10	2.002	Approx. 1.7%	Approx. 2%	0.99

Benefits

Delta's power quality solution solved the overheating and noise problems for the crane system and provided it with more stable facilities, reduced maintenance costs, and lowered safety risks. In addition, its power regeneration function helps the system save more than 30% in energy.

Chemical Industry

Static Var Generator
SVG2000 Series

Background

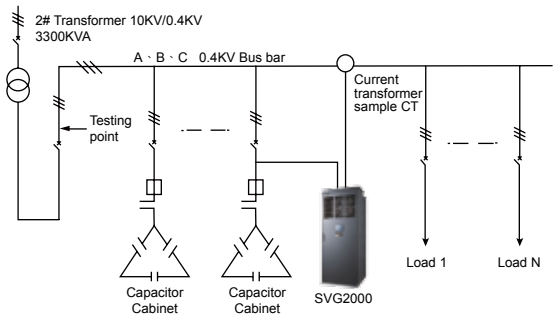
- Xinjiang Zhongtai Chemical Company is a large integrated chemical manufacturer of chlor-alkali, generating crude salt, calcium carbide and coke.
- Its chemical production line uses a large amount of inverters in many facilities that create harmonic distortion, especially for fans and pumps that consume excess reactive power and cause power instability.
- Power quality problems caused damage to the facilities, including short-circuiting of the power system copper busbar and overheating of capacitor cabinets and reactors. These problems led to power failure, system damage, melting of the thermal insulation tube and many other conditions. The most serious concerns were for sparks and short-circuits that would interrupt production and pose a risk of explosion.

Harmonic and Reactive Power Treatment for Chemical Industry

Zhongtai Chemical Production, Xingjiang, China

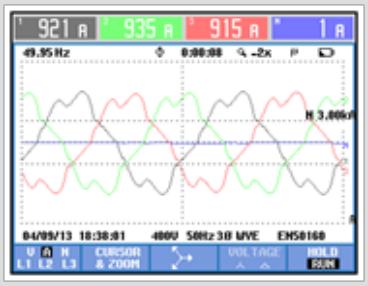
Delta's Solution

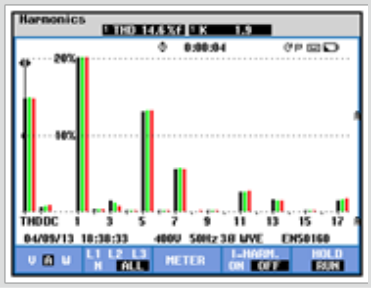
- One Static Var Generator - SVG2000 series (300 kVar) unit is connected to the low voltage side of a transformer to perform bidirectional compensation for reactive power and suppress harmonics.
- System Structure:



- Performance: Power factor improved from 0.82 to 0.95 and harmonic current dropped from 15% ~ 25% to 2% ~ 4%.

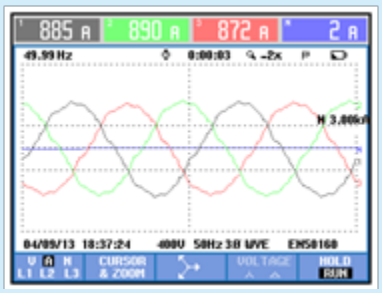
Before





Current Waveform | Harmonic Distortion

After



Benefits

Delta's power quality solution improved the production efficiency and stability for the Xinjiang Zhongtai Chemical Company. The SVG2000 series solved the overheating problems of copper busbars, capacitor cabinets and transformers while reducing noise, which ensures the facility of a longer lifespan and lowers the risk of chemical explosion from an interrupted production line.

Nylon Industry

Active Power Filter
APF2000 Series

Background

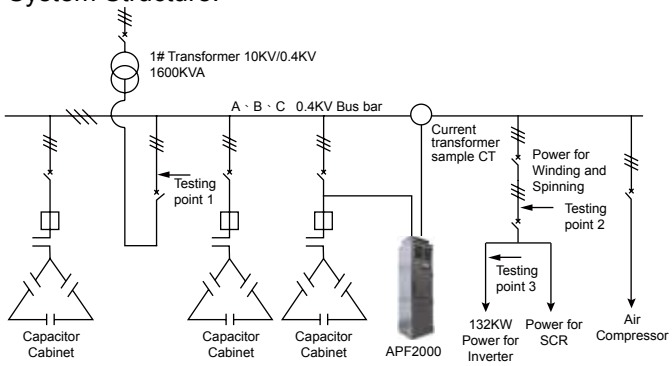
- Fujian Jinjiang Technology Company is a large-scale enterprise specializing in the production of high-tech nylon. It is one of the top 50 enterprises in Fujian Province.
- A nylon production line uses a large number of inverters and SCR power controllers to control power efficiency. However, this generates harmonic distortion in the current and voltage, causes overheating of the transformer, and damages the contacts in the capacitor cabinet. Besides facility damage, interruption of the production line would cause overheating of the materials and lead to poor product quality and affect company profits.

Harmonic and Reactive Power Treatment for Textile Manufacturing

Jinjiang Nylon Production, Fujian, China

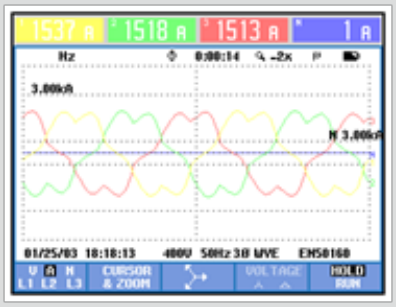
Delta's Solution

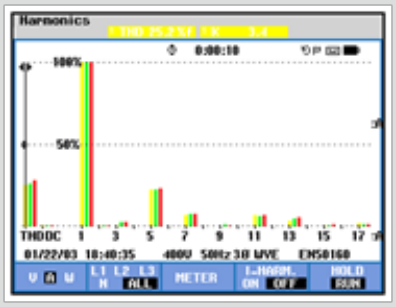
- Two Active Power Filter APF2000 Series units are connected to the low voltage side of the transformer to efficiently suppress harmonic current and voltage.
- System Structure:



- Performance: This corrects the harmonic wave from a distorted waveform into a perfect sinusoidal form and reduces harmonic current and voltage.

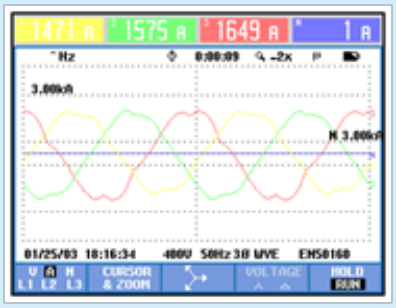
Before

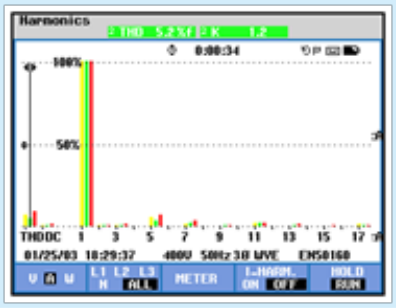




Power | Harmonic Distortion

After





Benefits

Delta's power quality solution provides high power efficiency for nylon production and ensures good product quality for Fujian Jinjiang Technology. The APF2000 series helps to solve the overheating problems of the production line, transformer and bus bars to provide clean power and ensure good product quality with high production stability.

Printing and Dyeing Industry

Active Power Filter
APF2000 Series

Background

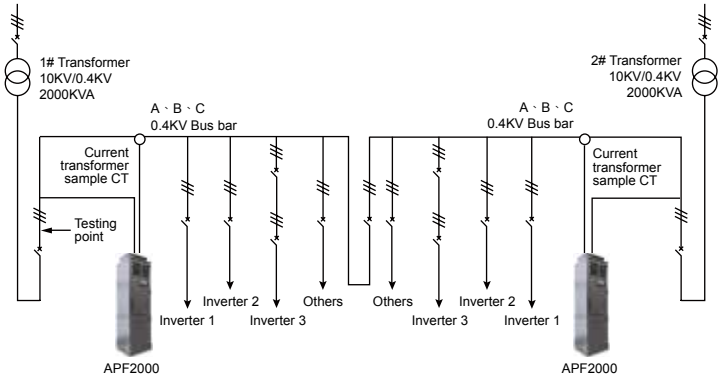
- Shaoxing Tengda Printing and Dyeing Co., Ltd. is a large export-oriented enterprise that incorporates trading, manufacturing, and processing. It specializes in printing and dying, and produces polyester knitted fabric, cotton knitted fabric, and polar fleece that are widely used in garments, blankets, and more.
- The printing and dyeing production line uses a large number of inverters to control power efficiency, which creates serious harmonic distortion of voltage and current in the low voltage grid and lowers the power factor.
- Harmonic problems cause overheating of electric facilities and damage to inverters, which leads to production line interruptions, reduces product quality and lowers productivity. Serious damage to transformers and capacitor cabinets result in minor power factor improvement and little difference in before-and-after application to the capacitor cabinet.

Power Factor Improvements for Printing and Dyeing Industry

Shaoxing Tengda Printing and Dyeing Co., Ltd, China

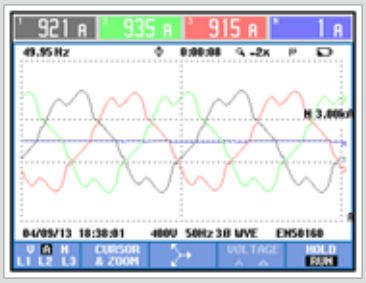
Delta's Solution

- Two Active Power Filter APF2000 Series units were deployed by the power distribution system and connected to the low voltage side of the transformer to improve power factor and suppress harmonics.
- System Structure:

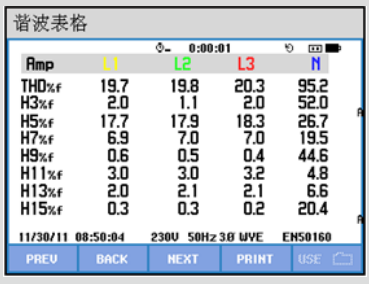


- Performance: The power factor has improved from 0.91 to 0.94. The harmonic current dropped from 15% ~ 20% to lower than 5%.

Before

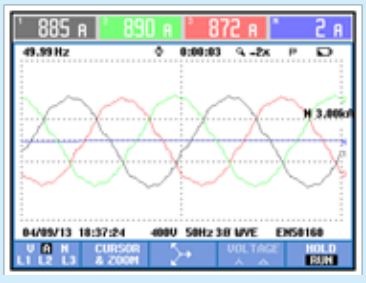


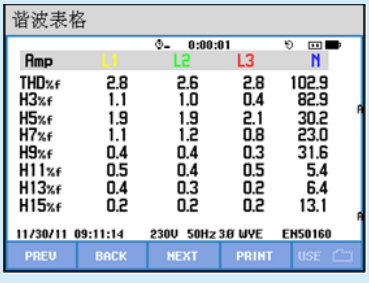
Current Waveform



Harmonic Distortion

After





Benefits

Delta's power quality solution effectively improved the power factor for the Shaoxing Tengda Printing and Dyeing Industry. Good power quality reduces damage to inverters, ensures a longer facility life, and leads to good production quality and productivity while saving on energy costs.

Crane Industry

Static Var Generator
SVG2000 Series

Background

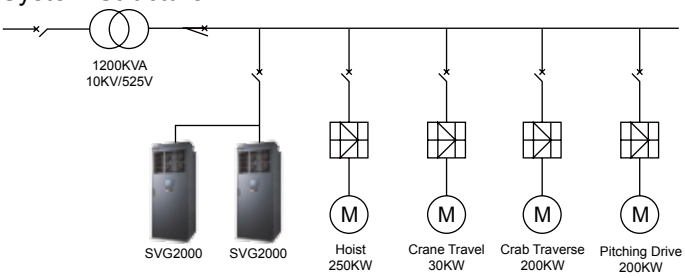
- Shekou Container Terminals, SCT is a major port in Shenzhen with convenient transportation via waterway, highway, and railway. Its cargo throughput volume was ranked in the world's top 3 in 2013.
- The port uses many quay cranes for cargo lifting and transporting. This type of system uses large power inverters and rectifiers to control the transportation speed. However, this generates harmonic currents in the system and consumes an excess amount of reactive power.
- Poor power quality results in many problems including burning out the reactor installed beside the capacitor cabinet, and providing low power efficiency and voltage distortion which causes unstable operation that may damage cargo during transportation. This also increases operation costs due to low power efficiency, damage during transportation, and utility company penalties for low power factor of RMB 10,000 to 20,000 every month.

Harmonic and Power Factor Treatment for Crane Industry

Shekou Container Terminal, China (Quay Crane Import / Export Port)

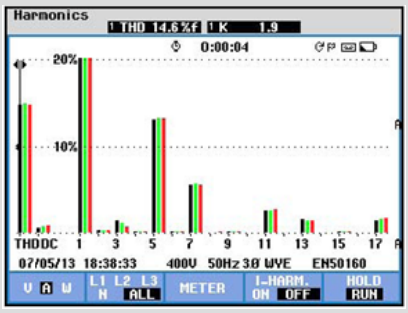
Delta's Solution

- Four Static Var Generator SVG2000 Series (500KVAR) units are deployed by the quay crane systems #4 and #6. The SVG2000 is connected to the low voltage side of transformers providing harmonics filtering and bidirectional reactive power compensation to improve power factor.
- System Structure:



- Performance: The power factor improved from 0.2 ~ 0.8 to 0.99. The harmonic current dropped from 10% ~ 50% to 2% ~ 5%.

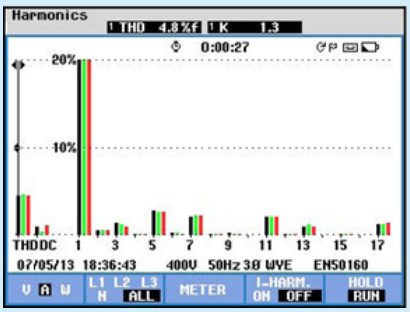
Before



Power Factor

Total Harmonic Distortion

After



Benefits

Delta's Power Quality Solution substantially improved the power factor of the SCT port from only 0.2 ~ 0.6 to 0.95, meeting government regulations and avoiding penalty costs. This is the benchmark of Delta's SVG2000 application for quay crane systems in China. It provides excellent harmonic filtering and reactive power compensation that helps SCT port save a great amount of energy and costs.

Telecom Industry

Active Power Filter
APF2000 Series

Background

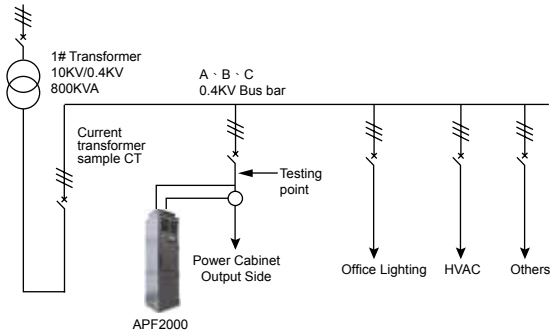
- China United Network Communications Group Co., Ltd. ("China Unicom") is a large company with branches located in 31 provinces providing services that include: mobile communications, domestic and international fixed telephone network and facilities (including wireless local loops), information services, image and multimedia communications and information services, and more.
- The Taiyuan office uses a large number of UPSs and switching power supplies in the IDC room to ensure uninterrupted data and information transmission, but this causes harmonics problem for the low voltage grid that leads to transmission failure.
- Power quality problems caused power activation failure and damaged the capacitor cabinet that led to loss of data and inaccurate billing, which impacted company profits.

Harmonic and Reactive Power Treatment for Telecom Industry

China Unicom

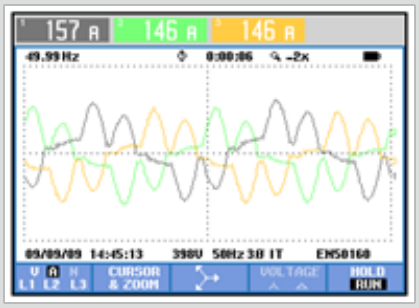
Delta's Solution

- One Active Power Filter APF2000 Series is connected to the UPS power supply side. The UPS is used to expand the capacity of an IDC engine room.
- System Structure:



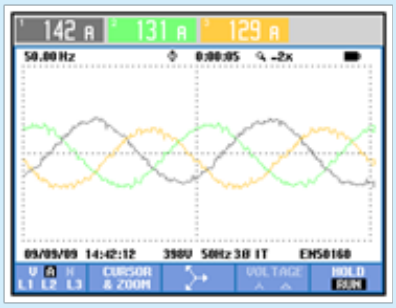
- Performance: Effectively reduces the harmonic current from 50% ~ 60% to below 5%.

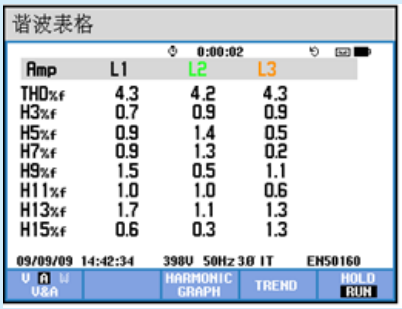
Before



Power Factor | Harmonic Distortion

After

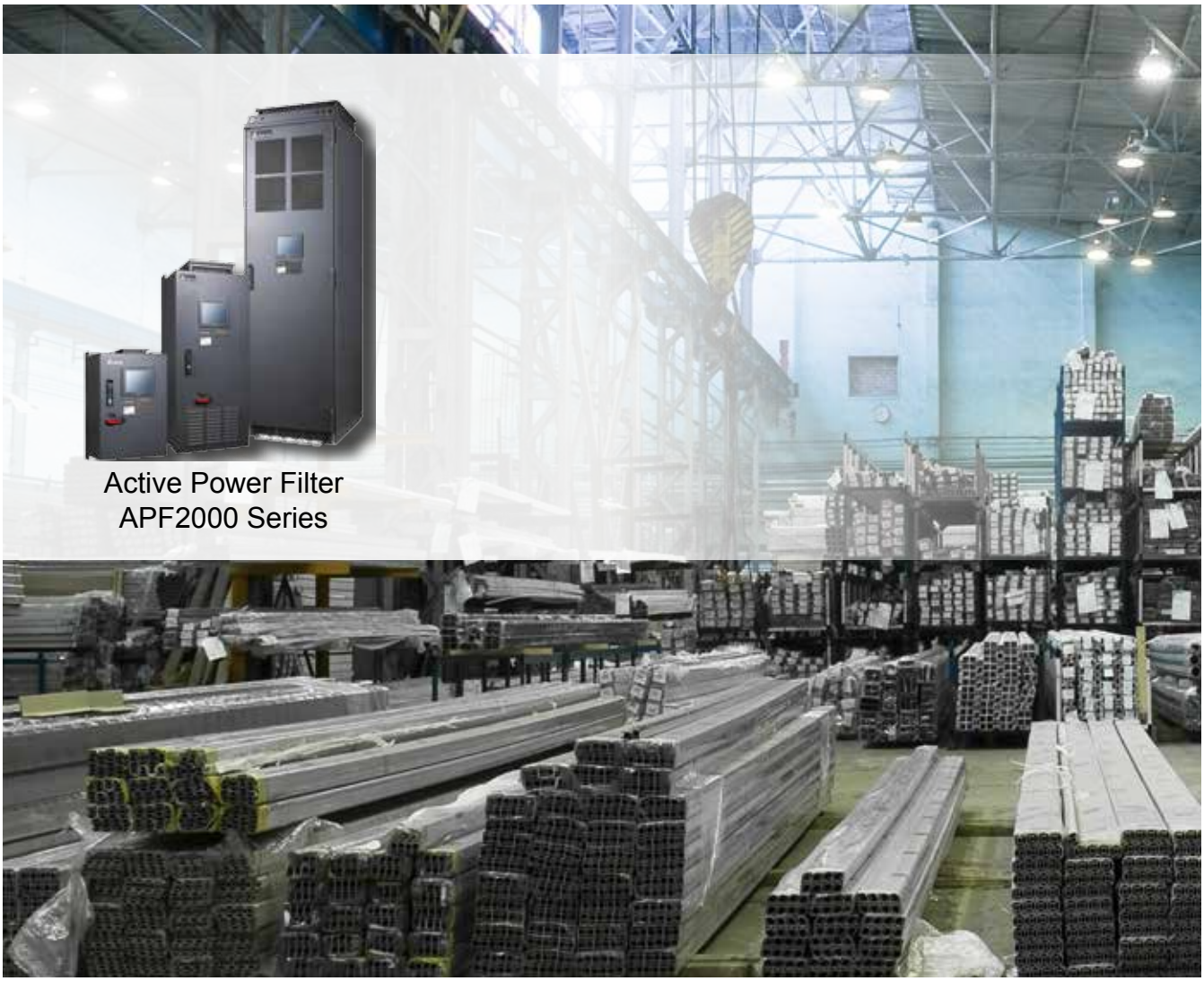




Benefits

Delta's power quality solution efficiently suppresses harmonic current down to 5% and ensures the Taiyuan telecom branch office with good power quality. This solves the IDC control room's loss of data problem and provides uninterrupted data transmission to ensure accurate billing and secure the company's profits.

Metallurgy Industry



Active Power Filter
APF2000 Series

Background

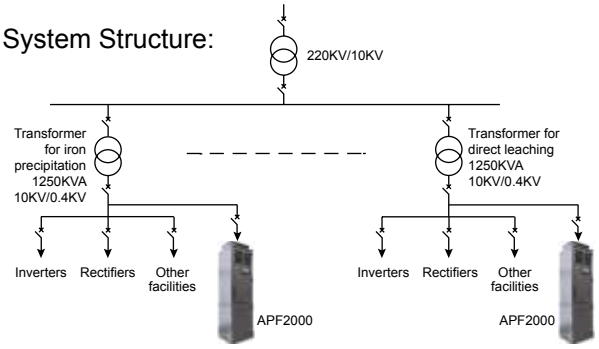
- Zhuzho Smelter Group Co., Ltd. in Hunan, China specializes in metal manufacturing, processing, and recycling. It is one of China's major manufacturers of descloizite products.
- Metal manufacturing and processing required many rectifiers and large power inverters that generated serious harmonics and reactive power affecting other manufacturing facilities. These problems led to facility malfunctions and damaged capacitor cabinets that constantly stopped production line operations and increased maintenance costs.

Harmonic and Reactive Power Treatment for Iron Precipitation and Direct Leaching

Zhuzho Smelter Group Co., Ltd., Hunan, China

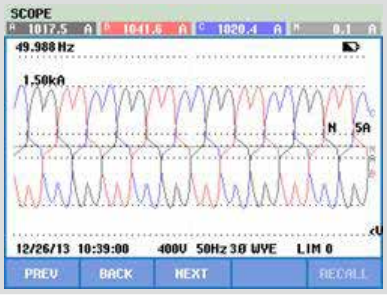
Delta's Solution

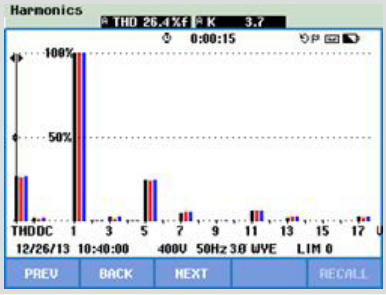
- Five Active Power Filters APF2000 series (300A) units were deployed by the five rectifiers and inverters used for the iron precipitation and direct leaching process, and connected in parallel to the power grid to suppress harmonics and reduce reactive power.
- System Structure:



- Performance: The current waveform was corrected back to a sinusoidal shape. The harmonic current decreased from 26.4% to 4%, meeting the government regulated standard.

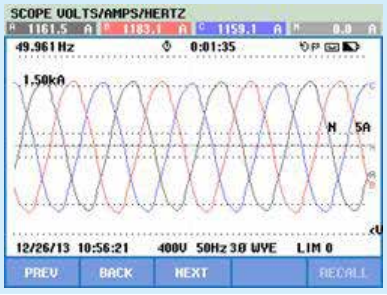
Before

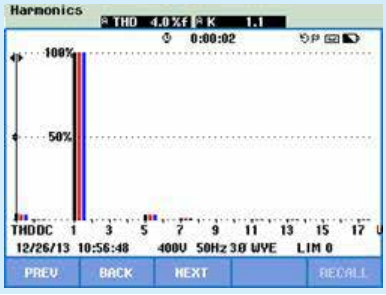




Current Waveform Harmonic Distortion

After





Benefits

Delta's power quality solution effectively improved the facility malfunction and capacitor cabinet damage problems faced by the Zhuzho Smelter Group on its production lines. The more stable facility ensured better production quality, lower maintenance costs and lower safety risks for safe, stable and efficient manufacturing lines.

Active Front End AFE2000

Active Front End (AFE) is a controllable rectifier with advantages such as providing bidirectional power exchange between AC and DC power and regenerating reusable power to the mains to reduce the cost of power. The AFE uses PWM modulation to greatly reduce distinctive peaks of current and form a perfect sine wave current. The power factor is corrected up to 1 and the ratio between load capacity and power capacity is 1:1. In addition, the AFE eliminates high order harmonics, provides very low harmonic current THD < 5% while improving the power factor, which allows you to save on the cost of purchasing additional electrical equipment for better power quality. The AFE also offers stable power quality unaffected from mains power fluctuations and can be applied to a serial connection.

Incorporating years of experience in AC motor drive development, Delta's innovative AFE2000 is designed for a wide range of applications and achieves outstanding energy saving results. The AFE2000 does not dissipate excess heat into the air but converts it into reusable power that can be supplied back to the mains. The AFE2000 is yet another Delta product that contributes to improving efficiency and productivity and that fulfills our mission "to provide innovative, clean and efficient energy solutions for a better tomorrow".

Active Power Filter APF2000

Delta's Active Power Filter APF2000 is your key to a clean grid for more efficient production. Today's automation equipment benefits us with a more convenient lifestyle and cost savings from higher production efficiency, however it can also bring significant power distortion problems that can lead to energy loss, increasing costs, and many other power quality issues.

Power quality is a major influence on power efficiency. A clean and efficient power system normally generates a sinusoidal current waveform, but the electrical equipment used in today's industrial automation industry generates non-sinusoidal currents that tend to cause power quality problems. Voltage or current distortion, reactive power impact, and unbalanced loads, are common problems that lower power reliability and power efficiency and also increase operation costs. Major concerns in the industrial automation industry are how to improve power quality and how to manage power grids.

Delta's APF2000 adopts the industry's highest standard 32-bit digital microprocessor to instantly compensate for all types of harmonics for ultimate power quality improvement. Perfect control of harmonic distortion reduces power loss and heat generation. The APF2000 is compact in design for all users to manage their space efficiently and is mounted with a 65,536-color TFT HMI for more realistic images and a vivid display. The ultimate mission of Delta's APF2000 is to provide you with improved power quality, lower energy loss and lower maintenance costs.

Static Var Generator SVG2000

Delta's SVG2000 is a Static Var Generator (SVG) that improves power quality. Compared to a traditional Static Var Compensator (SVC) with an LC system, Delta's SVG2000 offers many excellent features including enhanced stability, extended product lifetime, fast response, wide power range, large capacity, smooth tuning, low harmonics, stable system voltage, and many more, for greatly improved power quality.

Power quality is a major influence on power efficiency. Excellent power quality reduces energy loss and extends equipment lifetime for lower cost. In contrast, poor power quality caused by harmonics distortion, reactive power, or non-linear loads, tends to lower power reliability and utility. As many industries and applications continue to adopt a wide variety of electronic equipment to facilitate the production process, power quality distortion has become a common problem. The SVG2000 offers a way to solve this critical issue by properly managing power quality.

The SVG2000's compact design allows you to manage your installation space efficiently and the high standard color HMI provides realistic images and a vivid display. The SVG2000's excellent feature set helps to reduce energy loss, lower maintenance costs, and maximize your utility.

Smarter. Greener. Together.

Industrial Automation Headquarters

Delta Electronics, Inc.
Taoyuan Technology Center
No.18, Xinglong Rd., Taoyuan City,
Taoyuan County 33068, Taiwan
TEL: 886-3-362-6301 / FAX: 886-3-371-6301

Asia

Delta Electronics (Jiangsu) Ltd.
Wujiang Plant 3
1688 Jiangxing East Road,
Wujiang Economic Development Zone
Wujiang City, Jiang Su Province,
People's Republic of China (Post code: 215200)
TEL: 86-512-6340-3008 / FAX: 86-769-6340-7290

Delta Greentech (China) Co., Ltd.
238 Min-Xia Road, Pudong District,
ShangHai, P.R.C.
Post code : 201209
TEL: 86-21-58635678 / FAX: 86-21-58630003

Delta Electronics (Japan), Inc.
Tokyo Office
2-1-14 Minato-ku Shibadaimon,
Tokyo 105-0012, Japan
TEL: 81-3-5733-1111 / FAX: 81-3-5733-1211

Delta Electronics (Korea), Inc.
1511, Byucksan Digital Valley 6-cha, Gasan-dong,
Geumcheon-gu, Seoul, Korea, 153-704
TEL: 82-2-515-5303 / FAX: 82-2-515-5302

Delta Electronics Int'l (S) Pte Ltd
4 Kaki Bukit Ave 1, #05-05, Singapore 417939
TEL: 65-6747-5155 / FAX: 65-6744-9228

Delta Electronics (India) Pvt. Ltd.
Plot No 43 Sector 35, HSIIDC
Gurgaon, PIN 122001, Haryana, India
TEL : 91-124-4874900 / FAX : 91-124-4874945

Americas

Delta Products Corporation (USA)
Raleigh Office
P.O. Box 12173,5101 Davis Drive,
Research Triangle Park, NC 27709, U.S.A.
TEL: 1-919-767-3800 / FAX: 1-919-767-8080

Delta Greentech (Brasil) S.A
Sao Paulo Office
Rua Itapeva, 26 - 3° andar Edificio Itapeva One-Bela Vista
01332-000-São Paulo-SP-Brazil
TEL: +55 11 3568-3855 / FAX: +55 11 3568-3865

Europe

Deltronics (The Netherlands) B.V.
Eindhoven Office
De Witbogt 20, 5652 AG Eindhoven, The Netherlands
TEL: 31-40-2592850 / FAX: 31-40-2592851