

**Sineteng**

**APF / AHF**

**( Active Power Filter / Active Harmonic Filter )**

**Harmonic Compensation Solution**



**THDI = < 5%**

**DPF 0.99**

**Three phase balance**



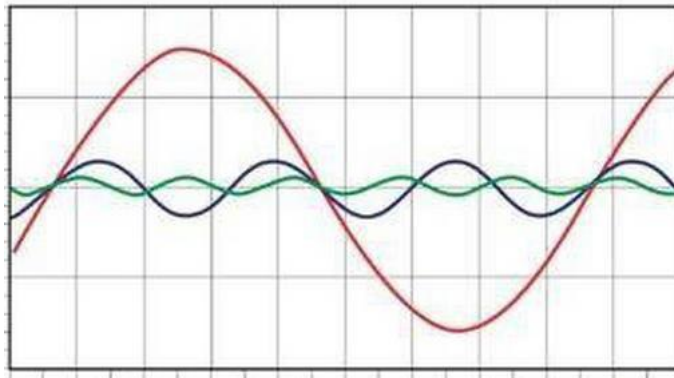
**Sineteng**

1. The meaning of harmonics
2. The generation of harmonics
3. Devices that produce harmonics
4. The harm of harmonic current to electrical equipment
5. The necessity of harmonic control
6. harmonic control method
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## 1. The meaning of harmonics

power supply system Harmonic definition is: the periodic non-sinusoidal power for Fourier series decomposition, in addition to the same frequency as the power grid base wave, but also get a series of larger than the power grid frequency of the component, this part of the electricity is called harmonics. The ratio of harmonic frequency to base wave frequency ( $N = F_N / F_1$ ) is called harmonic number.

the base wave frequency is 50Hz, and 3th order harmonic is 150Hz.,5th order 250Hz .....



## 2. The generation of harmonics

In the ideal Clean power supply system, the current and voltage are sine wave. In a simple circuit with only linear elements (resistors, inductors, and capacitors), the current flowing through is proportional to the voltage applied, and the current flowing through is the sine wave. In the actual power supply system, because of the existence of nonlinear load, when the current flows through the load which does not have a linear relationship with the added voltage, a non-sinusoidal current is formed.

When there is a nonlinear load in the power system, even if the power supply is powered by 50HZ power supply, when the frequency voltage or current acts on the nonlinear load, the sinusoidal voltage or current is different from the other frequencies of the frequency, which are different from the sinusoidal voltage or current of the power frequency, which is known as the electric harmonic

### 3. Devices that produce harmonics

With the development of power electronics technology, all kinds of power electronic equipment, such as inverter applications in enterprises more and more widely, greatly improve the production efficiency of enterprises, but the inverter, work will produce a large number of harmonic current, harmonic current in the power grid impedance to produce pressure drop, will make the voltage waveform also become non- sinusoidal. which cause reactive power, Harmonic at the same time. Harmonic will damage other equipment and the electric power system.



All nonlinear loads of the type of device that produce harmonics can produce harmonic currents.

The types of devices that produce harmonics are: **Switching mode power supply (SMPS), electronic fluorescent lamp ballast, speed regulating transmission device, uninterruptible power supply (UPS), magnetic iron**

**core equipment (transformers, motors, etc.) and household appliances (such as televisions).**

A variety of **rectifier equipment, AC/DC converter equipment and electronic voltage adjustment equipment, electric smelting equipment, electrochemical equipment, mine lifting equipment, open-pit mining equipment, electric locomotives, etc.**, as well as a wide variety of **lighting appliances, entertainment facilities and household appliances.**

In this way, other devices connected to the same point are subjected to non-sinusoidal voltages containing harmonic components, which prevent some sensitive devices from working properly. At present, harmonic problem has been widely valued all over the world, it is urgent to solve the harmonic problem.

#### **4. The harm of harmonic current to electrical equipment:**

1) The influence of harmonic on power supply transformer

The effect of harmonic on power supply transformer is mainly to produce additional loss, increase temperature rise, decrease output, affect insulation life.

2) The influence of harmonics on rotating motor

The main effect of harmonics on rotating motor is to produce additional loss, followed by mechanical vibration, noise and harmonic overvoltage.

3) The effect of harmonics on cables and shunt capacitors, when harmonic amplification is generated, the shunt capacitor will be damaged by overcurrent and overvoltage, which will endanger the safe operation of the whole power supply system when it is serious.

4) The influence of harmonic on the variable flow device

The AC distortion may cause the time interval of the control angle of the irreversible converter device to be different, and the distortion of the system is amplified by the positive feedback, which makes the converter work unstable,

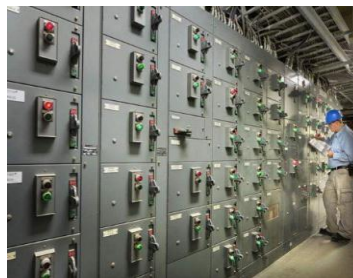


while the inverter may fail to change the flow and not work, or even damage the variable flow equipment.

- 5) harmonics interfere with communication, resulting in errors in the measurement of electrical dimensions.
- 6) Harmonics will also have adverse effects on relay protection automatic devices and computers
- 7) Also Three phase unbalance ---Overheat of Neutral Wire, Energy Wastage, Nuisance Tripping and so on.



Overheat of Neutral Wire  
And transformer broken



Switch trip



Capacitor damage



Misoperation  
of sensitive  
equipment



Energy  
Wastage

Motor  
heating



## **5. The necessity of harmonic control:**

The above harm, in some enterprises performance is more prominent, and in some enterprises do not show very obvious, but the hidden danger of harmonic hazards still exist. Especially in some industries with high degree of automation, if the harmonic content exceeds the standard, it will pose a great threat to the stability of the operation of the system, and once it is shown, it is bound to cause great losses. Therefore, harmonic control is very important.

First of all, it can improve the power supply quality of enterprise equipment, improve the reliability of equipment operation, reduce the economic loss caused by the misoperation of equipment;

Secondly, it can reduce the loss of harmonic current on the transmission and distribution line, at the same time reduce the heating of electrical equipment, reduce insulation aging, so as to improve the service life of equipment, reduce the maintenance costs of equipment;

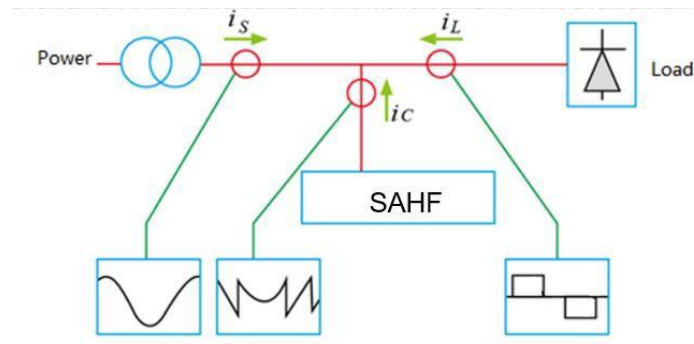
Third, harmonic control can reduce the resonant probability of compensating capacitors in the power grid, at the same time, reduce the impact of harmonics on the signal transmission of the system, increase the reliability of the system;

IV, it can reduce the pollution of harmonics to the public power grid.

## **6. Harmonic control method**

### **Active Power filter- working principle**

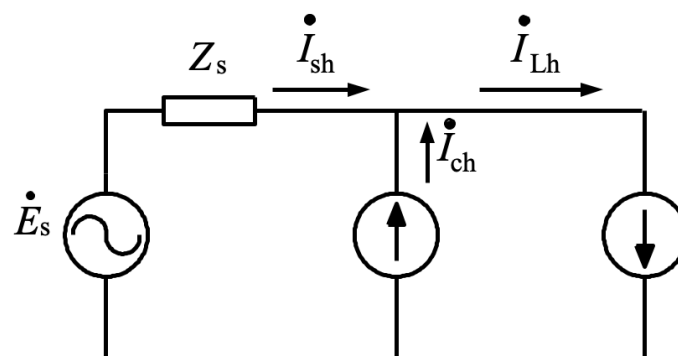
The SAHF detects the current instantaneous value of the compensated object by external CT, and controls the converter by DSP to produce the compensating current with the opposite direction relative to the size. The compensating current offsets the harmonic current and eventually obtains the desired power supply current.



- 1) 2<sup>th</sup> to 50<sup>th</sup> harmonic compensation, the THDI best effect to 3%, but also with the function of reactive power compensation PF 0.99, Three phase unbalance control, 100% balance.
- 2) Can choose which order to compensate and Adaptive function, can automatically track the compensation of changing harmonics.
- 3) Small size, modules design easy to install and transport.

#### Active Power filter-Working principle equivalent

The equivalent circuit diagram of its compensating harmonics is shown in the following figure:



As can be obtained from the figure, the harmonic current on the side of the power grid can be written as:

$$\dot{I}_{sh} = \dot{I}_{Lh} - \dot{I}_{ch}$$



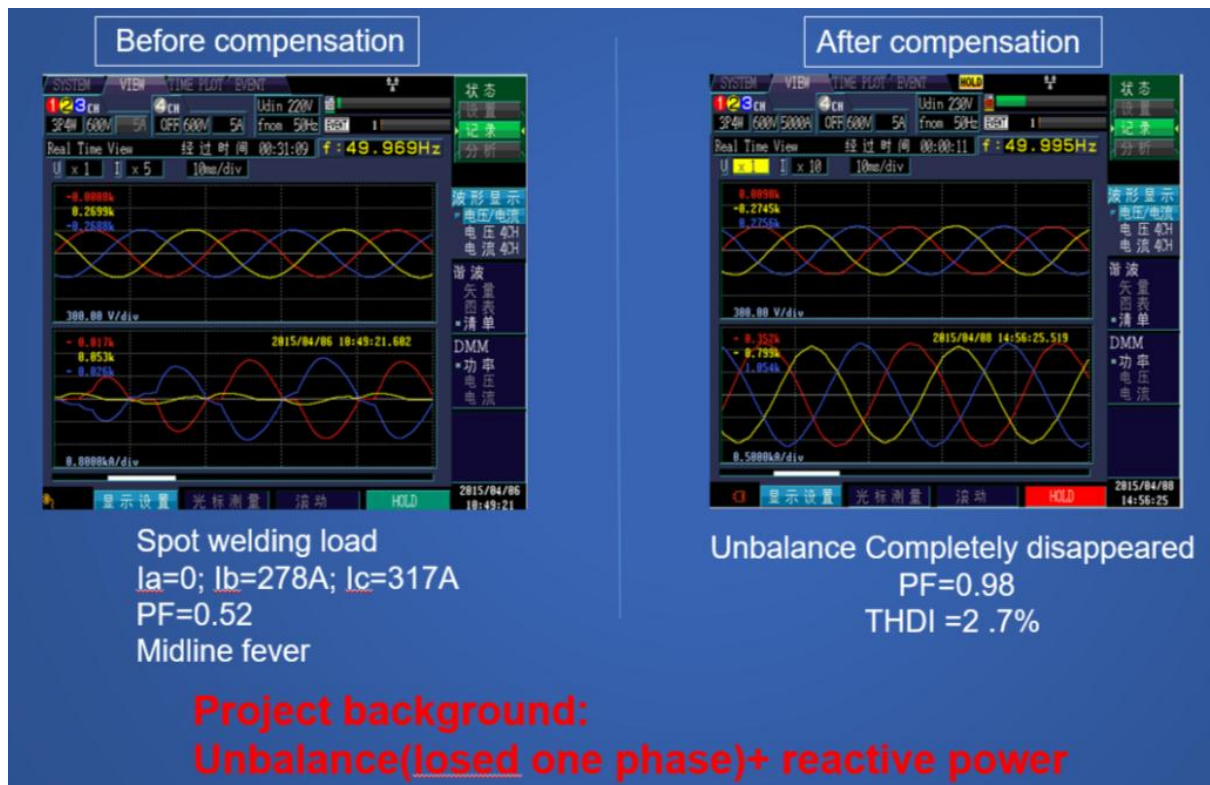
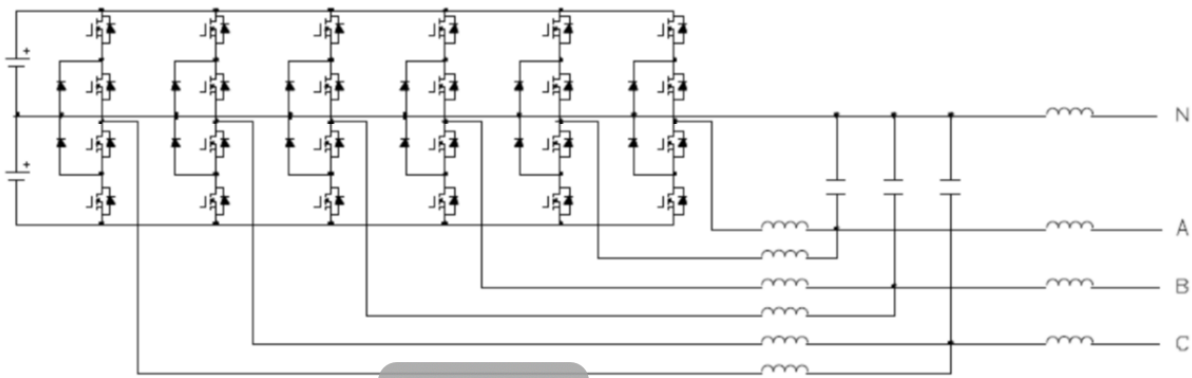
As long as the output current of the active power filter is controlled, And let

$$\dot{I}_{ch} = \dot{I}_{Lh}$$

Can make the harmonic current on the grid side

$$\dot{I}_{sh} = 0$$

### Topology of SAHF



## Sineteng SAHF advantages

- 1) Sineteng cabinet filter can be installed up 900 A with 6 sets 150A active filter modules, almost the largest capacity of one cabinet in this industry.
- 2) And easy to expand or reduce the capacity according to project requirement by add or reduce modules.
- 3) Module can also install in customers' switchgear.
- 4) When one module broken, other modules can continue to work



Shown as below, our wall mounted products can hanged on the wall and fixed it. Each capacity of our module have the wall mounted products. In the cities and distribution room which space are expensive or no place to install cabinets, wall mounted would occupy a more little space. And also saving manual transportation cost.



**SAHF:**

**THDI = < 5%**

**DPF 0.99**

**Three phase balance**

## 7. SAHF Introduction – Specifications

Item		Description
Electrical	Rated voltage	220/380/400/440/480/600/690Vac
	Wiring	3P3W/3P4W
	Frequency	50Hz/60Hz
	Rated current	35A~150A(200A can be customized )
	Current limit	35A~150A(According to model type)
	Efficiency	Up to 97.5%
Functions	Compensation harmonic	2 to 50 <sup>th</sup> orders , THDi 5%.
	Compensation for reactive power	-1~+1 adjustable
	Compensation for three-phase imbalance	100% imbalance full compensation

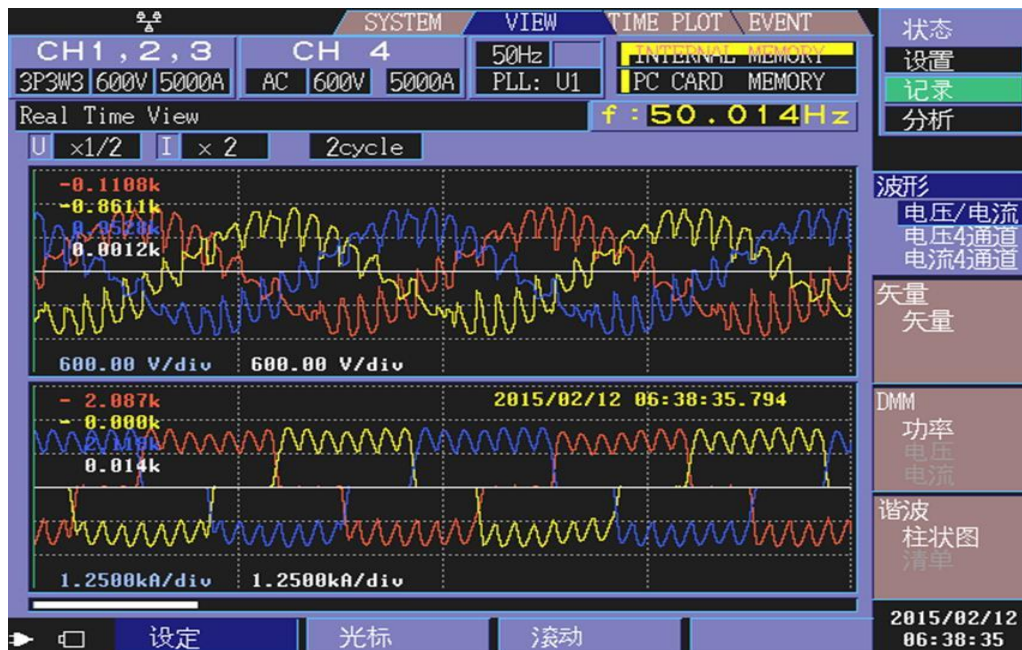
## Modules: 30A/35A/50A/75A/100A/150A/200A

mm	Rack mounted				Wall mounted			
	35A/50A	75A	100A	150A	35A/50A	75A	100A	150A
A	359	399	484	554	521.5	545	611	621
B	341	381	466	536	500	520	575	585
C	315	355	440	510	300	360	300	300
D	200	200	232	250	120.5	85.5	137.5	142.5
E	89	89	89	89	379	419	500	570
F	55.5	55.5	71.5	80.5	350	390	475	545
G	556.5	611.5	646	656	315	355	440	510
H	500	555	575	585	200	200	232	250
K	35	35	35	35				
Weight (kg)	23	28	38	47	23	28	38	47



## Comparison before and after compensation

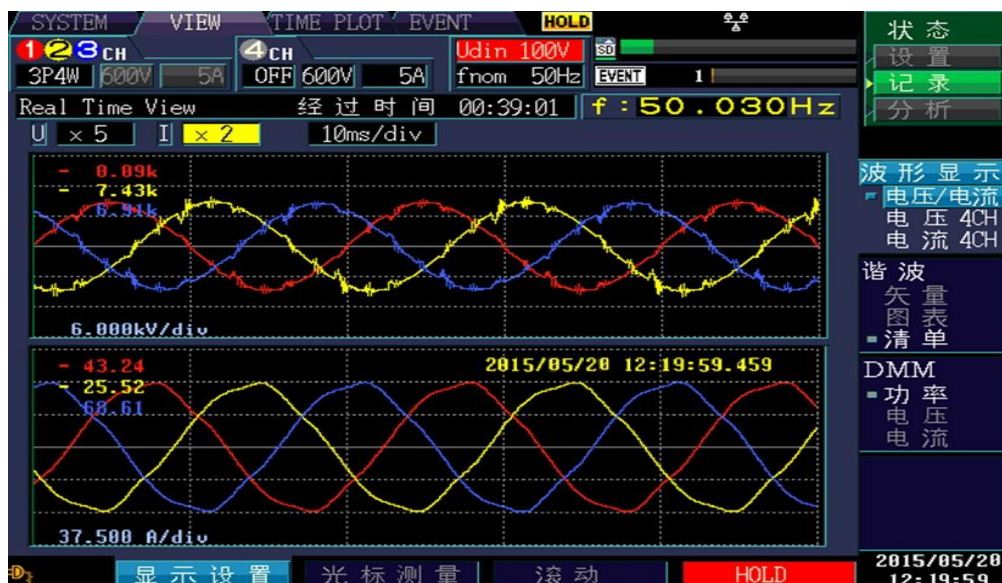
### Before Compensation



Intermediate frequency furnace load THDi=31% ;THDv=21%; PF=0.55

Serious dust Ventilation is not good

### After Compensation



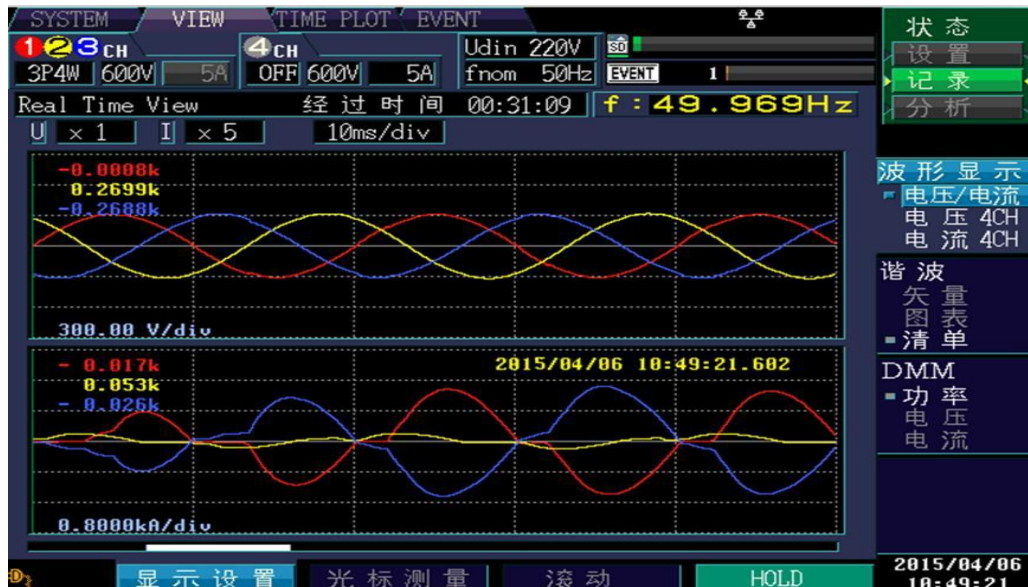
Harmonic basically disappeared THDi = 4.3%; THDv = 4.5%; PF = 0.98

Project background:

Reactive + harmonic + dust pollution + high TDHU + high temperature



## Before Compensation



Spot welding load

$I_a=0$ ;  $I_b=278A$ ;  $I_c=317A$  PF=0.52

Midline fever

## After Compensation



Unbalance Completely disappeared PF=0.98

THDI =2.7%

Project background:

Unbalance(losed one phase)+ reactive power

## Sineteng products application and installation sites

We are committed to providing users with healthy, stable and clean electricity consumption environment.



**THDI  $\leq$  5% PF 0.99**  
Three phase 100% balance



Rail traffic



Car plant



Port



Metallurgy



Petroleum and chemical



CNOOC Zhanjiang  
drilling platform



Suzhu fifth  
people's hospital



Beijing electric  
power corporation



HUAWEI Unicom  
data center



Nanjing Jiangning  
sewage treatment plant



Jinlong bus factory



Shaoxing textile mill

and so on....



**Authorized Distributor :**



## **PT. INTRACO INDONESIA**

**Website :** [www.intracoindonesia.co.id](http://www.intracoindonesia.co.id)

**E-mail :** [info@intracoindonesia.co.id](mailto:info@intracoindonesia.co.id)

Mobile Phone : +62 811 8697 999

Telephone : +62 21 6471 7528

Facsimile : +62 21 6471 7530

Address :

Ruko Mahkota Ancol Blok C / 50

Jl. R.E. Martadinata

Jakarta Utara 14420

INDONESIA