

JIANGSU SFERE ELECTRIC CO., LTD.

Add: 99 Chengjiang R.(E), Jiangyin, Jiangsu, China. 214429

Tel: +86-510-8619 9063

Fax: +86-510-8619 9069

E-mail: export@sfero-elec.com

www.sfero-elec.com

POWER QUALITY MANAGEMENT SOLUTION

www.sfero-elec.com

JIANGSU SFERE ELECTRIC CO., LTD.
江苏斯菲尔电气股份有限公司

Elecnova



Elecnova

Elecnova Power Quality

JIANGSU SFERE ELECTRIC CO., LTD.
江苏斯菲尔电气股份有限公司

www.sfere-elec.com

CONTENTS

SFR-APF Active Power Filter 01

SFR-SVG Series Static Var Generator 09

SFR-M Reactive Compensation Module 14

SFR-L Power Capacitor Module 18

WGK Series Reactive Compensation Controller 25

LBFK Series Low-voltage Compound Switch 30

LBT Series Dynamic Switching Unit 29

Main projects 32

SFR-APF Active Power Filter

Overview

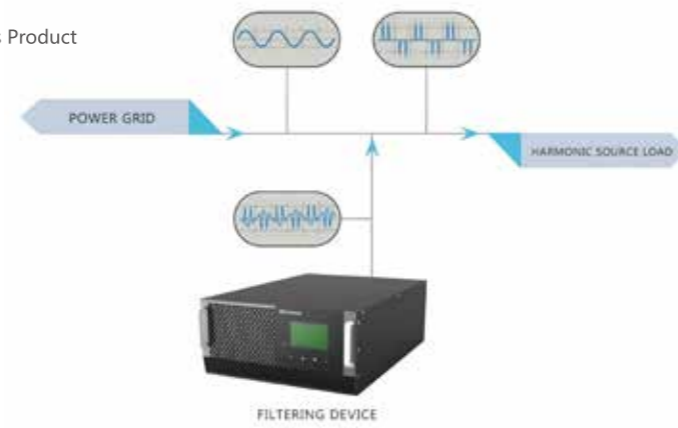
Active power filter is a new type of electronic device for dynamic filtering of harmonic wave and reactive power compensation. It can conduct real-time filtering and compensation to harmonic wave (both size and frequency are changed) and dynamic reactive power, and is used to overcome disadvantages of traditional harmonic suppression and reactive compensation methods of traditional filters, thus realizing systematic harmonic filtering function and reactive power compensation function. In addition, it is widely applied into power, metallurgy, petroleum, port, chemical and industrial and mining enterprises.



Model Description

SFR-APF 4 - 300 / 0.4 G

- Installation mode: M-Rack type
B-Wall-mounting type
G-Cabinet type
- Voltage class(kV)
- Compensation capacity(A)
- Wiring mode:3-Three-phase three-wire
4-Three-phase four-wire
- Model of Company' s Product



Picture 1 System diagram

Working Principle

Adopt CT to collect current signals generated by load, and separate out harmonic wave through detection circuit inside, and then transmit the harmonic wave to internal IGBT power converter through PWM signal, thus generating compensation current with the size equivalent to but phase opposite to harmonic wave of the system, thus realizing the real-time dynamic filtering function.

Introduction to Core Hardware

IGBT module of Infineon from Germany

- Refers to a high-integration tri-level module.
- Characterized by low voltage stress, high reliability.
- Conduction loss and switching loss are reduced greatly.



TI latest top-quality control chip

- Dual-core 32-bit CPU+2CLA and high-end industrial control chip TMS320F28377D, with high control precision.
- Triangular mathematical unit (TMU) and the second generation of Viterbi complicated mathematical unit, super strong operational capability.
- Multiple 16-bit ADCs, with high-precision sampling capability.



Introduction to Core Hardware

Flexible Application Scheme

The product refers to modular design, with convenient expansion and with parallel connection of 10 modules at most.

There are two kinds of modules, i.e. plug-in shelf type or wall-mounting type, adapting to multiple installation environments.

Three-phase three-wire is compatible with three-phase four-wire, and there are redundant wiring terminals of N lines to adapt to field environment to the greatest extent.

The CT is flexible in installation position, and it can be installed on both power source side and load side.

Excellent Filtering Performance

The maximum filtering number is 50, and the filtering rate of harmonic wave is greater than 97%.

There are multiple optional compensation modes, thus distributing active power filtering, reactive compensation and unbalance current compensation according to needs.

It refers to full-scope reactive compensation.

The complete three-phase unbalance strategy realizes active/reactive/split-phase unbalance compensation.

Tri-level main circuit brings lower power consumption and higher efficiency.

Complete Equipment and System Protection

Protection of external electrical faults of equipment, including busbar short-circuit, over-voltage and under-voltage, over-frequency and under-frequency, phase sequence error and current inverted sequence.

Protection of internal faults of equipment, including over-current protection and IGBT over-heating protection

Automatic capacity reduction in case that the working environment is out of limit

Current limit of software and hardware

Resonance avoidance, keeping far away from resonance points of the system automatically

Humanized Human-machine Interaction Experience

The interaction can adopt 7in LCD touch screen

Through the graphical display interface, the user can clearly get to know system waveform diagrams and harmonic spectrograms before and after compensation, as well as improvement situations of electric energy quality of the system, such as THDi, THDu, effective current value and power factor.

Low-voltage Active Power Filter (APF) JB/T 11067-2011

Shunt Active Power Filtering Equipment for Electrical Installation of Buildings JG/T 417-2013

Low-voltage Parallel Active Power Filter for Telecommunications YD/T 2323-2011

Introduction to Core Hardware

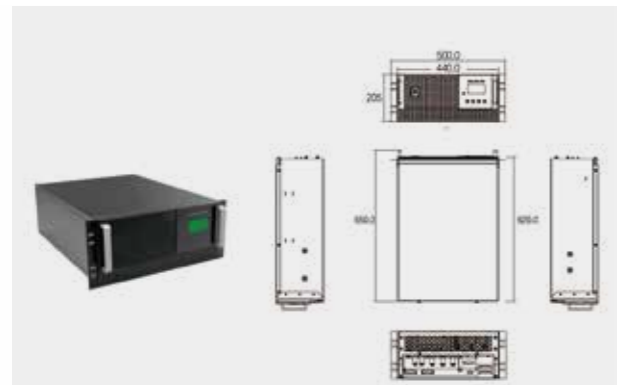
Product Specification	Rack Type Module				Wall-mounting Type				Full Cabinet Type
Power grid voltage	400/690V(-40%~+20%)								
Power grid frequency	50/60±5Hz								
Wiring pattern	Three-phase three-wire, three-phase four-wire								
Capacity	25A	50A	75A	100A	50A	75A	100A	25~400A	
Harmonic order	2-50 times of harmonic compensation, eliminating all harmonic waves or harmonic waves of selected number of times.								
Setting of harmonic degree	It is allowed to set independently to each time of harmonic wave								
Harmonic compensation efficiency	≥97%								
Full response time	≤5ms								
Compensation mode	Harmonic compensation, reactive compensation and three-phase unbalance compensation								
Parallel running capability	Supporting parallel connection of at most 10 modules								
Active power loss	<3% rated output capacity of equipment								
Display function (user interface)	3in LCD, displaying real-time data of module, waveform curve, parameter setting, record inquiry and manufacturing information				Inquiry system of 7in LCD touch screen (optional), real-time data of parallel connection module, waveform curve, parameter setting, record inquiry and manufacturing information				
Protection mode	Automatic current limit protection for power grid over-voltage and under-voltage, power grid over-frequency and under-frequency, inverted sequence of input voltage, over-current, over-heating and over-load, and busbar short-circuit.								
Cooling mode	Forced air cooling								
Noise	≤65dB								
Protection grade	IP20 (Higher protection grade can be customized.)								
Communication	Remote RS485/RS232/Ethernet communication function (optional)								

External Dimension and Installation Environment

	Wall-mounting Type (Touch Screen)			Rack Type (Centralized Monitoring of Touch Screen) SFR-APF□-(25~100)/□M				Full Cabinet Type SFR-APF□-(25~400)/□G
Rated compensation current/A	50	75	100	25	50	75	100	25A-400A
Weight/kg	38	45	45	33	33	34	38	400
Dimension (mm) Width*Thickness*Height	510*218*694	510*256.5*694		500*659*205		500*659*245		800*800*2200
Wire incoming mode	Upper incoming			Rear incoming				Upper incoming /lower incoming
Color	RAL7032 (Other colors can be provided as required.)							
Installation environment	Temperature: -10℃ - +45℃; Humidity: 5% - 90%; Altitude: altitude < 1,000m (For higher altitude, the product can be used through capacity reduction); Pollution grade: The product can run normally in severely polluted regions.							

Note: Special specifications can be customized!

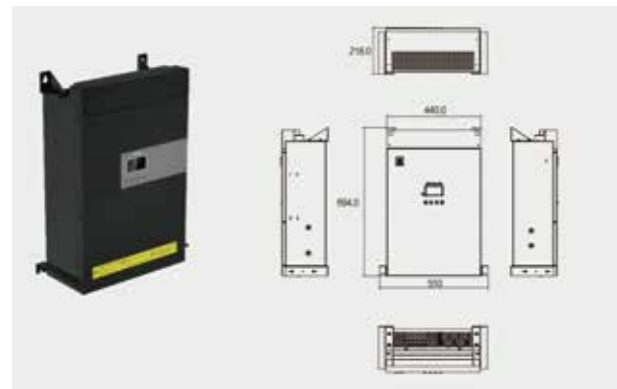
External Dimension of 25/50A Rack Module



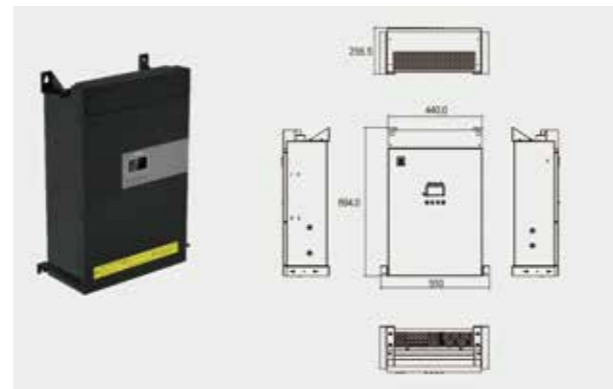
External Dimension of 75/100A Rack Type Module



External Dimension of Wall-mounting Type Product
SFR-APF□-50/□B

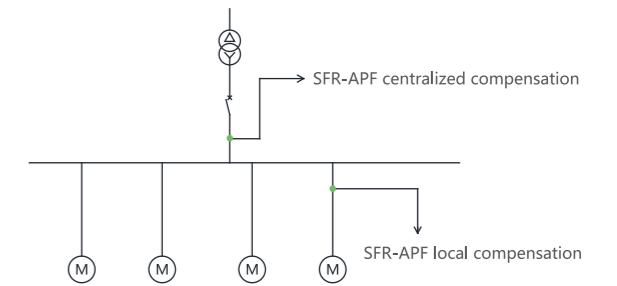


External Dimension of Wall-mounting Type Product
SFR-APF□-(75~100)/□B



Product Application

For SFR-APF series active filters, the compensation mode can be selected flexibly according to actual situation of load power distribution and required compensation effect. For single harmonic source generating relatively large harmonic current, it is required to conduct local compensation. For dispersed harmonic sources, it is required to conduct centralized compensation.



Experience Values of Distortion Factors of Harmonic Currents in All Industries with Recommended Schemes

Industrial Type	Harmonic Source	Experience Value	Treatment Mode
Metro, tunnel and airport	Frequency conversion fan, energy saving lamp and dimming equipment	15%	Centralized treatment
Data center, communication machine room and bank	Switch power source, frequency conversion air conditioner and escalator	20%	Centralized treatment
Office building and business center	Energy saving lamp, computer, elevator and frequency conversion air conditioner	20%	Centralized treatment
Theater and sports center	UPS, dimming equipment and energy saving lamp	25%	Centralized treatment
Automobile manufacturing	Electric welding machine	30%	Centralized treatment
Hospital	Ultrasonic instrument, nuclear magnetic resonance, CT, X-ray machine and frequency conversion air conditioner	20%	Centralized treatment or local compensation
Petroleum and chemical industry	Large-sized rectifier and frequency converter	35%	Centralized treatment or local compensation
Metallurgy	Intermediate frequency furnace, electric arc furnace and rolling machine	40%	Centralized treatment or local compensation

Table of Rapid Model Selection

Transformer Capacity (kVA)	Capacity and Quantity of Active Power Filter (Three-phase Four-wire)	Capacity and Quantity of Active Power Filter (Three-phase Three-wire)
200	SFR-APF4 -50/0.4	SFR-APF3 -50/0.4
250/315	SFR-APF4 -50/0.4	SFR-APF3 -75/0.4
400	SFR-APF4 -75/0.4	SFR-APF3 -75/0.4
500/630	SFR-APF4 -75/0.4	SFR-APF3 -100/0.4
800	SFR-APF4-100/0.4	SFR-APF3 -150/0.4
1000	SFR-APF4-100/0.4	SFR-APF3 -200/0.4
1250	SFR-APF4-150/0.4	SFR-APF3 -250/0.4
1600	SFR-APF4-200/0.4	SFR-APF3 -300/0.4
2000	SFR-APF4-200/0.4	SFR-APF3 -400/0.4
2500	SFR-APF4-300/0.4	SFR-APF3 -250/0.4 ×2
Scope of Application	Business center, office building, hotel, hospital, data center, theater and other occasions with relatively much single-phase load	Chemical, metallurgy, communication, textile, papermaking, printing, tobacco, automobile, port and other occasions with relatively much three-phase load

Note: Types M, B and G can be selected according to field situation.

Typical Application Case

Modern Building – Intelligent Modern Office Building

Harmonic characteristics

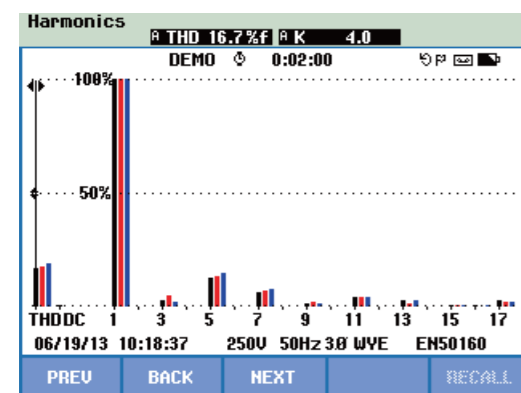
For there are numerous non-linear loads in the building, there may be a large number of 3-order, 5-order and 7-order harmonic waves in the power grid.

Problem description

The office building uses a large number of non-linear loads such as computer, elevator and energy saving lamp, thus causing severe distortion of current and voltage. In addition, the current of neutral line is too large, so there is the N-wire insulation aging, which causes tripping.

Effect analysis

The distortion factor of harmonic current of each phase of office building wire incoming is reduced greatly, and the occurrence of neutral line over-load accident is avoided effectively.



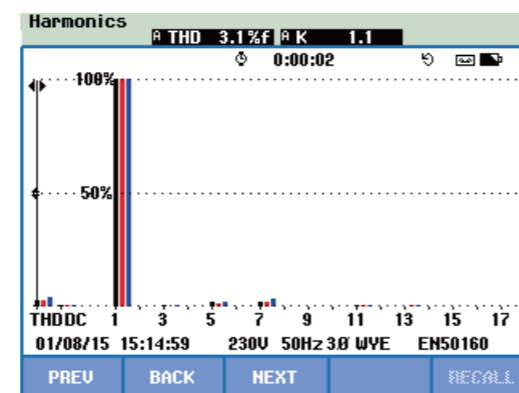
Before Compensation

Treatment meaning

The treatment may enhance reliability of power supply grid, effectively protect neutral line and reduce safety hazards.

Treatment measure

Adopt SFR-APF4 series active power filter to conduct centralized treatment to wire incoming of office building.



After Compensation



Iron and Steel Industry – Large-sized Metal Smelting and Processing Center

Harmonic characteristics

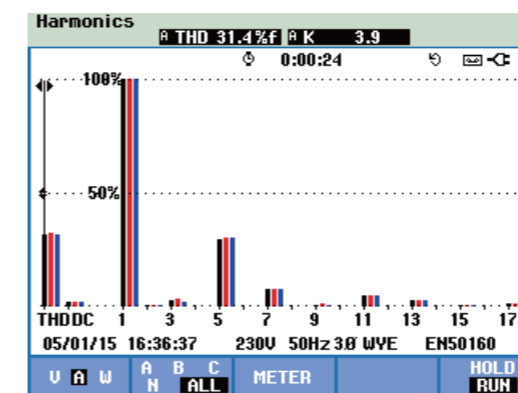
There are a large number of non-impact loads (such as electric arc furnace and rolling machine) in the iron and steel smelting system, and there will be 2-order to 13-order harmonic currents when it is working together with frequency converter.

Problem description

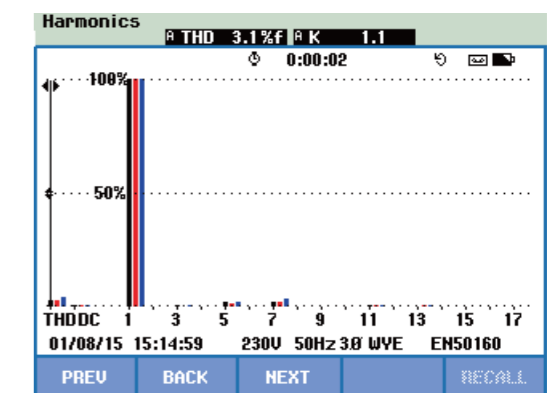
The current of power supply system has distortion, and PLC control system suffers from disturbance frequently. In addition, there are also multiple times of wrong actions and even burnout accident of relay.

Effect analysis

The distortion factor of harmonic current is reduced greatly, the electric energy quality of power supply system is improved fundamentally, and the accident of wrong action or even burnout of relay is avoided.



Before Compensation



After Compensation





Communication Industry – Large-sized Data Management Center

Harmonic characteristics

There are a large number of UPSs and switch power sources in the communication system, which may cause sharp increasing of 5-order, 7-order and 11-order harmonic waves in the system.

Problem description

The load refers to UPS, the wire incoming switch shows tripping for no reason, and the harmonic disturbance is severe.

Effect analysis

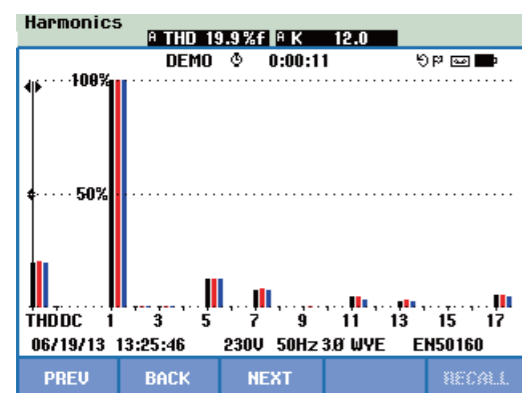
The distortion factor of harmonic current is reduced greatly, and the tripping and communication disturbance are solved effectively.

Treatment meaning

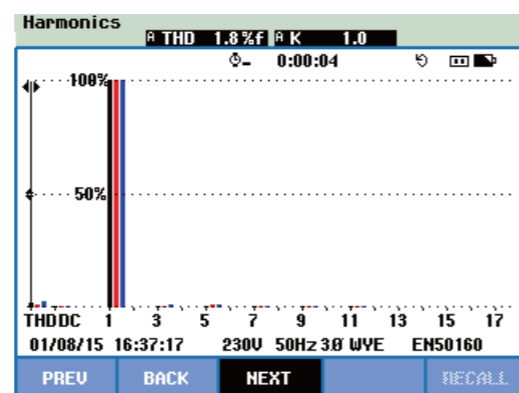
The treatment may enhance reliability of power supply, eliminate disturbance of harmonic wave to communication system, and extend service life of equipment.

Treatment measure

Adopt SFR-APF4 series active power filter to conduct local treatment to UPS.



Before Compensation



After Compensation

Petrochemical Industry – Large-sized Petroleum Drilling Platform

Harmonic characteristics

Adopt a large number of frequency converters, and harmonic currents mainly refer to 5-order, 7-order, 11-order, 13-order and 17-order currents.

Problem description

The capacitive compensation cabinet is damaged frequently, and the power factor is too low, thus causing reactive penalty.

Effect analysis

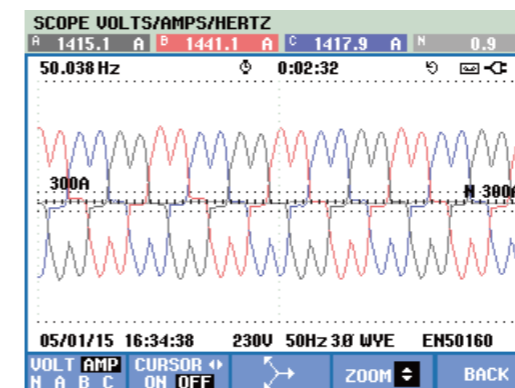
After treatment, the harmonic current is reduced greatly, the distortion factor is reduced, the reliability of capacitive compensation is obviously enhanced, and the power factor is stably compensated to 0.95 above.

Treatment meaning

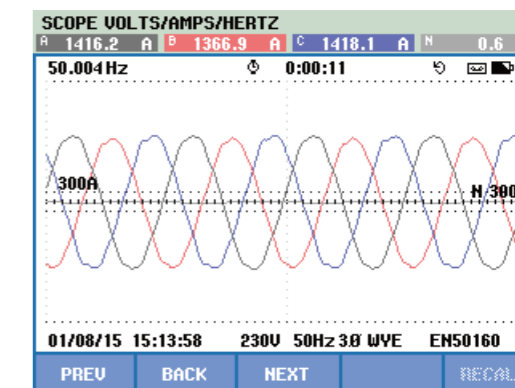
The treatment may reduce degree of error of electric power measuring instruments, thus guaranteeing accuracy of electric energy management and charging.

Treatment measure

Adopt SFR-APF3 series active power filter to conduct centralized treatment to harmonic current.



Before Compensation



After Compensation



SFR-SVG Series Static Var Generator

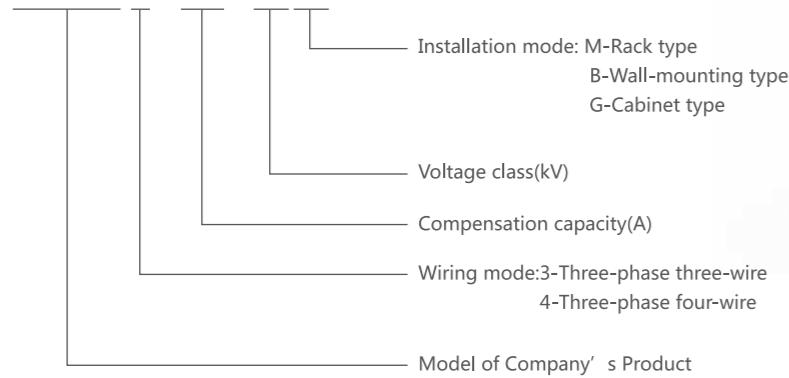
Overview

SFR-SVG is a new generation of static var compensator (SVC for short) product, and it is the representative of the latest technical application in the reactive compensation technology field. SVG is connected in a parallel way in power grid, and is equivalent to a changeable reactive current source, and its reactive current can be controlled flexibly to automatically compensate reactive power required by the system. On one aspect, this solves the switching compensation problem of parallelly connected capacitor of harmonic reactive disturbance effectively; on the other hand, it can suppress or treat harmonic wave according to actual requirements of the user, thus cleaning the power grid environment.



Model Description

SFR-SVG 4 - 300 / 0.4 G



Product Characteristics

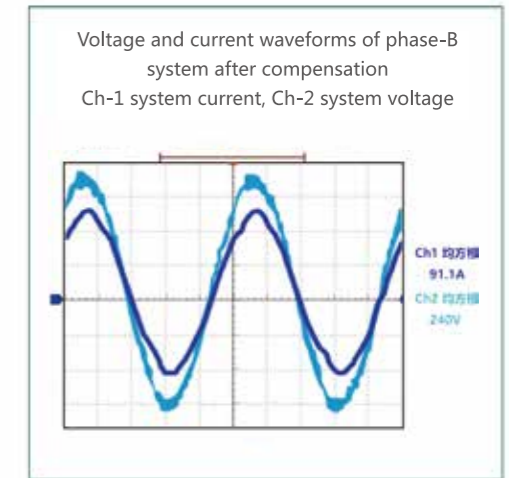
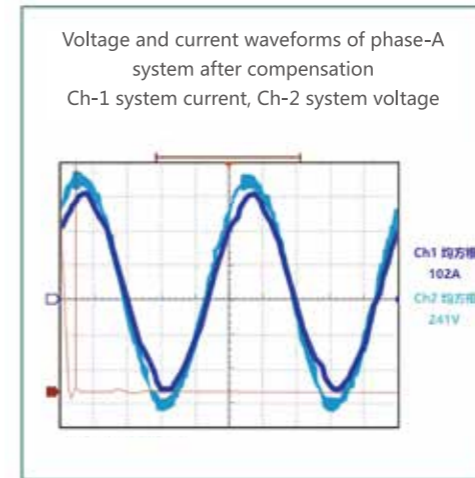
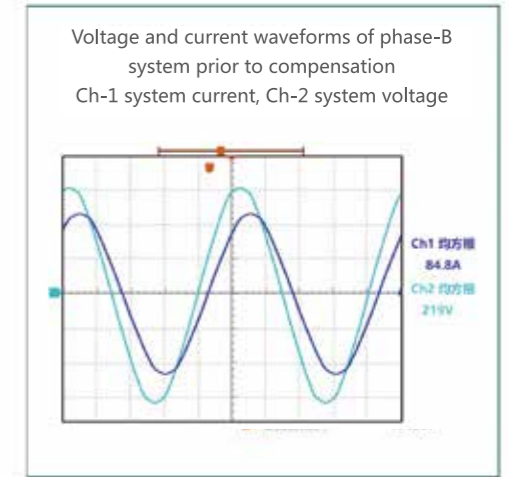
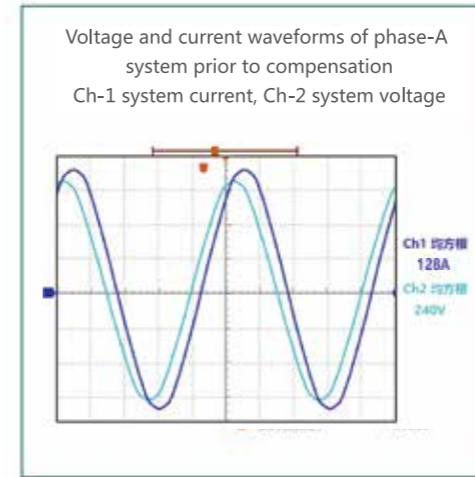
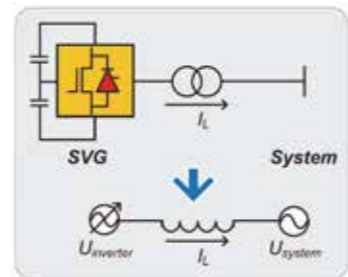
Compared with traditional switching modes with fixed capacitor compensation, mechanical switching capacitor and thyristor switching capacitor as main representatives, the IGBT type compensation device SVG has incomparable advantages.

It has the anti-harmonic function, which can guarantee system safety better.

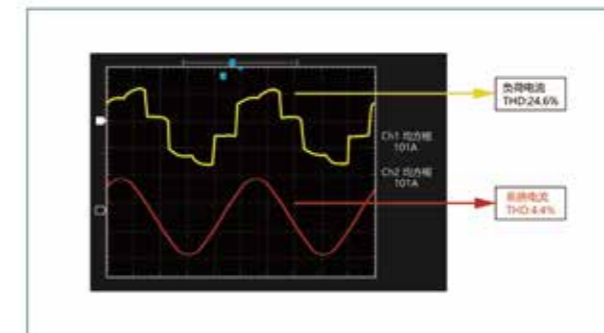
SVG is a controllable current source, and it only compensates reactive current of fundamental wave. The system harmonic current will not cause damage of compensation equipment, which will extend the service life and reduce work quantity of maintenance. Meanwhile, it can avoid harmonic enlarging which may be caused by capacitor bank of series reactor, and prevent other equipment of the system and compensation equipment

Dynamic continuous smooth compensation and higher response speed can enhance the compensation effect to voltage flicker.

SVG can change along with load, compensate power factor in a dynamic and continuous way. It can output and absorb reactive power, thus completely eradicating the situation of inverted transmission of reactive power.

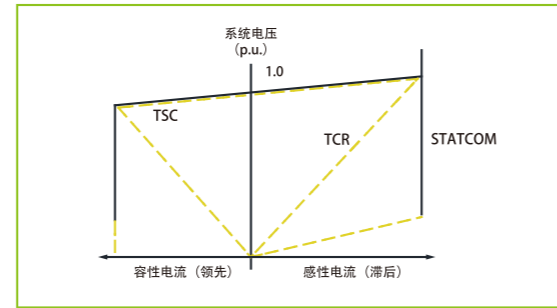


It can compensate harmonic wave dynamically while compensating reactive power, and can conduct effective treatment targeting 3-order, 5-order, 7-order, 9-order, 11-order and 13-order harmonic waves.



• Current source characteristics: it will not be influenced by busbar voltage in case of outputting reactive current; traditional SVC contains impedance characteristics, and output current is reduced in a linear way along with busbar voltage.

SVG has great advantages when it is used to control voltage. The lower the system voltage is, the more need the dynamic reactive power is required to support voltage. There is no relation between SVG outputting reactive current and system voltage, while the lower the system voltage is, the lower the capability of SVC outputting reactive current will be.



• **Shorter dynamic compensation time**

SVG response time is shorter than or equivalent to 5ms.

SVG can complete mutual conversion between capacitive reactive power to induced reactive power within an extremely short time period, and the rapid compensation speed can completely undertake compensation to impact load.

• **Smaller floor coverage area**

SVG Running Mode and Execution Standard

Function	Diagram of Waveform and Phasor	Description
No-load running mode		$U_i = U_s, I_L = 0$; SVG does not absorb or send out reactive power.
Capacitive running mode		$U_i > U_s$; I_L refers to leading current, with its amplitude value be controlled continuously through adjusting U_i , thus continuously adjusting reactive power sent out by SVG.
Induced running mode		$U_i < U_s$, and I_L refers to lagging current. At this time, the reactive power absorbed by SVG can be controlled continuously.

- 《Code for Electrical Design of Civil Buildings》 JGJ/T16-92
- 《Regulations Governing Electrical Installations Supplied with Low Voltage》 DGJ08-100-2003
- 《Code for Design of Low Voltage Electrical Installations》 GB50054-95
- 《Code for Design of Electric Power Supply Systems》 GB50025-95
- 《Power Quality – Admissible Deviation of Supply Voltage Quality of Electric Energy Supply – Admissible Deviation of Supply Voltage》 GB/T15945-1995
- 《Quality of Electric Energy Supply – Permissible Deviation of Frequency for Power System》 GB12326-2000
- 《Power Quality – Voltage Fluctuation and Flicker》 GB/T14549-93
- 《Quality of Electric Energy Supply – Admissible Three-phase Voltage Unbalance Factor》 GB/T15543-1995
- 《National Technical Measures for Design of Civil Construction Special Edition – Energy Conservation》

SVG Technical Parameters

Function	Technical parameters	Wall mounted	Rack mounted				Cabinet type			
		SFR-SVG□-(30~50)/□B	SFR-SVG□-(30~200)/□M				SFR-SVG□-(100~500)/□G			
Electrical characteristics	Rated voltage (V)	AC380V±15%, AC690V±15%								
	Working frequency (Hz)	50Hz±5%								
	Rated compensation capacity (kVA)	30	50	30	50	75	100	150	200	100~500
	Scope of reactive adjustment	Continuously adjustable from rated inductive to rated capacitive								
	Response time	5ms								
	Loss of active power	<3% rated module power								
	Over-load capability	120%								
	Multi-set running mode	Parallel running								
	Mean time between failures	≥ 100,000 hours								
	Switching frequency	Average 10kHz								
Local protection	Control algorithm	compensation algorithm of screening vector of frequency domain possessing self-adaptation capability								
	Controller	Digital signal processor (DSP)								
	Communication capability	Adopting Modbus remote communication protocol, communication interface RS485/232 and CAN bus								
Structural characteristics	Control connection	Optical fiber or electrical connection								
	W×H×D(mm)	510×218×694	500×265×530	510×265×530	340×629×709	340×929×709	Refer to capacity of cabinet			
	Protection grade	IP21 or customized according to the user's demand								
	Color	RAL7035 (light gray), able to provide other colors as required								
	Cooling mode	Forced air cooling								
Environmental conditions	Overall structure	Floor type								
	Installation mode	Indoor installation; optional fixing modes and optional cable incoming modes.								
	Environmental temperature	-10~40 °C								
	Storage temperature	-40~65 °C								
Electromagnetic compatibility	Relative humidity	5% - 95%, no condensation								
	Altitude	< 1,000m, 1,000 - 4,000m; according to national standard GB/T3859.2, for every increased 100m, the power is reduced by 1%.								
		Conforming to GB/T7251-2005								

Table of Rapid Model Checking of SFSVG

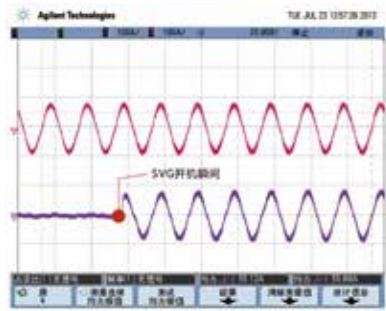
Transformer Capacity (KVA)	Three phase four wire	Three phase three wire
200	SFR-SVG4-100/0.4 × 1	SFR-SVG3-100/0.4 × 1
250/315	SFR-SVG4-100/0.4 × 1	SFR-SVG3-100/0.4 × 1
400	SFR-SVG4-150/0.4 × 1	SFR-SVG3-200/0.4 × 1
500/630	SFR-SVG4-200/0.4 × 1	SFR-SVG3-300/0.4 × 1
800	SFR-SVG4-250/0.4 × 1	SFR-SVG3-400/0.4 × 1
1000	SFR-SVG4-300/0.4 × 1	SFR-SVG3-500/0.4 × 1
1250	SFR-SVG4-400/0.4 × 1	SFR-SVG3-300/0.4 × 2
1600	SFR-SVG4-250/0.4 × 2	SFR-SVG3-400/0.4 × 2
2000	SFR-SVG4-300/0.4 × 2	SFR-SVG3-500/0.4 × 2
2500	SFR-SVG4-400/0.4	SFR-SVG3-400/0.4 × 3
Scope of Application:	Business center, office building, hotel, hospital, data center, theater and other occasions with relatively much single-phase load	Chemical, metallurgy, communication, textile, papermaking, printing, tobacco, automobile, port and other occasions with relatively much three-phase load

Note: Types M, B and G can be selected according to field situation.

Compensation Effect

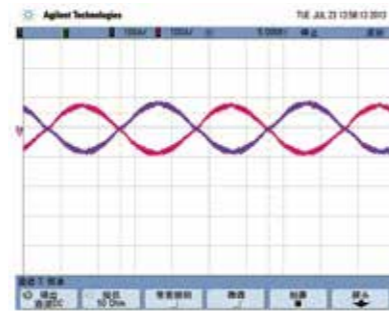
Rapid Response

SVG will conduct full compensation of reactive power of system at the moment of startup.



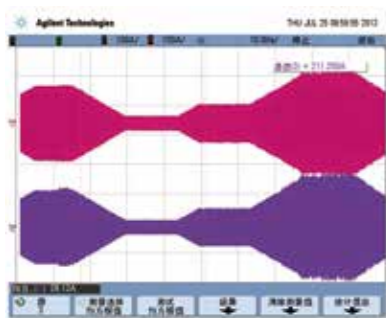
Perfect Compensation

SVG will send out compensation current with the size equivalent to but phase opposite to the reactive current of the system.



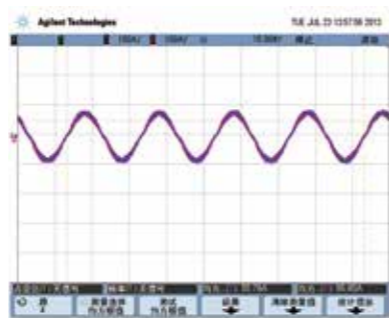
Real-time Tracking

SVG can conduct compensation in a dynamic and real-time way according to the change of reactive current of the system.



Inverted Overlapping

Compensate reactive current of the system and reactive current sent out by SVG after the current is inverted.



Analysis on Application Field

Electrical railway and rail traffic

Power supply systems of high-speed railway and rail traffic use a large number of cables for power transmission, which will generate the following threats to power grid:

- A great deal of capacitive reactive power will be generated, and the power factor will be too low.
- The off-line terminal voltage will be raised.
- There is the risk of resonance with the system.

Heavy industry occasions such as hoister and rolling machine

Both hoister and rolling machine belong to typical impact loads, and they mainly exist in various mining production occasions and the metallurgical industry, and will generate the following threats to power grid:

- The reactive impact will be relatively large, thus causing voltage fluctuation of power grid, and if the situation is severe, the running of other equipment will be disturbed, and then the production efficiency will be reduced.
- The power factor will be too low, and it is necessary to pay much reactive penalty each month.
- A part of devices will generate harmonic wave, thus threatening the power grid safety.

Drilling power supply system

Main loads of power supply system of oil-gas drilling platform include winch, rotary table and slurry pump. Due to particularity of drilling conditions, the system belongs to typical impact load, and it may generate the following influences on power grid:

- The reactive impact will be large, and the power factor will be low.
- The harmonic content of current is relatively high.
- The voltage fluctuation will be severe, the voltage distortion factor will be high, thus influencing power supply of various instruments such as control system and PLC.

SFR-M Series LV Dynamic Harmonic Suppression

Reactive Compensation Module

Overview

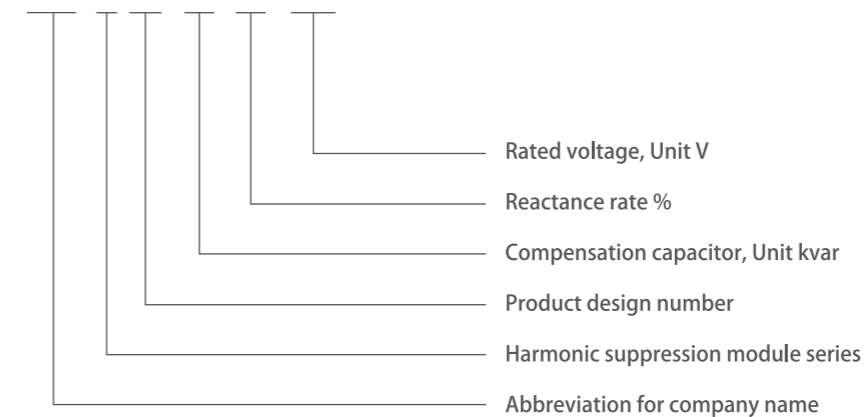
SFR-M series LV dynamic harmonic suppression reactive compensation module is designed for the problem of harmonic and power factor in the situation of serious harmonic pollution in 0.4kV low voltage distribution network. It is used as an integrated reactive power compensation module with functions of power factor enhancement, effective harmonic suppression, reduction of line loss and improvement of power quality.

The components of dynamic harmonic suppression reactive compensation module include DSP digital processing circuit, highly integrated detection, control, protection, display unit, zero crossing switching module, discharge and air cooling unit, filter reactor, low-voltage filter power capacitor and function module operation status indicator circuit. This module is a new generation of dynamic reactive compensation equipment for 0.4kV low voltage distribution network which is suitable for frequent load change and high voltage qualification rate requirement situation. It is a typical dynamic tracking compensation integration module with switching time $\leq 20\text{ms}$.



Naming Meaning

SFR - M XD - 30 - P7 / 480



Technical parameter

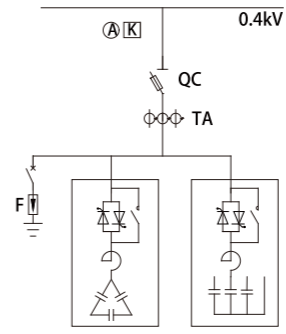
Function	Specification	
Measurement accuracy	Current	$\leq 1\%$
	Voltage	$\leq 0.5\%$ (80%~120% U_n)
	Temperature	$\leq \pm 1^\circ\text{C}$
Switching mode	Zero-crossing switch	
Compensation operation	Working voltage	AC 380V $\pm 20\%$
	Consumption	$\leq 5\text{VA}$
	Max. working current	$1.35 \times I_n$
	Switching inrush current	$\leq 2 \times I_n$
Host protection	Over voltage	430V (can be set)
	Under voltage	300V (can be set)
	Harmonic exceeding	0%~100% (can be set)
Local protection	Over current	0~100A (can be set)
	Over temperature	55 $^\circ\text{C}$ (can be set)
	Unbalance	50% (can be set, only for total compensation)
Network interface	Pluggable data line, internal network protocol	
Mechanical installation	Outline dimension	280mm \times 290mm \times 370 (430) mm
	Installation dimension	295mm \times 350 (410) mm
	Weight	$\leq 45\text{kg}$
Environment temperature	Working temperature	-15 $^\circ\text{C}$ ~45 $^\circ\text{C}$
	Storage temperature	-25 $^\circ\text{C}$ ~55 $^\circ\text{C}$
Altitude	$\leq 2000\text{m}$	
Standard	GB/T 15576-2008	

Model selection

SFR-M series model selection (take reactance 7% as example)

Compensation mode	Capacity (kVar)	Model	Application field
Three-phase total compensation	50	SFR-MXD-50-P7/480	It is used for many occasions with nonlinear load, large harmonics and devices sensitive to harmonics, such as frequency converter, intermediate frequency furnace, UPS power supply, rolling mill and lighting and switching power supply.
	25+25	SFR-MXD-2525-P7/480	
	40	SFR-MXD-40-P7/480	
	20+20	SFR-MXD-2020-P7/480	
	30	SFR-MXD-30-P7/480	
	20+10	SFR-MXD-2010-P7/480	
	20	SFR-MXD-20-P7/480	
	10+10	SFR-MXD-1010-P7/480	
	15	SFR-MXD-15-P7/480	
	10+5	SFR-MXD-1005-P7/480	
Phase separation compensation	10	SFR-MXD-10-P7/480	
	30	SFR-MXD-30-P7/280	
	20	SFR-MXD-20-P7/280	
	10	SFR-MXD-10-P7/280	

Typical design

Content	Solution
Primary wiring diagram	Combine compensation, zero-crossing switch, harmonic suppression
	
Compensation capacity (kvar)	Total capacity 240kvar (Total compensation 150kvar+Separate compensation 90kvar)

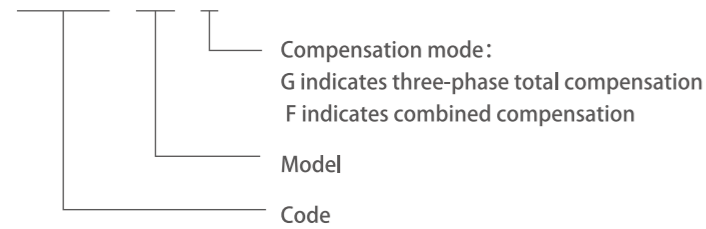
Configuration list

Name	Model	Quantity
Knife fuse switch	630A	1
Controller	WGK-31-203-F	1
Status indicator	WGK-31-ZTA	1
Ammeter	PA194I-9X4	1
Current transformer	SHI 500/5	3
Micro circuit breaker	160A	1
Surge protection device	SDX54/4P	1
Total compensation module	SFR-MXD-30-P7/480	5
Separate compensation module	SFR-MXD-30-P7/280	3
Cabinet (GCI)	1000 \times 1000 \times 2200(mm)	1

The upper example adopts the dynamic harmonic suppression reactive power compensation module configured with WGK-31-203 controller, determines the compensation capacity and reactance coefficient according to the requirement, improves the power factor of the system, and suppresses the harmonic component. The controller can control 32 total compensation modules and separate compensation modules. When the compensation capacity should be added, please add the quantity of dynamic compensation modules and change the specification of knife fuse switch and fuse.

Matching controller

WGK-31 - 203 - G



Technical parameters

Items	Parameters	
Signal input	Range	Phase voltage 20~220V or line voltage 20~480V
	Overload	Continuous: 1.2 Un; instantaneous: 2Un
	Power consumption	< 1VA
	Range	5A
	Overload	Continuous: 1.2 In; instantaneous: 2In
Current	Power consumption	< 1VA
	Frequency	45~65 Hz
Power supply	AC/DC 80~270V	
Communication	Data line connection, physical layer isolation connect up to 32 SFR series modules	
Relay output	2 programmable alarm relay outputs Capacity 3A/250VAC (3A/30VDC)	
Measurement accuracy	Current: 0.5(20%~120%), 1.0 (5%~20%) Voltage: 0.5 (50%~120%), 1.0 (5%~50%) Power : 1.0 Frequency: ±0.1Hz Harmonic measurement: B	
Display mode	128*64 LCD, contrast can be set	
Protection degree	Panel IP65, case IP30	
Environment	Working temperature: -15~55℃ Storage temperature: -20~75℃	
Safety	Insulation between signal, power supply, output terminal and case resistor > 100MΩ Withstand voltage between signal input, power supply and output > AC 2kV	
Outline	Outline dimension: 120×120×114mm Weight: 0.6kg	

SFR-L Series Low-voltage Power Capacitor Module

Overview

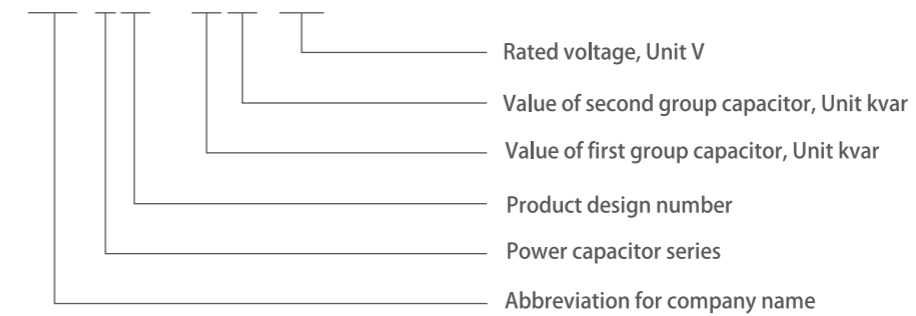
SFR-L series LV power capacitor module is designed for 0.4kV low voltage distribution network. It is used as a new generation of compensation module with functions of energy saving, reduction of line loss, power factor enhancement and improvement of power quality. This module is mainly used in the occasions where the harmonic pollution is not that serious.

SFR-L series low voltage power capacitor modules take two Δ type compensation capacitors or one Y type compensation capacitor as main body and are highly integrated with compound switch, microprocessor and other function modules.



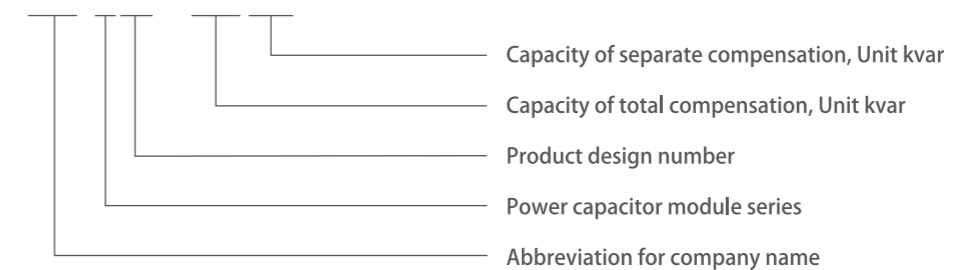
Model description

SFR - L XD - 20 20 / 450



Total compensation and separate compensation combined type

SFR - L XD - 20G 20F



Technical parameters

Function	Specification	
Measurement accuracy	Current	$\leq 1.0\%$ (5%~120%In)
	Voltage	$\leq 0.5\%$ (80%~120%Un)
	Power	$\leq 2\%$
	Power factor	$\leq \pm 0.01$
Switching mode	Zero cross switching	
Compensation operation	Working voltage	AC 380V $\pm 20\%$, distortion rate $\leq 5\%$
	Consumption	$\leq 5VA$
	Max. working current	$1.35 \times I_n$
	Switching inrush current	$\leq 3 \times I_n$
Host protection	Over voltage	430V (can be set)
	Under voltage	300V (can be set)
	Harmonic exceeding	0%~100% (can be set)
Local protection	Over current	0~100A (can be set)
	Over temperature	55°C (can be set)
	Unbalance	50% (can be set)
Control setting	Control parameter	Target power factor, switching threshold, delay time etc.
	Peripheral unit parameters	Current transformer ratio
Network interface	Pluggable data line, internal network protocol	
Mechanical installation	Outline dimension	W-71.5mm L-370mm, height is according to different capacity
	Installation dimension	Distance of installation fixing holes: W-85mm*L-315mm
	Weight	$\leq 6.5kg$
Environment temperature	Working temperature	-15°C~45°C
	Storage temperature	-25°C~55°C
Altitude	$\leq 2000m$	
Standard	GB/T 15576-2008	

Module selection

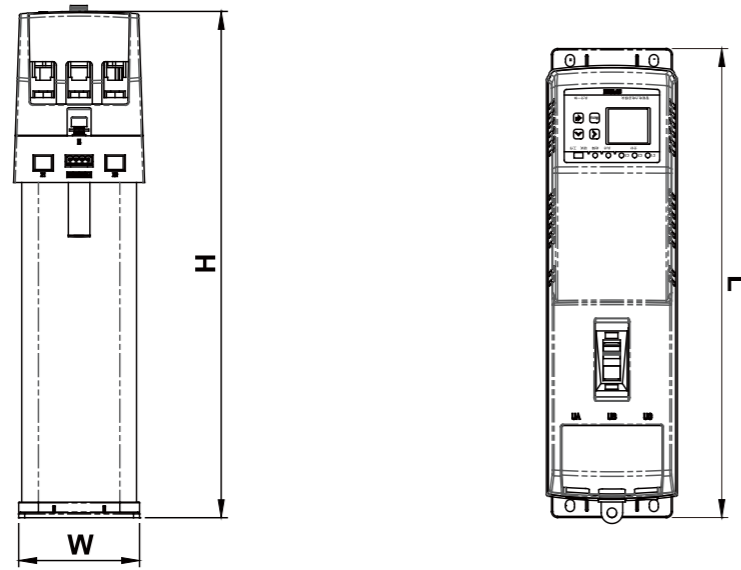
Compensation mode	Capacity (kvar)	Model	Application field
Three-phase total compensation	40+40	SFR-LXD-4040/450	It is used in the fields where the power quality meets the national standard, the requirement for power quality is not very high and no harmonic sensitive equipment. Phase separation compensation is used in the occasion that three phase load imbalance greater than 30%.
	40+20	SFR-LXD-4020/450	
	30+30	SFR-LXD-3030/450	
	20+20	SFR-LXD-2020/450	
	20+10	SFR-LXD-2010/450	
	10+10	SFR-LXD-1010/450	
Phase separation compensation	10+5	SFR-LXD-1005/450	
	30	SFR-LXD-30/250	
	20	SFR-LXD-20/250	
Total and separation combined compensation	10	SFR-LXD-10/250	
	5	SFR-LXD-05/250	
	40+20	SFR-LXD-40G20F	
	40+15	SFR-LXD-40G15F	
	40+10	SFR-LXD-40G10F	
	30+20	SFR-LXD-30G20F	
	30+10	SFR-LXD-30G10F	
	20+20	SFR-LXD-20G20F	

Typical design

Solution Component	Three-phase total compensation, zero-cross switching	Configuration list		
		Name	Model	Quantity
Primary wiring diagram		Knife fuse switch	630A	1
		Controller	WGK-31-201-G	1
		Status indicator	WGK-31-ZTA	1
		Ammeter	PA194I-9X4	1
		Current transformer	SHI 500/5	3
		Micro circuit breaker	160A	1
		Surge protection device	SDX54/4P	1
		Total compensation module	SFR-LXD-2020/450	6
Compensation capacity (kvar)	Total capacity 240kvar	Cabinet (GCJ)	800×800×2200(mm)	1

The upper example adopts low voltage power capacitor module. The compensation capacity is determined according to the transformer and load capacity, and the general compensation transformer capacity is about 30-40% of transformer. If you need separate compensation, please select separate compensation module. The low voltage power capacitor module can improve the power factor of the system, realize the zero crossing switching of the capacitor, and can communicate through RS485 interface via RJ45 data plugged line. When the compensation capacity should be added, please add the quantity of modules and change the specification of knife fuse switch.

Overall dimensions



Outline dimension	Length (L)mm	Width (W)mm	Height (H)mm	Distance between fixing poles mm
Total and separate compensation series				
SFR-LXD-40G20F/40G15F	392	110	423	70×372
SFR-LXD-30G20F/20G20F	392	110	383	
SFR-LXD-40G10F/30G10F	392	110	363	
SFR-LXD-20G15F/20G10F	392	110	363	
SFR-LXD-4040/450	392	110	423	
SFR-LXD-4020/450	392	110	363	
SFR-LXD-3030/450	392	110	363	
Total compensation series				
SFR-LXD-2525/2010	370	71.5	332	85×315
SFR-LXD-2020/2010	370	71.5	332	
SFR-LXD-1510/1005	370	71.5	332	
SFR-LXD-1010/1005	370	71.5	267	
SFR-LXD-0505	370	71.5	227	
SFR-LXD-05025	370	71.5	227	
Separate compensation series				
SFR-LXD-30/250	370	71.5	332	85×315
SFR-LXD-20/250	370	71.5	267	
SFR-LXD-15/250	370	71.5	267	
SFR-LXD-10/250	370	71.5	227	
SFR-LXD-05/250	370	71.5	227	
SFR-LXD-025/250	370	71.5	130	

Typical design

Component	Solution
Primary wiring diagram	<p style="text-align: center;">Three-phase total compensation, zero-cross switching</p>
Compensation capacity (kvar)	Total capacity 240kvar

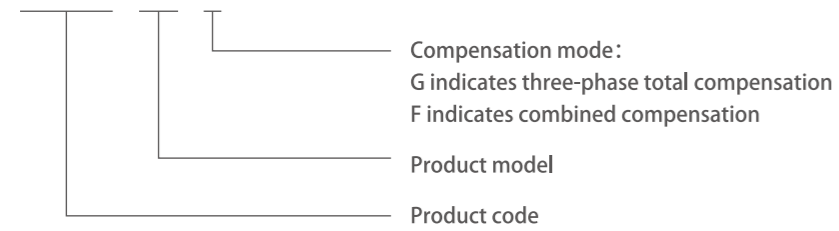
Configuration list

Name	Model	Quantity
Knife fuse switch	630A	1
Controller	WGK-31-201-G	1
Status indicator	WGK-31-ZTA	1
Ammeter	PA194I-9X4	1
Current transformer	SHI 500/5	3
Micro circuit breaker	160A	1
Surge protection device	SDX54/4P	1
Total compensation module	SFR-LXD-2020/450	6
Cabinet (GCJ)	800×800×2200(mm)	1

The upper example adopts low voltage power capacitor module. The compensation capacity is determined according to the transformer and load capacity, and the general compensation transformer capacity is about 30-40% of transformer. If you need separate compensation, please select separate compensation module. The low voltage power capacitor module can improve the power factor of the system, realize the zero crossing switching of the capacitor, and can communicate through RS485 interface via RJ45 data plugged line. When the compensation capacity should be added, please add the quantity of modules and change the specification of knife fuse switch.

Matching controller

WGK-31 - 201 - G



Items	Parameters		
Signal input	Wiring mode	Three phase three wire or three phase four wire	
	Voltage	Range	Phase voltage 20~220V or line voltage 20~480V
		Overload	Continuous: 1.2 Un instantaneous: 2 Un
		Power consumption	< 1VA
	Current	Range	5A
Overload		Continuous: 1.2In; instantaneous: 2 In	
Power consumption		< 1VA	
Frequency	45~65 Hz		
Power supply	AC/DC 80~270V		
Communication	Internal	RJ45 interface, connect up to 32 SFR series modules	
	External	Support MODBUS-RTU protocol	
Relay outputs	2 programmable alarm relay outputs Capacity 3A/250VAC (3A/30VDC)		
Accuracy	Current: 0.5(20%~120%) , 1.0 (5%~20%)		
	Voltage: 0.5 (50%~120%) , 1.0 (5%~50%)		
	Power : 1.0		
	Frequency: ±0.1Hz		
Display mode	Harmonic measurement: B		
	128*64 LCD, contrast can be set		
Protection degree	Panel IP65, case IP30		
Environment	Working temperature: -15~55℃		
	Storage temperature: -20~75℃		
Safety	Insulation between signal, power supply, output terminal and case resistor > 100MΩ		
	Withstand voltage between signal input, power supply and output > AC 2kV		
Outline dimension	Outline dimension: 120×120×114mm		
	Weight: 0.6kg		

WGK-31 - 205 - U



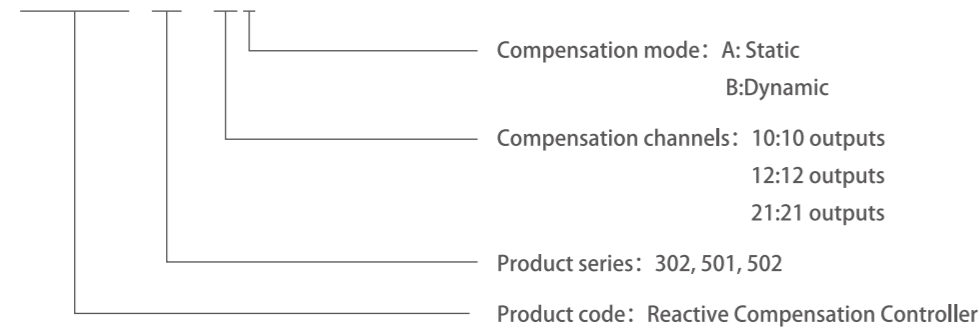
Items	Parameters		
Signal input	Wiring mode	Three phase three wire or three phase four wire	
	Voltage	Range	Phase voltage 20~380V
		Overload	Continuous: 1.2 Un instantaneous: 2 Un
		Power consumption	< 1VA
	Current	Range	5A
Overload		Continuous: 1.2In; instantaneous: 2 In	
Power consumption		< 1VA	
Frequency	45~65 Hz		
Power supply	AC/DC 80~270V		
Energy pulse	80mS±20%		
Communication	Internal	RJ45 interface, connect up to 36 SFR series modules	
	External	Support MODBUS-RTU protocol	
Relay outputs	2 programmable alarm relay outputs Capacity 3A/250VAC (3A/30VDC)		
Digital input	8 dry contact inputs, can be logic link with relay output		
Data storage	Record daily demand information for 3 months, which can be transferred through the U disk		
Accuracy	Compensation current: 0.5(20%~120%) , 1.0 (5%~20%)		
	Electric quantity measurement of incoming cabinet: 0.5S		
	Active energy of incoming cabinet: 0.5S		
	Reactive energy of incoming cabinet: 1.0S		
Display mode	Frequency: ±0.1Hz		
	Harmonic measurement: B		
Protection degree	128*64 LCD, contrast can be set		
	Panel IP65, case IP30		
Environment	Working temperature: -15~55℃		
	Storage temperature: -20~75℃		
Safety	Insulation between signal, power supply, output terminal and case resistor > 100MΩ		
	Withstand voltage between signal input, power supply and output > AC 2kV		
Outline dimension	Outline dimension: 120×120×114mm		
	Weight: 0.6kg		

WGK Series Reactive Compensation Controller

Universal type (configured with SLG)

Model description

WGK - 31 -501 - 12A



Main Characteristics

- The model refers to fully digital design, and adopts AC sampling algorithm;
- The human-machine interface adopts four-digit LED nixie tube display or large-screen Chinese LCD;
- The model refers to modular assembly, and its appearance refers to streamline design;
- The model possesses RS-485 standard bus interface, and it supports Modbus-RTU communication protocol;
- The model can display parameters including voltage, current, power factor, active power, reactive power, harmonic voltage, harmonic current, frequency, capacitor switching status and temperature;
- The model has harmonic protection function;
- The model can adjust the target power factor $\cos\varphi$ within the scope of 0.80 (lagging)-1-0.80(leading);
- The model can conduct selection through manual/automatic switching;
- The model supports isovolumetric, encoding and fuzzy control switching modes;
- The model can be of pressure loss release after the power supply to power grid has been suspended for longer than 15ms;
- It is allowed to set the output capacity of each output circuit at the same time.

Installation Dimension

unit: mm

Product Series	Surface Frame Dimension	Matching Dimension of Screen Assembly	Installation Depth	Opening Size
501	120×120	112×112	105	113×113
502	120×120	112×112	105	113×113
302	120×120	110×110	65	111×111

Main Technical Parameters

project	parameter
Display mode	LED or LCD
Sampling voltage	400V or 220V
Working voltage	AC220V or taken from voltage signal input
Rated number of sections	10 sections/12 sections/21
Rated input	5A
Setting scope of power factor	0.8 (induced) – 0.95 (capacitive)
Setting scope of switching time	0.1s – 9.99s
Switching control program	The switching control program supports isovolumetric/encoding (1:2:2, 1:2:3, 1:2:4:8…) and fuzzy control switching modes
Work mode	Manual compensation/Automatic compensation
Harmonics	There are harmonic measuring and protection functions
Communication port	There are RS-485 and Modbus-RTU standard field bus communication interfaces (optional)
Installation mode	panel installation

WGK-31-501 terminal description

S/N. of Terminal	Status	Description	Remark
1, 2	Input	Input of sampling current transformer	Taken from phase-A transformer of main screen
3, 5	Input	Input of sampling voltage: 400V	Taken from phase-B and phase-C
4, 6	/	/	Idle terminal
7, 8	Input	Input of working power source	AC 220V
9	Output	Wire incoming of contactor power source	Connected with live wire
10~21	Output	Output control ends from the first group to the twelfth group	AC contactor coil
24~25		Communication interface	MODBUS protocol

WGK-31-502 terminal description

S/N. of Terminal	Status	Description	Remark
1, 2, 3, 4, 5, 6	Input	Input of sampling current transformer	Input of sampling current transformer
7, 9, 11, 12	Input	Input of sampling voltage: 220V	Input of sampling voltage: 220V
8, 10	/	/	Idle terminal
13, 14	Input	Input of working power source	Input of working power source
15	Output	+12V DC power source output	+12V DC power output
16~27	Output	Output control ends from the first group to the twelfth group	Output control ends from the first group to the twelfth group
30~31		Communication interface	Communication interface

WGK-31-302 terminal description

S/N. of Terminal	Status	Description	Remark
1, 2	Input	Power Source	AC/DC80~270V
4, 5, 6, 7, 8, 9	Input	Current signal	4, 6 and 8 refer to wire incoming ends of three-phase current.
11, 12, 13, 14	Input	Voltage signal	Three-phase voltage input, which are A, B and C respectively
20~41	Output	Control output	12/21 circuits of control output, and 20 refers to public end.
58, 59, 60		1 circuit of RS485	They are A+, B- and G respectively.
81~84	Output	Alarm output	Two circuits of relay output (81, 82) and (83, 84)
70~74	Input	Switch input	4 circuits of switch input, and 70 refers to public end.
61, 62	Input	PT100 temperature sensing	Optional pieces

LBFK Series Low-voltage Compound Switch

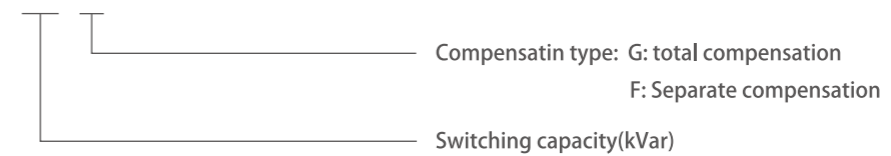
Overview

LBFK series low-voltage compound switch refers to connecting SCR and magnetic latching relay in a parallel way, adopting internal single chip for controlling, making SCR undertakes zero-passing switching at the moment of switching, i.e. switching on when the voltage passes zero and switching off when the current passes zero; the conducting time of SCR is very short (doesn't generate heat), and then, the magnetic latching relay will be connected for running. Therefore, it has advantage of SCR switch that there is no inrush current in case of passing zero, and the advantage that there is no power loss when the AC contractor is running. In this case, defects including heating during the running of SCR and spark in case of contactor switching are avoided. It is a kind of relatively ideal switch. Especially because that there is no inrush current or spark when the magnetic latching relay is on or off, the service life of its electrical apparatus is longer than the design service life, and its mechanical service life reaches millions of times, which may guarantee long-term running.



Naming Meaning

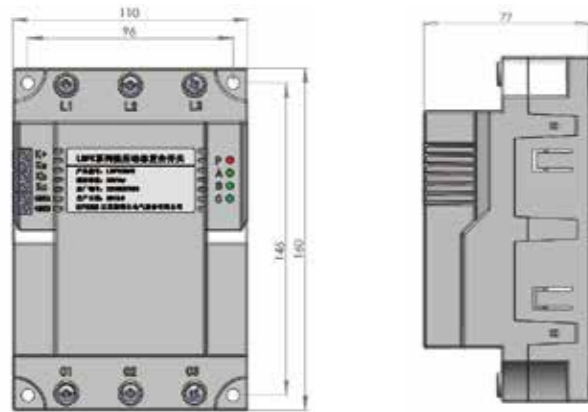
LBFK 40 / G



Technical Parameters

Item	Parameter
Rated voltage	AC wire voltage 380V±20%
Rated frequency	50Hz
Harmonic distortion	≤ 5.0%
Control voltage	5~40kvar
Power consumption of the machine	DC12V±10%/10mA
Consumption	≤ 4VA
Contact resistance	≤ 2mΩ
Environment temperature	-25~+55℃
Switching times	1.20 million times
Altitude	≤ 2000m

External Dimension



External dimension: 110×77×160 mm (width × depth × height)
 Installation dimension: 96×146 mm (width × height); the screw adopts M5*20.

Wiring Method

	Port	Description
Main circuit	L1,L2,L3	Wire incoming end;
	C1,C2,C3	Connected to the capacitor (or series reactor) end
Modbus	485A	Communication interface A
	485B	Communication interface B
Control circuit (G type)	K+ end	The positive end of control voltage is connected with COM end of the controller.
	Ka+ end	The negative end of control voltage is connected with output end of each circuit of the controller.
	Kb+ end	Empty
	Kc+ end	Empty
Control circuit (F type)	K+end	Positive end of control voltage
	Ka+end	Phase-A control end
	Kb+end	Phase-B control end
	Kc+end	Phase-C control end

Note: The indicator P refers to power source lamp; when the main circuit is energized, the indicator will be on; otherwise, it will be off.
 When G type is switched on, indicators A, B and C refer to switching indication. In case of switching on, the indicators will be on; otherwise, the indicators will be off.
 When F type is switched on, indicators A, B and C respectively refer to three-phase switching indication. In case of switching on, the indicators will be on; otherwise, the indicators will be off.

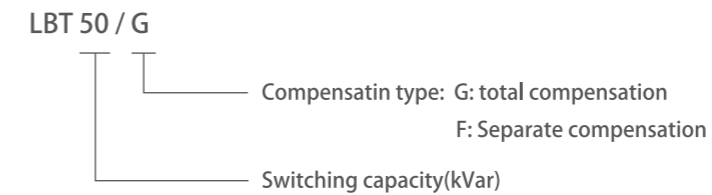
LBT Series Dynamic Switching Unit

Overview

LBT series dynamic switching unit refers to a kind of contactless rapid switch with high reliability, and it is used in dynamic power factor compensation equipment. It is especially applicable to switching occasions requiring rapid and no-wear switching. It is usually applied into occasions where reactive change is frequent, such as lifting equipment, elevator and electric welding machine.

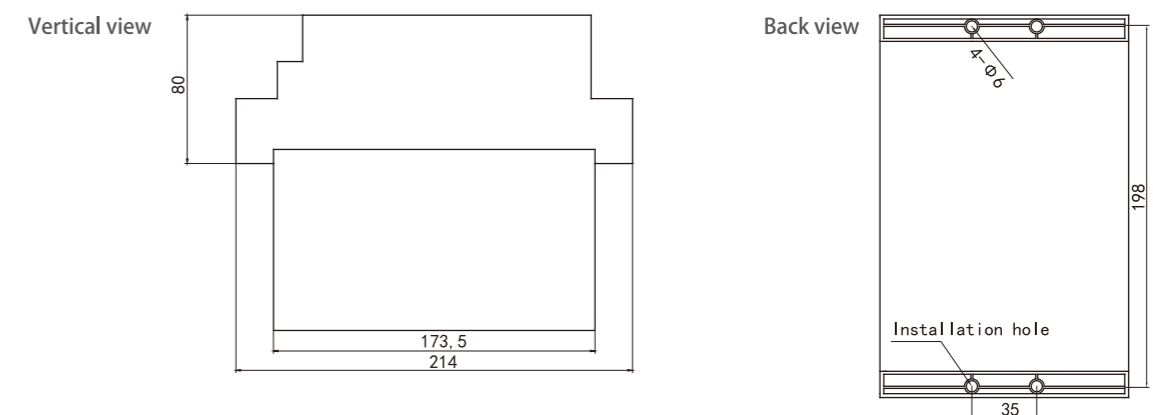


Naming Meaning



Main Technical Parameters

Item	Parameter
Working power source	AC220V±20%
Switching capacity	15~50kVar
Control voltage	5~15V DC
Switching time	≤20ms
Contact voltage resistance	1600V
Cooling mode	active air cooling
Environmental temperature	-25°C~+70°C
Environmental humidity	≤85%
Allowable maximum altitude	≤2,000m (5,000m can be customized)
Service life	10 ⁶ times
External dimension	External dimension: 116 (width) × 214 (height) × 186 (depth) (unit: mm)
Installation hole dimension	Installation hole dimension: 35 (width) × 198 (height)



Configuration and model selection

Common Configuration and Model Selection of Harmonic Elimination Type Compensation Cabinet (Three-phase Common Compensation)
Un=400V, Fn=50Hz, and P=7% (reactance rates: P5.5, P12.5; see the following contents for reference)

Transformer Capacity (kVA)	Compensation Capacity (kVar)	Number of Compensation Ways	Reactive Compensation Controller	Knife Switch (A)	SLG+LBT Model Selection		Recommended Cabinet Body Dimension W×D×H (mm)
630	200	6	WGK-31-501-10B	400	4×SLG25-P7/400 2×SLG50-P7/400	4×LBT25/G 2×LBT50/G	1000×800×2200
800	240	6		630	6×SLG40-P7/400	6×LBT40/G	1000×800×2200
1000	300	6		630	6×SLG50-P7/400	6×LBT50/G	1000×800×2200
1250	360	9		800	9×SLG40-P7/400	9×LBT40/G	1000×800×2200
1250	400	8		800	8×SLG50-P7/400	8×LBT50/G	1200×1000×2200
1600	240×2	12	WGK-31-501-12B	630×2	12×SLG40-P7/400	12×LBT40/G	1000×800×2200 (×2)
2000	300×2	12		630×2	12×SLG50-P7/400	12×LBT50/G	1000×800×2200 (×2)
2500	360×2	18	WGK-31-501-10B	800×2	18×SLG40-P7/400	18×LBT40/G	1000×800×2200 (×2)
2500	400×2	16		800×2	16×SLG50-P7/400	16×LBT50/G	1200×1000×2200 (×2)

Welcome your inquiry for other specifications!

*It is suggested that main and auxiliary cabinets should be separated in case that the compensation capacity exceeds 300kvar.

Common Configuration and Model Selection of Harmonic Elimination Type Compensation Cabinet
(Three-phase Common Compensation + Single-phase Separate Compensation)

Un=400V (single-phase 230V), Fn=50Hz, and P=7% (reactance rates: P5.5, P12.5; see the following contents for reference)

Transformer Capacity (kVA)	Compensation Capacity (kVar)	Reactive Power Compensation Controller	Common Compensation Part		Separate Compensation Part		Recommended Cabinet Body Dimension W×D×H (mm)
			SLG	LBT	SLG	LBT	
315	100(30)	WGK-31-502-12B	2×SLG15-P7/400 2×SLG20-P7/400	2×LBT15/G 2×LBT20/G	3×SLG10-P7/230	1×LBT30/F	1000×800×2200
630	180(60)	WGK-31-502-12B	4×SLG15-P7/400 2×SLG30-P7/400	4×LBT15/G 2×LBT30/G	3×SLG20-P7/230	1×LBT60/F	1000×800×2200
800	240(90)	WGK-31-502-12B	5×SLG30-P7/400	5×LBT30/G	3×SLG10-P7/230 3×SLG20-P7/230	1×LBT30/F 1×LBT60/F	1000×800×2200
1250	360(120)	WGK-31-502-12B	6×SLG40-P7/400	6×LBT40/G	6×SLG20-P7/230	2×LBT60/F	1200×1000×2200

Welcome your inquiry for other specifications!

Main projects



Beijing Kehua Zhongsheng Network Cloud Computing Engineering Company Project



Taiyuan iron and steel (Group) Co., Ltd.



Zhuhai Yanlord Binjiang Commercial Complex



Shanghai Chest Hospital



Inner Mongolia Wuhai Chemical Industry Co., Ltd.



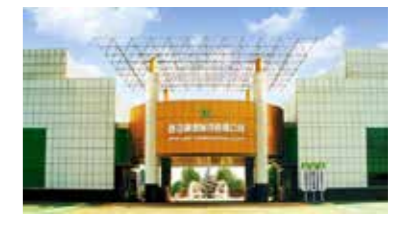
Construction Upgrading and Expansion Project of XCMG



The First People Hospital of Yunnan Province



Inner Mongolia Wuhai Chemical Industry Co., Ltd.



12 Billion Solid Preparation Expansion Project of Lijun Pharmaceutical



Municipal Government of Pinggu District of Beijing



Xinjiang Hami Power Plant



CPI Lanzhou New District Co-generation of Heat and Power Project