LTE 雷特电机

Power · Quality · Resource

雷福特德®

LOFUTEC®

LTE 雷特电机
Power · Quality · Resource

PARTNER SOLUTIONS

REFERENCES

LTEC雷特电机
Power · Quality · Resource

>>> About us

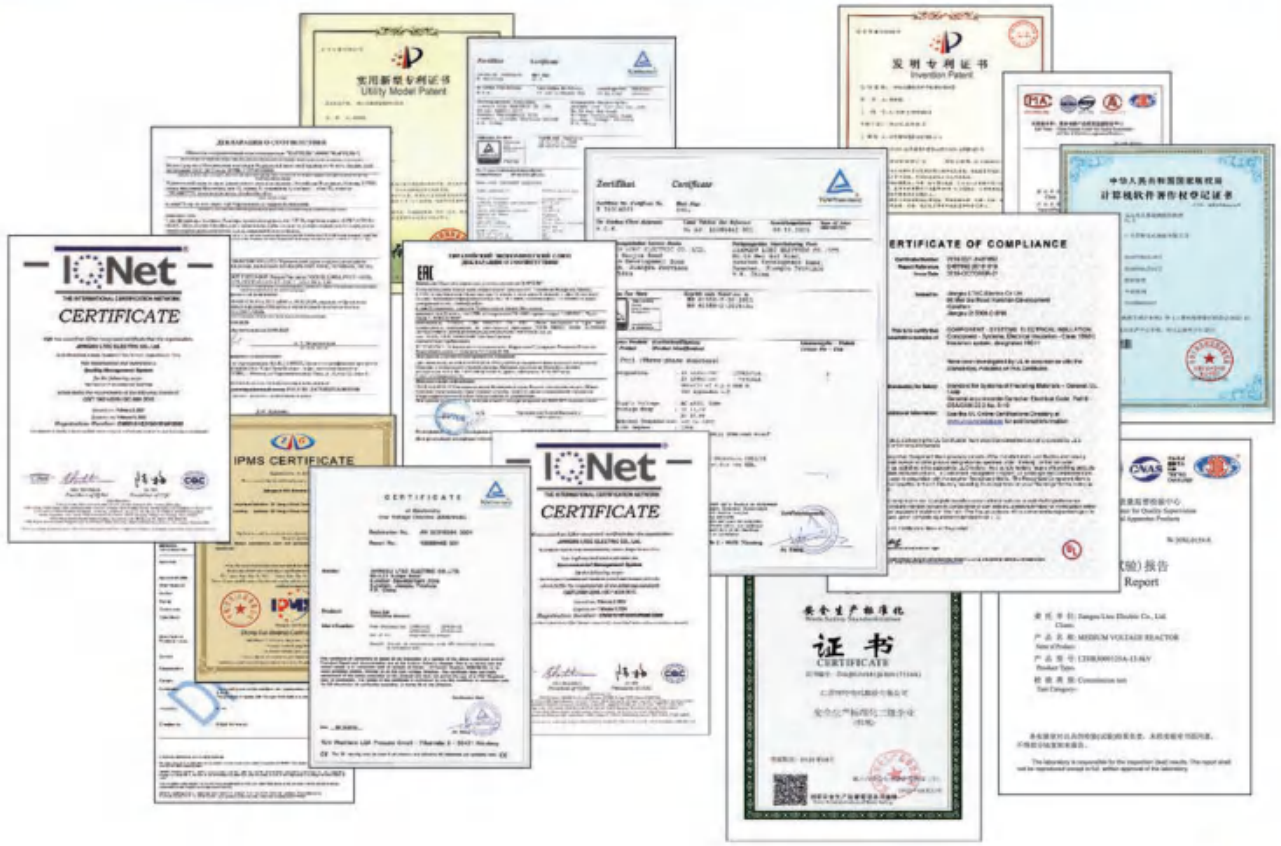
Founded in 2004,LTEC has become the long-term partners of many global enterprises. We are located in Kunshan, China, covering an area of about 20,000 square meters with annual sales of nearly RMB 100 million.

We are dedicated to provide the power quality and converter solutions up to 35kV, including LV and MV detuned or filter reactors, passive filters, sine filters, and MV rectifier transformers. Our products are widely used in power grid, industry, transportation, IT, education, and municipal projects.

LTEC is continually striving to improve our process and technology,approved by ISO9001 quality system. Since 2021, the environmental system of ISO14001:2015 have been carried out in our factory.We have the leading certifications of reactors and transformers, in consist of UL, TUV, CE, EAC,GOST. In addition to that, we cooperate closely with domestic universities for technical innovation. We build up our name with superior quality. By 2020, our products have sold out to more than 30 countries and regions, including Europe, America,Asia, Oceania and so on.

TÜVRheinland CERTIFIED
c US E487892
CE EAC
ISO9001 ISO14001

LV&MV Power Factor Correction
Reactors · Capacitors · Filters · Transformers...



R&D Capability

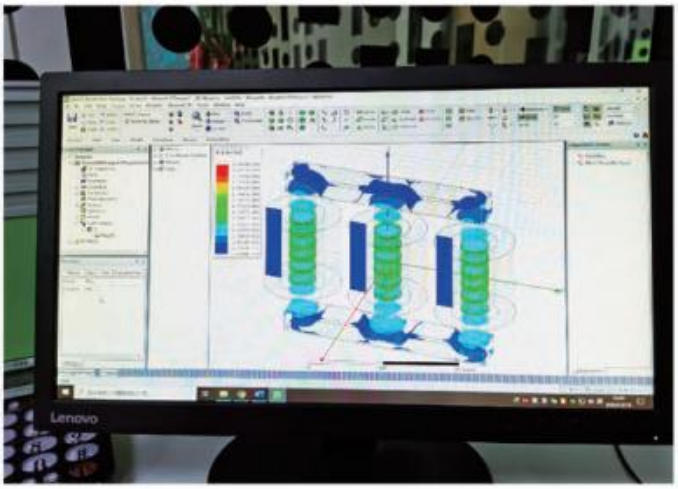
Our R&D group have more than 30 years experiences of designing and manufacturing the reactors. The advanced Solidworks software simulates the reactors in view of 360 degree. Up to now, our dry type reactors can be up to 5000kVar, with BIL 200kV at 35kV system.

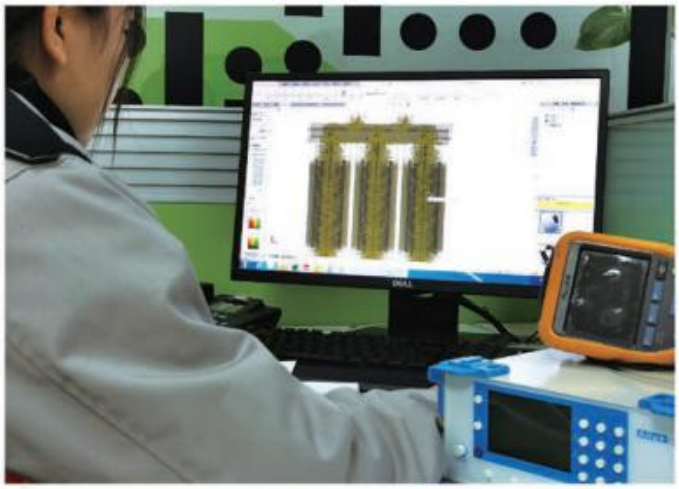
We could offer you the high performance reactors, superior to the defined standard. The customized solutions are also available upon requested,to satisfy your requirements in any applications.

UL 1446	EN 50588
IEC 60076	EN 50216
IEEE 519	EN 61558-2-20

Up to July 2020, we have achieved 3 invention patents, 29 utility model patents, and 10 software copyrights.

Moreover, we have innovated an unique reactor design software, so that we could start the primary structural designs immediately upon receipt of your technical specifications. And all the key parameters of withstand voltage, temperature rise, magnetic and current densities will be simulated in our software, as well as the overall dimensions.





西安交通大學 XI'AN JIAOTONG UNIVERSITY

江蘇大學 JIANGSU UNIVERSITY

Production Management

From the beginning, we follow the strict sampling inspection regulations to the incoming materials, and confirm all the key characteristics each lot before in-house, including appearances, dimensions, specifications, insulation performances, electrical conductivities, and then implement the product traceability in the whole process.

Tailor-made Iron Core Stacking Robot

Magnetic cores are manufactured with cold rolled magnetic sheet with high permeability.
The special coating to the core surface helps the anti-rust and moisture, with very lower losses and noise.

Automatic Foil Winding Station

All our products are manufactured based on the latest standard of ISO9001:2015 certified by CQC in China. In addition,we have been approved by the safety production standardization.

The windings are made by H Class enameled wires or foils, with NOMEX insulation paper between the windings. The Aluminum foils can be reliably connected with Copper busbar by a special cold press welding method.

We delicately select the UL or RoHs approved insulation materials with VPI(vacuum pressure impregnated) process to every reactor.

Typically we have the 180 degree insulation system approved by UL(or optional 220 degree) , so the life expectations and insulation strength of reactors can be longer to 100,000 hours.

Automatic Vacuum Pressure Impregnation Station（LV）

We are specialized in manufacturing the high efficiency and excellent performance LV and MV reactors, with optimization of our quality management system time to time.

Our dry type reactors are designed with natural air cooling, and equipped with thermal protection switches to prevent over-heating.

Vacuum Pressure Impregnation Station(MV)

Vacuum impregnation by UL approved resin ensures better insulation functions, high voltage stress, and long lifetime.

The multi air gaps helps to minimize the losses in magnetic core and windings. Limbs, yokes and air gaps are blocked by adhesives and pressing elements designed to reduce acoustic noise.

Testing Capacity

The testing facility area covers about 1000 square meters, for comprehensive testing of dry type reactors. We can perform the routine, type and special tests, such as temperature rise, lightning impulse.All the reactors will be 100% tested before delivery, along with the full testing reports and technical drawings for file.

The testing center is also equipped with the frequency conversion power, frequency ranging from 45Hz to 240Hz, output current to 1300A, to meet any frequency testing request. The lightning impulse testing capability is up to 1200kV, with chop wave output voltage to 900kV. In addition to that, we are also equipped with the YOGOKAWA power analyzer to precisely measure the losses and other parameters with a high level of 0.2%.Above all,the 250kVA partial discharge testing equipment is installed in an independent room with1pC background PD.

The temperature rising testing are simulated under the real load condition, and can be monitored by the Fluke thermal imager and data recorder after minimum 6 hours running internally.
In some special cases, we also carry out the heavy testing for very high voltage, but extremely low current reactors or vice versa.

>>> Basics of PFC

Today, electricity is the most common energy in the world. The growing use of electronic devices with non-linear waves leads to a distortion of sinusoidal voltage and current now, and brings in the additional losses of power. They have also resulted in current increase of power capacitors and other parts of the system as well as the issues of capacitor resonance with other inductive loads. Therefore, it could damage the components in the systems.

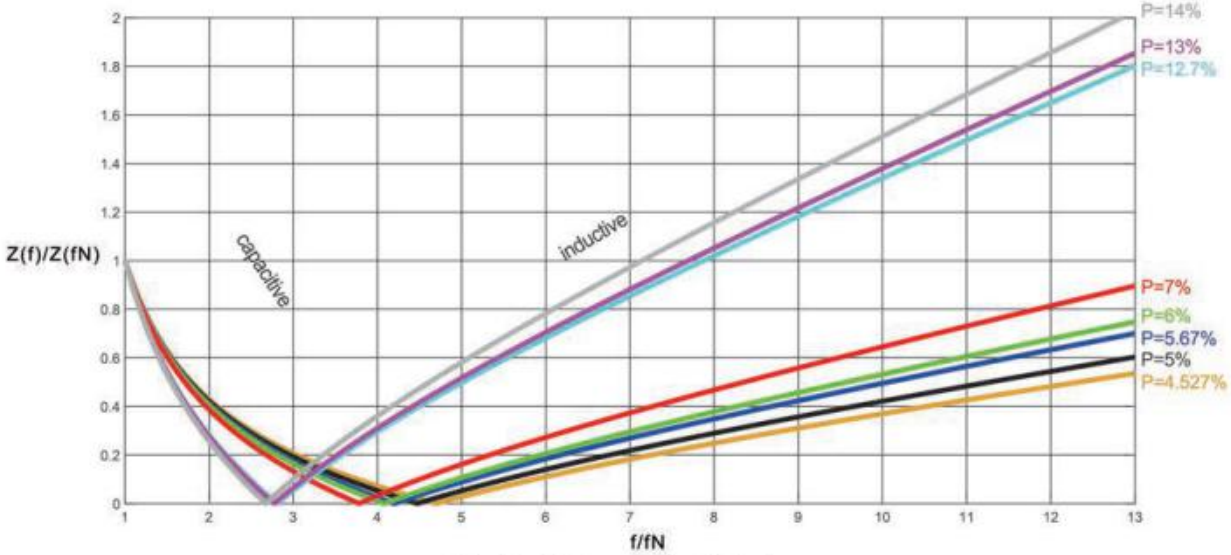
In the industrial system with non-linear waves, the capacitors without series reactors prove to be not safe. The reason is that the shunt resonance between power capacitors and the impedance in the system will cause the amplification of harmonic current. The solution is the use of detuned reactors forming a resonating circuit with its resonant frequency below the lowest order harmonic in the system. The basic principle is very simple, according to below resonance frequency formula.

$$f_r = f_N \sqrt{\frac{100\%}{P}}$$

The capacitor cabinet in the PFC system is actually a passive filter. Reactors with different blocking factors will absorb and limit its amplification, according to different harmonic load. It has below features:

- For frequencies below f_r., the reactor/capacitor system behaves like a capacitance and compensates the reactive energy.
- For frequencies above f_r., the reactor/capacitor system behaves like an inductance, prevents any risk of parallel resonance and absorb certain harmonic current.

Therefore, the overall power cost will be reduced in the way of power factor compensation and harmonic restriction. We could reduce the power loss, prolong the life of capacitors and eliminate the unnecessary interference of electronic products. LTEC endeavours to provide you a unique power solution, and create a clean, green and safe environment!



common detuning factors and ordinal of resonance

Parameters & Definitions

Rated Tuning Frequency f_r

The specified tuning frequency of the filter circuit in which the reactor is operating as a key component.

Below is the reference charts between common blocking factors and tuning frequencies.

Blocking factor p	Tuning frequency f_r		Recommended applications
	f_N=50Hz	f_N=60Hz	
5.67%	210Hz	252Hz	when THDI in mains must be reduced due to 5th and 7th harmonic current distortions
6%	204Hz	245Hz	Generally given in Japan or USA in 3 phase circuit with 5th and 7th harmonics for better detuning results
7%	189Hz	227Hz	Most common PFC in Europe with major 5th,7th harmonics in the mains to avoid inductance attenuations
12.7%	140Hz	168Hz	when THDI in mains must be reduced due to 3rd harmonic current distortions
13%	138Hz	166Hz	Generally given in Japan or USA in 3 phase circuit with 3rd harmonics for better detuning results
14%	134Hz	160Hz	Most common PFC in Europe with major 3rd harmonics in the mains to avoid inductance attenuations

★ Power Factor λ

The power factor is the ratio of active power P to apparent power S under sinusoidal conditions.

$$\lambda = \frac{|P|}{S}$$

★ Blocking Factor P

Ratio of the impedances of a reactor/capacitor combination in PFC.

$$P = 100 \cdot \frac{X_L}{X_C} = 100 \cdot 4 \cdot \pi^2 \cdot f^2 \cdot L \cdot C$$

★ Harmonic Order h

Ratio of the frequency of a harmonic to the fundamental network frequency.

★ IPxx Degree of Protection

A measure of the degree of protection: the first digit refers to electric shock hazards and the second one to the intrusion of unwanted substances.

★ Insulation Class

Permissible temperature for the insulation materials used in the reactor.

★ Rated Inductance L_N

Specified inductance at rated frequency. It also includes mutual inductance between phases, if applicable.

★ Total Losses P_{tot}

Losses are measured at the rated frequency and current. It includes the winding resistance losses and additional losses due to harmonics, referring to 75°C.

★ Low Voltage LV

In PFC, voltages up to 1 kV RMS.

★ Medium Voltage MV

In PFC, voltages above 1 kV RMS and below 35 kV RMS.

★ Rated Frequency f_N

Repetition rate of the fundamental wave of system voltage. Usually 50 or 60Hz.

★ Rated Voltage U_N

In PFC, this is usually the rated AC RMS voltage.

★ Capacitor Voltage U_C

Required voltage strength of the capacitor. The series connection of capacitor and reactor causes a voltage rise at the capacitor terminals, which must be considered as below formula when selecting a capacitor for the application.

$$U_C = \frac{U_N}{(1-\frac{P}{100\%})}$$

★ RMS Current I_{rms}

Current load on the reactor in permanent operation, caused by the fundamental wave plus harmonics in the system.

★ Rated Power of Capacitor Q

Reactive power of capacitor resulting from the ratings of capacitance, frequency and voltage.

$$Q = 2\pi f \cdot C \cdot U_N^2$$

★ Output of Capacitor Q_{LC}

Net compensation power of capacitor resulting from series connection with reactors in PFC.

$$Q_{LC} = Q \times \left(\frac{U_N}{U_C}\right)^2 \div (1 - P\%)$$

★ Rated Current I_N

Specified continuous r.m.s value of current at power frequency.

>>> User manual

★ Acceptance

- Check that no parts are missing and that the shipment has not been subjected to any damage due to improper transit.
- Check that the electrical characteristics indicated on the rating plate correspond to those specified on the order.

In other cases, please attach the packing list with your complaint.

★ Handling

- Unpack the reactors on the site properly.
- Lift up the reactors at the top of four loops with the sling if required.

If a fork lift truck is used, ensure that the type of fork is appropriate for the size and weight for the reactor.

★ Operations

- Make sure that the mounting screws of the reactors are well fixed.
- Install the reactors in the cabinet in vertical directions with adequate clearance to other electrical components.
- Don't touch the hot reactors during operations.
- Sufficient heat dissipations and cooling system shall be considered.

In case of any doubts, pls contact LTEC for technical support.

★ Storage

Store the goods in a dry, well-ventilated area free from rain, water spray, chemicals and dust.

Storage temperature: -0℃+ 40℃.

Check the conditions of the reactors in stock regularly.

★ Maintenance

- Monthly check the tightness of the reactor terminals.
- Yearly check the cleanness of the equipment, the ventilation system, the temperature of the area where reactors are installed.

Periodical checks and inspections are required to ensure reliable operation of reactors.

★ Protection

Temperature switch for low voltage products are provided with a separate screw terminal to cut off the line in the event of over heating, normally 135℃ closed contact (250VAC,5A).

★ Safety

Special attentions must be taken to avoid any misuse of the reactors in each application.

No particular fire precautions are required.

All the operations described in this document shall be performed in accordance with local safety standards and under the responsibility of a competent authority.

>>> Low voltage reactors for PFC

The products, also called detuned reactors or filter reactors, are generally used in series with capacitors in PFC system, in order to reach its target induced current. It can be tuned to a certain resonance frequency to absorb the harmonic currents in the grid.

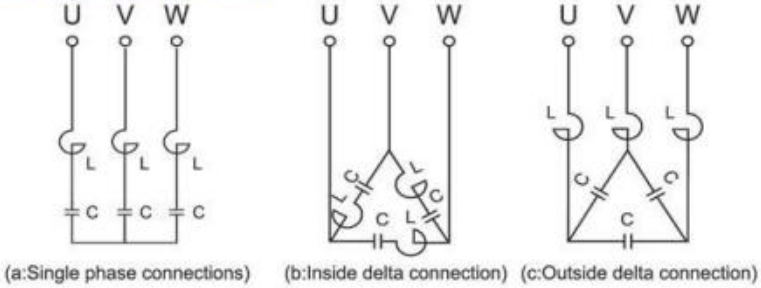
Technical Data

Standard	EN 60076-6,EN 61558-2-20,UL1446
Rated voltage	230V to 1000V
Rated frequency	50Hz/60Hz
Dielectric test	50Hz 3kV,60s
Cooling method	Natural air
Ambient temperature	-25 to +50℃
Elevation above sea level	≤1000m a.s.l.(≤5000m optional)
Protection class	IP00 indoor mounting
Permitted harmonic content	U3=0.5%U_N; U5=5%U_N; U7=5%U_N,
Inductance tolerance	0/+5% (or +/-3% as requested)
Blocking factor	5%-14%
Linearity	1.55-2.2I_N
Insulation class	H (UL approved resin)
Maximum humidity	95%
Design method	Single phase or three phase, dry type iron core, multiple air gap
Winding material	Copper/ Aluminum
Thermal protection	135℃ normally closed switch (optional)
Terminals	Copper terminals or busbars (flexible cables available on request)
Approval marks	CE,TUV, EAC,

Features

- Very higher linearity
- Lower temperature rising
- Stand 25 times short circuit current in one second
- VPI in full automatic system
- Over heat protection
- Copper connections
- Anti-dust non-wooden packing
- Certified by international standards

Connections Diagram



(a:Single phase connections) (b:Inside delta connection) (c:Outside delta connection)

Standard Series Reactors for Power Capacitors

Ordering Code	U_N(V)	Q_{LC}(kVar)	Q(kVar)	U_C(V)	L_N(mH)	I_N(A)	I_{max}(A)	P	Weight(kg)
f_N=50Hz, 3Phase, Copper wire winding									
LTFR307013C	400	13.3	15	440	3*2.879	19.2	21.7	7%	11
LTFR307022C		22.2	25		3*1.727	32.0	36.2		17
LTFR307026C		26.7	30		3*1.439	38.5	43.5		18
LTFR307044C		44.4	50		3*0.864	64.1	72.4		27
LTFR307066C		66.6	75		3*0.575	96.2	108.7		36
LTFR307088C		88.9	100		3*0.432	128.3	144.9		57
LTFR307015C	400	15.0	20	480	3*2.557	21.7	24.5	7%	13
LTFR307025C		25.0	33.4		3*1.534	36.1	40.8		17
LTFR307030C		30.0	40		3*1.278	43.3	48.9		18
LTFR307050C		50.0	66.8		3*0.767	72.2	81.6		28
LTFR307075C		75.0	100		3*0.511	108.3	122.3		37
LTFR307100C		100.0	134		3*0.384	144.3	163.1		58
LTFR314010C	400	10.1	15	525	3*8.194	14.6	16.5	14%	14
LTFR314016C		16.9	25		3*4.916	24.4	27.5		19
LTFR314020C		20.0	30		3*4.148	28.9	32.6		27
LTFR314025C		25.0	37		3*3.318	36.1	40.8		29
LTFR314033C		33.7	50		3*2.458	48.7	55.0		36
LTFR314050C		50.0	74		3*1.659	72.2	81.6		58

Other specifications are available upon request.

Standard Series Reactors for Power Capacitors

Ordering Code	U_N(V)	Q_{LC}(kVar)	Q(kVar)	U_C(V)	L_R(mH)	I_R(A)	I_{rms}(A)	P	Weight(kg)
f_N=50Hz,3Phase,Aluminum foil winding									
LTFR307022A	400	22.2	25	440	3*1.727	32.0	36.2	7%	18
LTFR307026A		26.7	30		3*1.439	38.5	43.5		19
LTFR307044A		44.4	50		3*0.864	64.1	72.4		28
LTFR307066A		66.6	75		3*0.575	96.2	108.7		40
LTFR307088A		88.9	100		3*0.432	128.3	144.9		44
LTFR307025A	400	25.0	33.4	480	3*1.534	36.1	40.8	7%	19
LTFR307030A		30.0	40		3*1.278	43.3	48.9		20
LTFR307050A		50.0	66.8		3*0.767	72.2	81.6		29
LTFR307075A		75.0	100		3*0.511	108.3	122.3		44
LTFR307100A		100.0	134		3*0.384	144.3	163.1		46
LTFR314016A	400	16.9	25	525	3*4.916	24.4	27.5	14%	28
LTFR314020A		20.0	30		3*4.148	28.9	32.6		30
LTFR314025A		25.0	37		3*3.318	36.1	40.8		34
LTFR314033A		33.7	50		3*2.458	48.7	55.0		36
LTFR314050A		50.0	74		3*1.659	72.2	81.6		49

Other specifications are available upon request.

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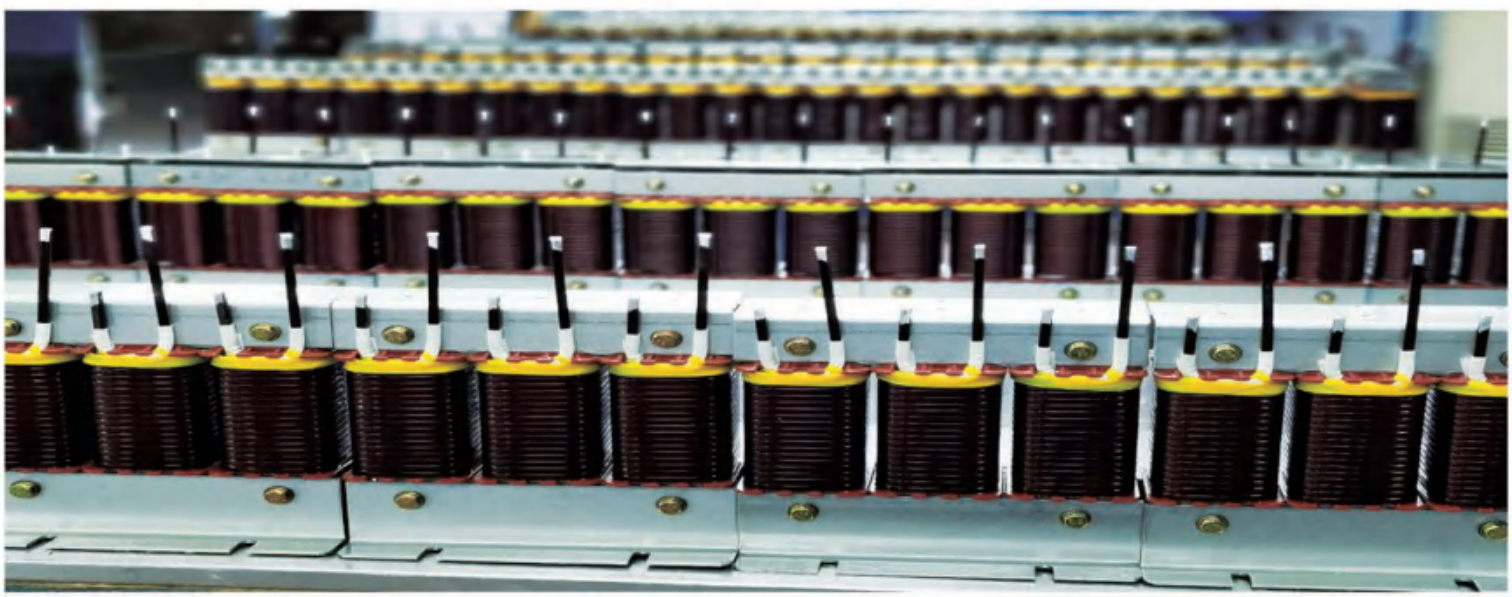
Standard Series Reactors for Power Capacitors

Ordering Code	U_N(V)	Q_{LC}(kVar)	Q(kVar)	U_C(V)	L_N(mH)	I_N(A)	I_{rms}(A)	P	Weight(kg)
f_N=50Hz,3Phase,Aluminum wire winding									
LTFR307017AL	400	17.7	20	440	3*2.159	25.6	28.9	7%	15
LTFR307022AL		22.2	25		3*1.727	32.0	36.2		16
LTFR307026AL		26.7	30		3*1.439	38.5	43.5		17
LTFR307035AL		35.5	40		3*1.080	51.3	57.9		24
LTFR307044AL		44.4	50		3*0.864	64.1	72.4		25
LTFR307066AL		66.6	75		3*0.575	96.2	108.7		39
LTFR307088AL		88.9	100		3*0.432	128.3	144.9		55
LTFR307020AL	415	20.1	30	525	3*2.050	28.0	31.7	7%	16
LTFR307026AL		26.9	40		3*1.537	37.4	42.2		24
LTFR307033AL		33.6	50		3*1.230	46.7	52.8		25
LTFR307040AL		40.3	60		3*1.025	56.1	63.3		26
LTFR307050AL		50.4	75		3*0.820	70.1	79.2		28
LTFR307067AL		67.2	100		3*0.615	93.4	105.6		39
LTFR307100AL		100.7	150		3*0.41	140.1	158.3		57

Other specifications are available upon request.



Standard Series Reactors for Power Capacitors

Ordering Code	U_N(V)	Q_{LC}(kVar)	Q(kVar)	U_C(V)	L_N(mH)	I_N(A)	I_{rms}(A)	P	Weight(kg)
f_N=60Hz,3Phase,Aluminum foil winding/Copper wire winding									
LTFR307026A	480	26.9	30	525	3*1.710	32.0	35.0	7%	18
LTFR307032A		32.3	36		3*1.430	39.0	42.0		20
LTFR307053A		53.8	60		3*0.860	65.0	69.0		31
LTFR307064A		64.5	72		3*0.710	77.0	83.0		38
LTFR307080A		80.6	90		3*0.570	97.0	104.0		40
LTFR307129A		129.0	144		3*0.360	155.0	167.0		66
LTFR312027A	480	27.7	50	690	3*3.210	33.3	36.0	12.7%	30
LTFR312055A		55.4	100		3*1.600	66.7	72.0		50
LTFR312110A		110.8	200		3*0.800	133.4	144.0		102
LTFR314005C	220	5.3	15	400	3*3.960	13.8	15.0	14%	10
LTFR314010C		10.6	30		3*1.980	27.7	30.0		17
LTFR314021C		21.1	60		3*0.990	55.4	60.0		30

Other specifications are available upon request.

>>> Low voltage shunt reactors

The products, also called decompensation reactors or reactors bank, are generally used in parallel connections in the system to produce the inductive reactive power, in order to eliminate the capacitive loads of the cables and reduce the energy cost.

Technical Data

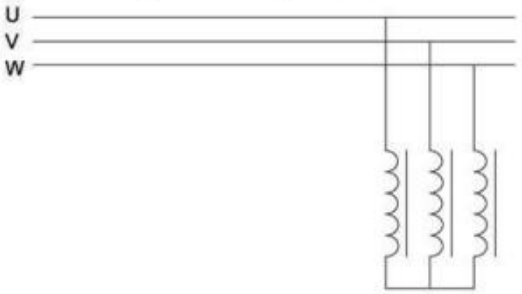
Standard	EN 60076-6,EN 61558-2-20,UL1446
Rated voltage	230V to 1000V
Rated frequency	50Hz/60Hz
Dielectric test	50Hz 3kV,60s
Cooling method	Natural air
Ambient temperature	-25 to +50℃
Elevation above sea level	≤1000m a.s.l.(≤5000m optional)
Protection class	IP00 indoor mounting
Inductance tolerance	0/+5% (or +/-3% as requested)
Blocking factor	100%
Insulation class	H (UL approved resin)
Maximum humidity	95%
Design method	Single phase or three phase, dry type iron core, multiple air gap
Winding material	Copper/ Aluminum
Thermal protection	135℃ normally closed switch (optional)
Terminals	Copper terminals or busbars
Approval marks	CE,TUV, EAC,

Features

- VPI in full automatic system
- Over heat protection
- Copper connections
- Anti-dust non-wooden packing
- Certified by international standards
- Suitable for long transmission lines

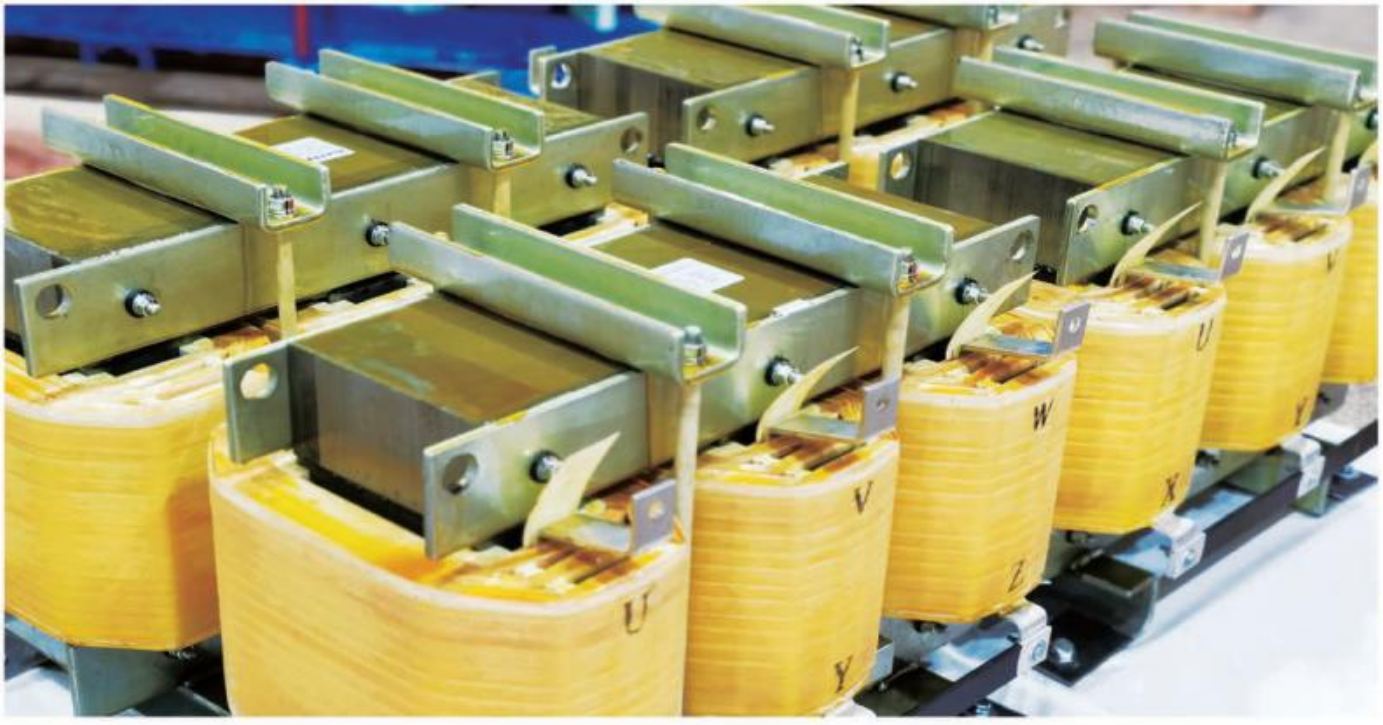
Connection Diagram

(where the system is capactive)



Ordering Code	U_N(V)	Q(kVar)	L_N(mH)	I_N(A)	Weight(kg)
f_N=50Hz,3Phase,Aluminum wire winding					
LTSR30400001AL	400	1	505	1.45	15
LTSR30400002AL		2	252	2.9	16
LTSR30400005AL		5	102	7.2	37
LTSR30400010AL		10	51.2	14.4	45
LTSR30400012AL		12.5	40	18	73
LTSR30400015AL		15	33.6	22	77
LTSR30400020AL		20	25.3	28.9	78
LTSR30400025AL		25	20.4	36.3	121
LTSR30400030AL		30	16.6	43.5	156
LTSR30400040AL		40	12.75	58	179
LTSR30400050AL		50	10.2	72.5	235

Other specifications are available upon request.



Three phases five pillars reactors
3 in 1 designs for single load
compensations

Single phase reactors
for traditional compensations
in Chinese networks

ODM request
Autotransformers
Isolation transformers

Filter reactors for 690V 200kVar capacitors
in 480V system to limit the 3 harmonics

CE-directive reactors
mounted with European standard
terminal blocks

>>> Special products

-Other system voltages(for example 110V,208V,690V)
lower than 1000V
-Other temperature rise(for example 20K)
-Other linearity and inductance accuracy(for example 3.4In)
-Special temperature protection switch(for example 145℃)
-Special power capacitor application request
-Special environment condition
(for example ambient temperature 52℃ or attitude 4000 meters)

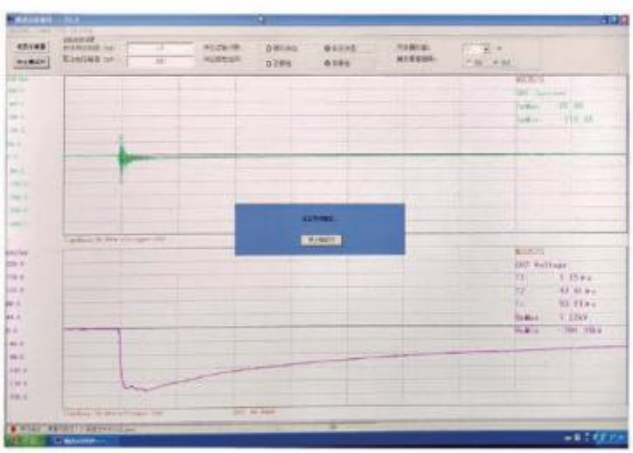
cable lug reactors
for flexible connections
with intelligent capacitors

>>> Medium voltage reactors for PFC

The products, also called detuned reactors or filter reactors, are generally used in series with capacitors in PFC system, in order to reach its target induced current. It possesses the functions of increasing power factors and limiting harmonic current.

Technical Data

Reference standard	EN 60076-6,UL1446
Rated voltage	3kV to 35kV
Rated frequency	50Hz/60Hz
Cooling method	Natural air
Ambient temperature	-25 to +50℃
Elevation above sea level	≤1000m a.s.l.(≤5000m optional)
Protection class	IP00 indoor mounting
Permitted harmonic content	U3=0.5%U_N; U5=5%U_N; U7=5%U_N,
Inductance tolerance	-/+3%
Blocking factor	5%~14%
Linearity	1.55-2.2I_N
Insulation class	H(UL approved resin)
Maximum humidity	95%
Design method	Single phase or three phase, dry type Iron core or air core, multiple air gap
Winding material	Copper/Aluminum
Terminals	Copper bar
Approval marks	TUV,

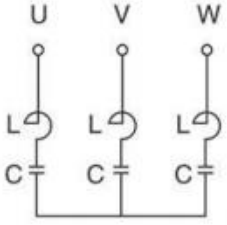


Features

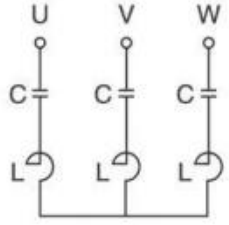
- Very higher linearity
- Lower temperature rising
- Stand 25 times short circuit current in one second
- VPI process control
- Copper connections
- Anti-dust non-wooden packing
- EN standard type testing

Air core inrush reactors for current limiting

Recommended Design



(a)



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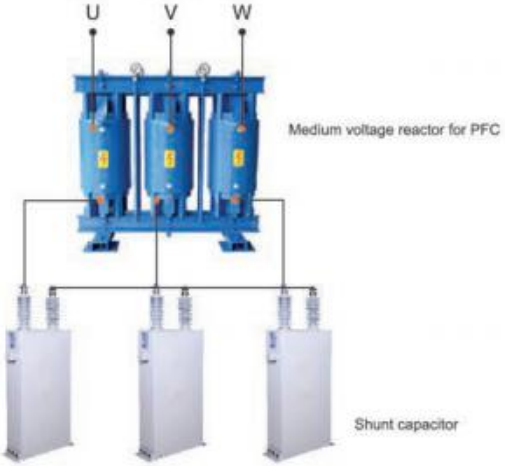
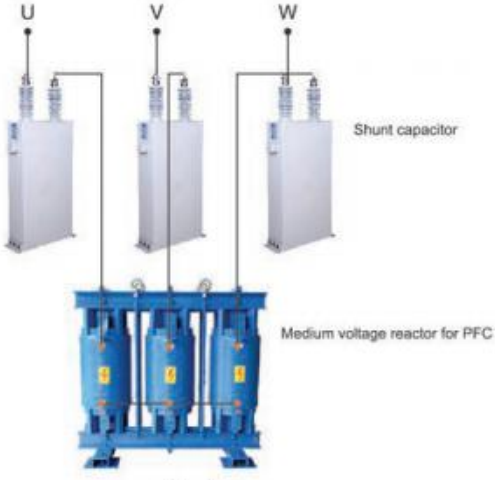


(a)



(b)

Standard Reactors for Shunt Capacitors

Ordering Code	U_N (V)	Q_{LC}(Kvar)	Q(Kvar)	U_C(V)	L_N(mH)	I_N(A)	I_{rms}(A)	P	Weight(kg)
f_N=50Hz,3Phase,Aluminum wire winding									
LTHR3070150A-11KV	11	150	166	12	3*193.366	7.9	8.9	7%	180
LTHR3070300A-11KV		300	332		3*96.683	15.7	17.8		280
LTHR3070500A-11KV		500	554		3*58.010	26.2	29.7		340
LTHR3071000A-11KV		1000	1108		3*29.005	52.5	59.3		520
LTHR3071500A-11KV		1500	1662		3*19.337	78.7	89.0		860
LTHR3072000A-11KV		2000	2216		3*14.502	105	118.6		1130
LTHR3072500A-11KV		2500	2770		3*11.602	131.2	148.3		1220
LTHR3140100A-6.3KV	6.3	100	125	7.6	3*205.770	9.2	10.4	14%	160
LTHR3140300A-6.3KV		300	375		3*68.590	27.5	31.1		310
LTHR3140550A-6.3KV		550	688		3*37.413	50.4	57.0		460
LTHR3140900A-6.3KV		900	1126		3*22.863	82.5	93.2		800
LTHR3141750A-6.3KV		1750	2190		3*11.758	160.4	181.2		1160

Other specifications are available upon request.

Filter Reactors for Shunt Capacitors

Ordering Code	U_N(KV)	L_N(mH)	I_N(A)	I_{rms}(A)	Weight(kg)
f_N=60Hz,3Phase, Aluminum wire winding					
LTHR3029040A-13.8KV	13.8	3*29.780	35	40	460
LTHR3014090A-13.8KV		3*14.890	75	90	650
LTHR3009125A-13.8KV		3*9.926	110	125	1000
LTHR3008140A-13.8KV		3*8.508	125	140	1000
LTHR3007164A-13.8KV		3*7.445	150	164	1050
LTHR3186020A-34.5KV	34.5	3*186.726	15	20	550
LTHR3093035A-34.5KV		3*93.363	30	35	760
LTHR3062050A-34.5KV		3*62.242	45	50	870
LTHR3046065A-34.5KV		3*46.681	55	65	1180
LTHR3037085A-34.5KV		3*37.345	70	85	1540

Other specifications are available upon request.

>>> Reactors for frequency converter

The products are often installed at the outer side or inner side of converters. The main function is to limit the surge current flowing in the power grid, and to reduce its interference with other electrical components.

Features

- High voltage drop
- VPI in full automatic system
- Copper connections
- Anti-dust non-wooden packing
- Certified by international standards

Technical Data

Standard	EN60076-6,EN61558-2-20,UL1446
Rated voltage	380V to 1140V
Rated frequency	50Hz/60Hz
Line voltage tolerance	+/-10%
Dielectric test	50Hz 3kV,60s
Cooling method	Natural air
Ambient temperature	-25 to +50℃
Elevation above sea level	≤1000m a.s.l.(≤5000m optional)
Protection class	IP00 indoor mounting
Rated voltage drop	3%-6%
Insulation class	H (UL approved resin)
Maximum humidity	95%
Design method	Single phase or three phase, dry type iron core, multiple air gap
Winding material	Copper
Terminals	Copper terminals
Approval marks	CE,TUV, EAC,

Input AC reactors

Also called line reactors, are used at inner side of the converter, so as to protect its electrical components and DC circuit from transient overpressure. It can also reduce the surge and peak current and increase the input power factor, as well as restrain the harmonics in the grid and improve the functions of input current wave,to ensure the safe operations of the frequency converter and motors.

Ordering Code	U_N(V)	Converter (HP)	Power (KW)	I_N(A)	L_N(mH)	Weight(kg)
f_N=50Hz, 3Phase, Copper wire winding						
LTACL38007	380	7	5.5	15	1.42	5
LTACL38010		10	7.5	20	1.06	6
LTACL38015		15	11	30	0.7	7
LTACL38020		20	15	40	0.63	9
LTACL38025		25	18.5	50	0.42	10
LTACL38030		30	22	60	0.36	11
LTACL38040		40	30	80	0.26	15
LTACL38050		50	37	90	0.24	16
LTACL38060		60	45	120	0.18	21
LTACL38075		75	55	150	0.15	23
LTACL38100		100	75	200	0.11	29
LTACL38120		120	90	220	0.1	32
LTACL38150		150	110	250	0.09	34
LTACL38175		175	132	290	0.07	37
LTACL38200		200	150	330	0.06	40
LTACL38250		250	185	380	0.05	43
LTACL38300		300	220	490	0.04	60
LTACL38400		400	300	660	0.03	70

Other specifications are available upon request.

Output AC reactors

Also called outlet reactors, are used for output side of the converter. It can have smooth filtering by reducing the transient voltage dv/dt, and prolong the motor's service life. The reactors are also applied to reduce eddy-current loss and the leak current caused by the harmonics, so as to protect the IGBT power switching components inside the frequency converter.

Ordering Code	U_N(V)	Converter (HP)	Power (KW)	I_N(A)	L_N(mH)	Weight(kg)
f_N=50Hz, 3Phase, Copper wire winding						
LTOCL38007	380	7	5.5	15	1.42	6
LTOCL38010		10	7.5	20	1.06	7
LTOCL38015		15	11	30	0.7	10
LTOCL38020		20	15	40	0.63	12
LTOCL38025		25	18.5	50	0.42	13
LTOCL38030		30	22	60	0.36	15
LTOCL38040		40	30	80	0.26	19
LTOCL38050		50	37	90	0.24	21
LTOCL38060		60	45	120	0.18	28
LTOCL38075		75	55	150	0.15	30
LTOCL38100		100	75	200	0.11	38
LTOCL38120		120	90	220	0.1	42
LTOCL38150		150	110	250	0.09	45
LTOCL38175		175	132	290	0.07	49
LTOCL38200		200	150	330	0.06	53
LTOCL38250		250	185	380	0.05	58
LTOCL38300		300	220	490	0.04	79
LTOCL38400		400	300	660	0.03	92

Other specifications are available upon request.

DC reactor

Is used at the DC side of the rectifier, mostly on the frequency converter (AC-DC-AC).It has the function of limiting the current waveform pulse in the rectifier, and the harmonics caused by the converter, thus improving the input power factor.

Ordering Code	U_n(V)	Converter (HP)	Power (KW)	I_n(A)	L_n(mH)	Weight(kg)
f_n=50Hz, 3Phase, Copper wire winding						
LTDCL38007	380	7	5.5	15	4.45	5
LTDCL38010		10	7.5	20	3.2	6
LTDCL38015		15	11	30	2.23	7
LTDCL38020		20	15	40	1.77	8
LTDCL38025		25	18.5	50	1.46	10
LTDCL38030		30	22	60	1.19	11
LTDCL38040		40	30	80	0.9	14
LTDCL38050		50	37	90	0.73	15
LTDCL38060		60	45	120	0.6	16
LTDCL38075		75	55	140	0.48	18
LTDCL38100		100	75	180	0.36	19
LTDCL38120		120	90	220	0.28	21
LTDCL38150		150	110	270	0.24	23
LTDCL38175		175	132	320	0.2	24
LTDCL38200		200	150	400	0.16	25
LTDCL38250		250	185	440	0.14	28
LTDCL38300		300	220	530	0.12	35
LTDCL38400		400	300	750	0.08	49

Other specifications are available upon request.

>>> Passive hamonic filters

This product is kind of low-pass harmonic filter to help improving harmonic currents, so that the total THDI can meet the limits of IEEE519,and the power factor can reach above 0.95 at 100% loading. There is no resonance between passive harmonic filter and system power. The input capacity can be switching in different groups according to the load request, to avoid the over compensation and under compensation of power factor. It can be applied to single or multiple 6-pluse inverter diving device, and other three-phase 6-pulse diode or SCR rectifier as follows:

--AC Inverter --DC Motor Drives --Fans and Pumps
--Elevators --Water Treatment Facilities --Diode or Silicon Rectifiers

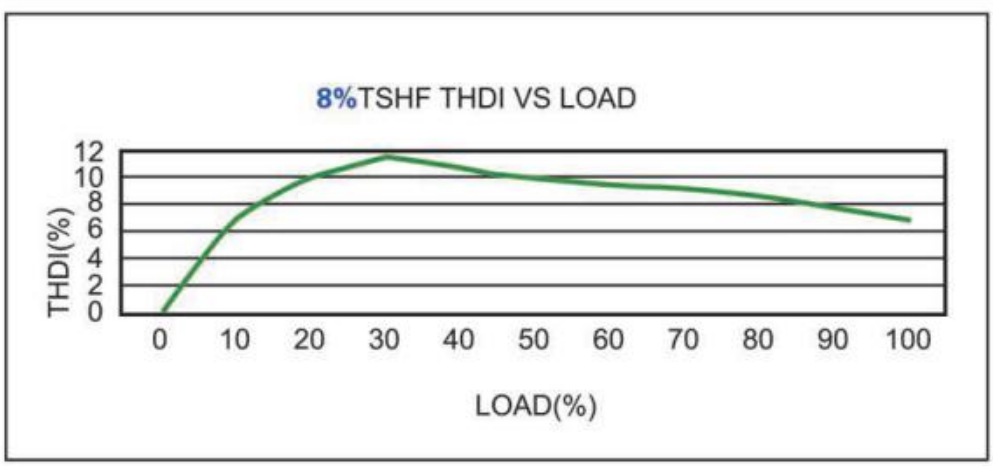
Technical Data

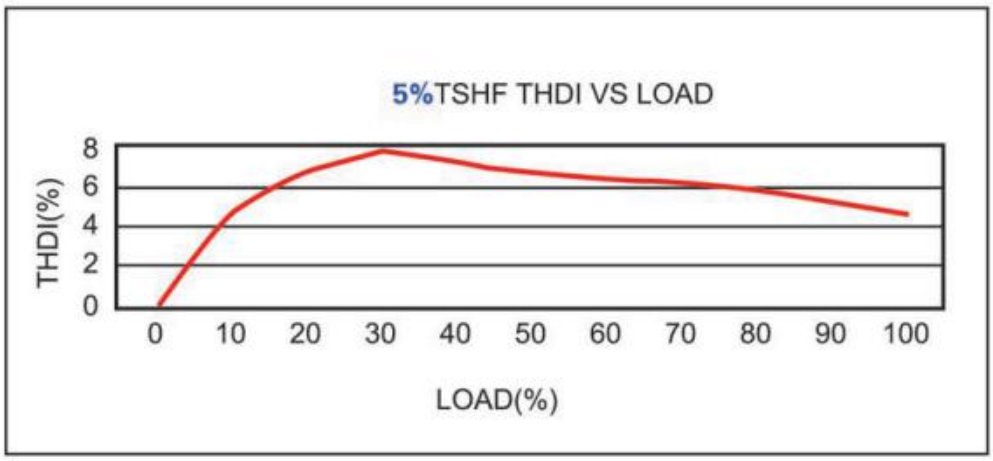
Reference standard	EN60076-6,EN61558-2-20,IEEE-519
Rated frequency	50Hz/60Hz
Rated voltage	220V to 690V
Total harmonic current distortion	According to IEEE-519
Total voltage distortion limits	Special application (hospitals、airports) 3% General system applications 5%
Line voltage tolerance	+/-10%
System impedance	1.5%-6%
THDI Target value	<5%, 8%,12% at 100% load
Efficiency	>95%
Insulation class	H (UL approved resin and capacitor)
Dielectric test	50Hz 3KV,60s
Protection class	IP00(IP20 to IP54 optional)
Overload capability	1.5 times rated current for 1 minute
Ambient temperature	-40 to +50℃
Cooling method	Natural air
Elevation above sea level	≤1000m a.s.l.(≤4000m optional)
Voltage unbalance distortion rate	<1%
Design method	Three phase, dry type iron core, multiple air gap
Winding material	Copper/Aluminum
Terminals	Copper terminals or busbars
Approval marks	CE,TUV, EAC,

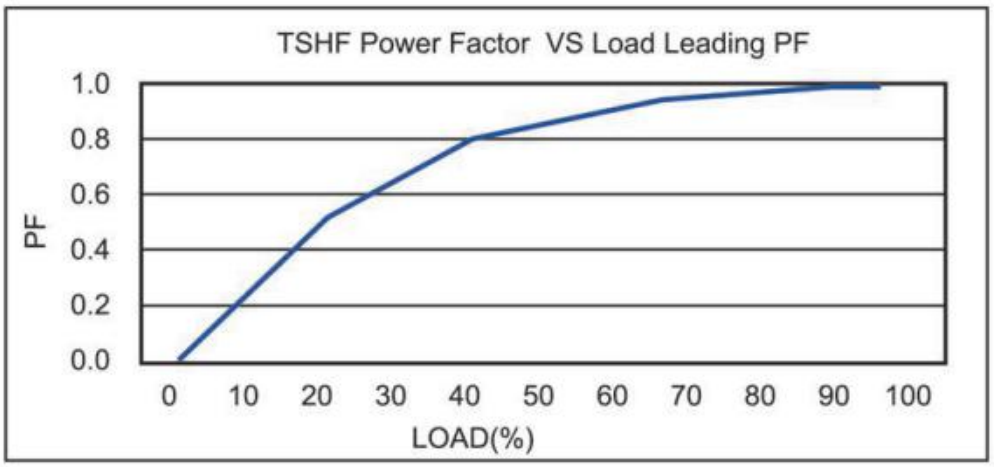
Ordering code (THDI<8%)	Ordering code (THDI<5%)	U_N(V)	Motor(HP)	Power(KW)	Rated current(A)
f_N=50Hz, 3Phase, Copper wire winding					
TSHF840020-08	TSHF840020-05	400	20	15	32
TSHF840025-08	TSHF840025-05		25	19	40
TSHF840030-08	TSHF840030-05		30	22	48
TSHF840040-08	TSHF840040-05		40	30	60
TSHF840050-08	TSHF840050-05		50	37	75
TSHF840060-08	TSHF840060-05		60	45	90
TSHF840075-08	TSHF840075-05		75	55	110
TSHF840100-08	TSHF840100-05		100	75	145
TSHF840125-08	TSHF840125-05		125	90	180
TSHF840150-08	TSHF840150-05		150	110	210
TSHF840200-08	TSHF840200-05		200	160	280
TSHF840250-08	TSHF840250-05		250	185	350
TSHF840300-08	TSHF840300-05		300	220	420
TSHF840400-08	TSHF840400-05		400	300	610
TSHF840600-08	TSHF840600-05		600	450	860

Other specifications are available upon request.

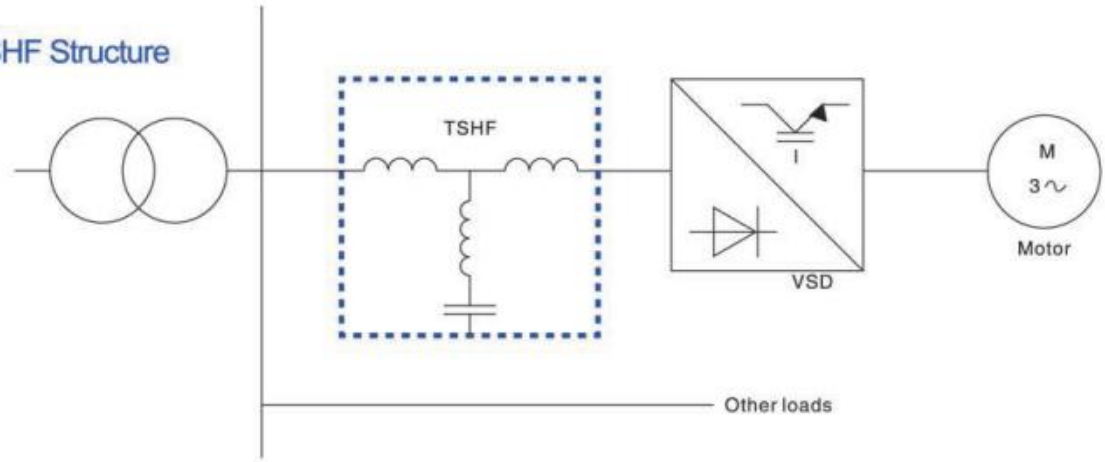
Performance Characteristics







TSHF Structure

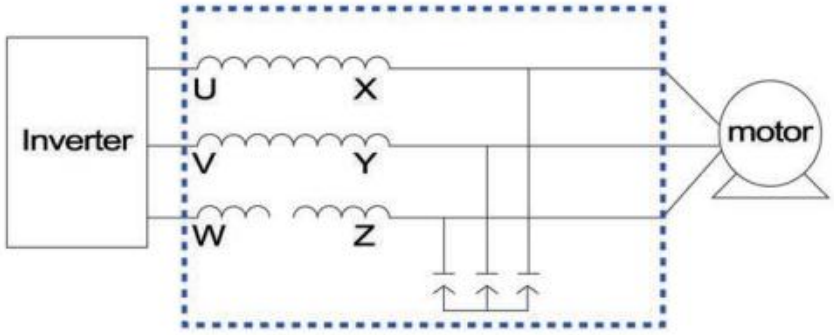


Without

Passive
hamonic filters

With

Connection Diagram



>>> Sine wave filters

The products are specially designed for VFD to protect the motors. It is used at the output side of frequency converters and converted the PWM output signal of motor into a smooth sine wave form. Besides it reduces the resonance phenomenon caused by distributed capacitance and inductance of the long cable (longer than 50 meters).

Technical Data

Standard	EN60076-6,EN61558-2-20,UL1446,EN60939
Rated voltage	380V to 1000V
Rated frequency	50Hz/60Hz
Line voltage tolerance	+/-10%
Switching frequency	3KHz~10KHz
Dielectric test	50Hz 3KV,60s
Cooling method	Natural air
Ambient temperature	-25 to +50℃
Elevation above sea level	≤1000m a.s.l.(≤4000m optional)
Protection class	IP00 indoor mounting
Insulation class	H(UL approved resin)
Maximum humidity	95%
Design method	Three phase, dry type iron core, multiple air gap
Winding material	Copper
Terminal	Copper terminals
Approval marks	CE,TUV, EAC,

Features

- Substantially reduce the high dv/dt and eddy-current loss generated by VFD
- Reduce the motor noise and prolong its lifetime
- Improve the THDV<5% at 100% load condition
- Copper connections
- Recommended for applications with long cable distances and higher frequency interferences

Ordering Code	U_N(V)	Converter (HP)	Power (KW)	I_N(A)	Weight(kg)
f_N=50Hz, 3Phase, Copper wire winding					
SFR840007	400	7	5.5	12	13
SFR840010		10	7.5	16	14
SFR840015		15	11	24	18
SFR840020		20	15	32	22
SFR840025		25	18.5	40	29
SFR840030		30	22	48	34
SFR840040		40	30	60	42
SFR840050		50	37	75	48
SFR840060		60	45	90	64
SFR840075		75	55	115	72
SFR840100		100	75	150	96
SFR840125		125	90	180	108
SFR840150		150	110	220	143

Other specifications are available upon request.

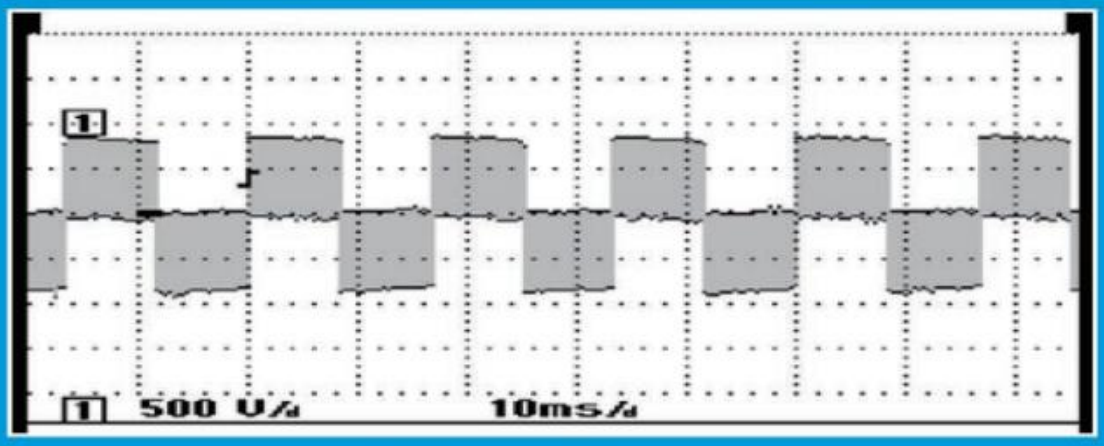
Before filtering


Sine wave filter

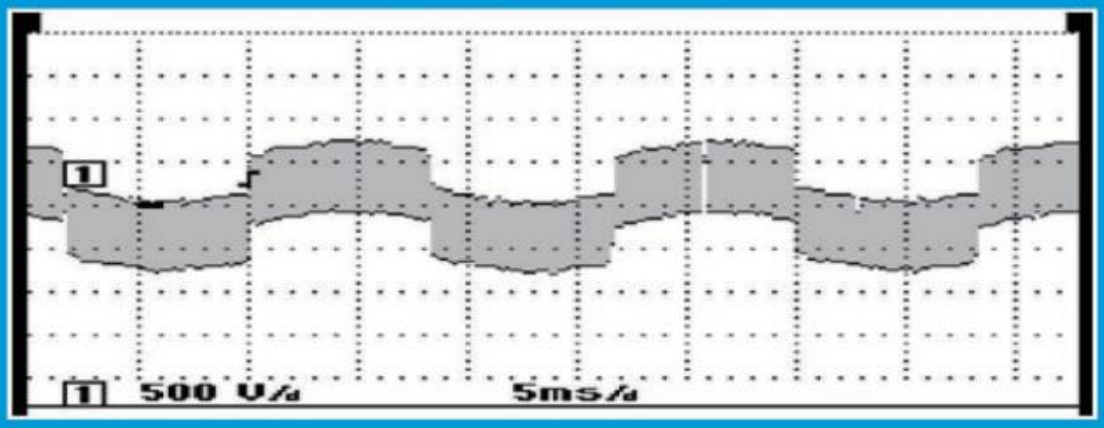
After filtering

Figures of Contrast

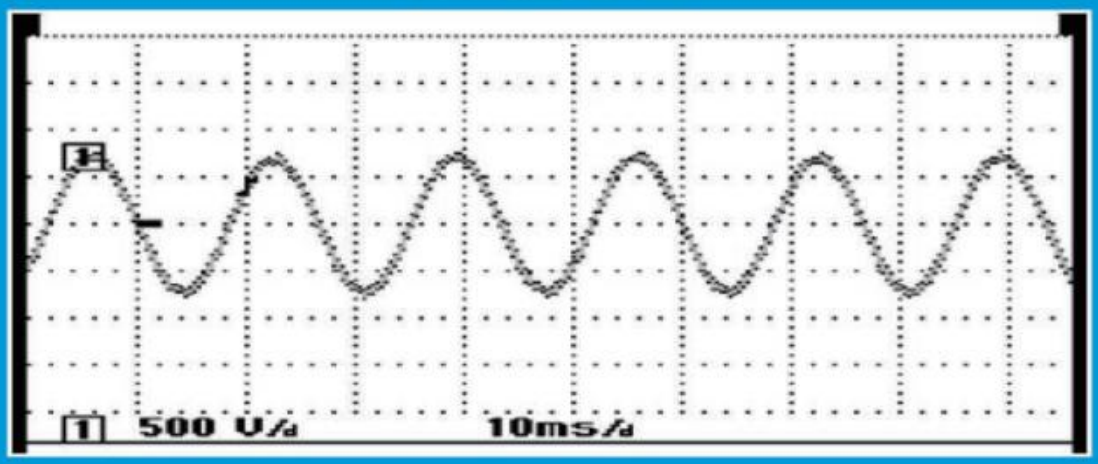
Without output AC reactor & sine wave filter



With output AC reactor



With sine wave filter



>>> Low voltage capacitors for PFC

The use of power capacitors with reactors can help to reduces the harmoniche distortion and minimizes the disturbing effects on operation of other loads. Depending on the chosen tuned frequency, a part of the harmonic current will be absorbed by the power capacitor.

Made in China

Made in Germany

Technical Data

Standard	IEC 60831
Rated voltage	230V to 1000V
Rated frequency	50Hz/60Hz
Output range	2.5 to 30kVar
Tolerance of capacitance	-5....+10%
Elevation above sea level	≤1000m a.s.l.(≤4000m optional)
Filling material	PU Resin
Insulation level	3/-kV
Max permissible current	1.35 I_N
Max permissible voltage	1.1 U_N
Dielectric	Low loss polypropylene film
Loss	Tangent: ≤0.002(20℃ 50Hz)
Temperature range	-40℃~55℃
Protection class	IP00 indoor mounting
Design method	Single phase or three phase, dry type, cylindrical structure
Safety device	Overpressure separation (Discharging to 75V in 1 minute)
Approval marks	CE,TUV

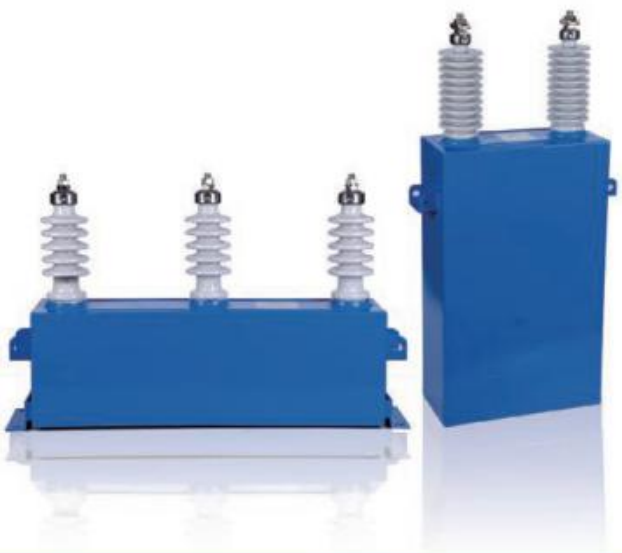
Standard Capacitors for Power Factor Corrections

Ordering Code	U_N(V)	Q(kVar)	C_N(μF)	I_N(A)	ΦD×H (mm)	Weight (kg)	Package (pcs/box)	fr(Hz)
LTMJYS0.440-5-3	440	5	3*27	3*7	65×160	0.6	10	189
LTMJYS0.440-10-3		10	3*55	3*14	76×230	1.0	6	
LTMJYS0.440-15-3		15	3*82	3*20	86×230	1.5	6	
LTMJYS0.440-20-3		20	3*110	3*27	86×278	1.8	6	
LTMJYS0.440-25-3		25	3*137	3*33	96×278	2.0	4	
LTMJYS0.440-30-3		30	3*164	3*40	106×278	2.4	4	
LTMJYS0.480-7.5-3	480	7.5	3*34.5	3*9	65×230	0.6	10	
LTMJYS0.480-10-3		10	3*46	3*12	76×230	0.8	6	
LTMJSY0.480-12.5-3		12.5	3*57.6	3*15	76×230	0.9	6	
LTMJYS0.480-15-3		15	3*69	3*18	86×230	1.2	6	
LTMJYS0.480-25-3		25	3*115	3*30	96×278	1.8	4	
LTMJYS0.480-30-3		30	3*138	3*36	106×278	2.0	4	
LTMJYS0.525-10-3	525	10	3*38	3*11	76×230	1.0	6	
LTMJYS0.525-12.5-3		12.5	3*48	3*14	86×230	1.5	6	
LTMJYS0.525-15-3		15	3*58	3*17	86×230	1.7	6	
LTMJYS0.525-20-3		20	3*77	3*22	86×278	1.8	6	
LTMJYS0.525-25-3		25	3*96	3*28	96×278	2.0	4	
LTMJYS0.525-30-3		30	3*115	3*33	106×278	2.4	4	

Other specifications are available upon request.

>>> Medium voltage capacitors for PFC

The MV capacitors are mainly used for 1kV and above AC power system, with other components as reactors or resistors. They can provide a low resistance path for one or multi harmonic currents, and thus improving the power factor in the system.



Technical Data

Standard	IEC60871
Rated voltage	3kV to 12kV
Rated frequency	50Hz/60Hz
Output range	50kVar to 500kVar
Tolerance of capacitance	-5....+10%
Elevation	≤1000m a.s.l.(≤4000m optional)
Filling material	Non PCB oil
Insulation level	As per IEC standard
Max permissible current	$1.43I_N$
Max permissible voltage	$2.2U_N$
Dielectric	Polypropylene film
Loss Tempe	tangent: ≤0.0005(20℃ 50Hz)
Temperature range	-25℃~50℃
Protection class	IP00 indoor mounting
Design method	Single phase or three phase, oil type
Safety device	Overpressure separation (Discharging to 75V in 10 minutes)

Standard Capacitors for Power Factor Corrections

Ordering Code	U_N (kV)	Q (kVar)	C_N (μF)	I_N(A)	LxBxH (mm)	Stud	Weight (kg)
f_N=50Hz, 1Phase/3Phase							
LTBF-M-6.6√3-100-1W	6.6	100	21.92	15.2	383x140x530	M16	29
LTBF-M-6.6√3-200-1W		200	43.84	30.3	383x180x635	M16	46
LTBF-M-6.6√3-300-1W		300	65.77	45.5	383x180x810	M16	64
LTBF-M-6.6√3-400-1W		400	87.69	60.6	383x180x980	M16	80
LTBF-M-6.6√3-500-1W		500	109.61	75.8	383x195x1090	M16	96
LTBF-M-11√3-100-1W	11	100	7.89	9.1	383x140x595	M16	29
LTBF-M-11√3-200-1W		200	15.78	18.2	383x140x810	M16	46
LTBF-M-11√3-300-1W		300	23.68	27.3	383x180x890	M16	64
LTBF-M-11√3-400-1W		400	31.57	36.4	383x180x1060	M16	80
LTBF-M-11√3-500-1W		500	39.46	45.5	383x195x1165	M16	96
LTBF-M-7.2-100-3W	7.2	100	3*6.14	3*8.0	600x170x481	M12	38
LTBF-M-7.2-200-3W		200	3*12.28	3*16.0	600x150x621	M12	54
LTBF-M-7.2-300-3W		300	3*18.42	3*24.0	600x170x691	M12	69
LTBF-M-7.2-400-3W		400	3*24.56	3*32.0	645x195x691	M12	83
LTBF-M-7.2-500-3W		500	3*30.70	3*40.0	725x195x751	M12	104
LTBF-M-12-100-3W	12	100	3*2.21	3*4.8	600x170x481	M12	38
LTBF-M-12-200-3W		200	3*4.42	3*9.6	600x150x621	M12	54
LTBF-M-12-300-3W		300	3*6.63	3*14.4	600x170x691	M12	69
LTBF-M-12-400-3W		400	3*8.84	3*19.2	645x195x691	M12	83
LTBF-M-12-500-3W		500	3*11.05	3*24.0	725x195x751	M12	104

Other specifications are available upon request.

>>> Thyristor switches

The thyristor switches adopts the leading technology of zero-crossing switching, which could give the user an ideal and timely reactive power compensation. In practical application, the switching module could replace the contactor in PFC system, and will input the reactive capacity in zero-crossing switching voltage, to avoid the inrush current and sudden voltage variation.

Technical Data

Standard	IEC 60947
Rated frequency	230V to 690V
Rated frequency	50Hz/60Hz
Signal voltage	DC 12V 25mA/steps
Control voltage	220V 50Hz
Dynamic response time	≤20ms
Protection class	IP30
Elevation above sea level	As per IEC standard
Maximum humidity	90%
Ambient temperature	-25℃ to +55℃
Mounting position	Vertical

Standard Thyristor Switches for Three Phase Compensation

Ordering Code	U_N(V)	Q(kVar)	I_N(A)	Fan	Weight(kg)
LTSCR-20KVAR-400V	400	20	30	X	4
LTSCR-25KVAR-400V	400	25	37.5	X	4
LTSCR-30KVAR-400V	400	30	45	X	4
LTSCR-40KVAR-400V	400	40	60	X	4
LTSCR-50KVAR-400V	400	50	75	X	4
LTSCR-60KVAR-400V	400	60	90	X	4

Other specifications are available upon request.

>>> Power factor controllers

The controllers can be used in the low and medium voltage range with dual-core MCU and DSP control, advanced software algorithms and reliable electromagnetic compatibility design. It can effectively and reasonably control the shunt capacitor bank switching, improve power factor, reduce line losses, and improve voltage quality.

Technical Data

Standard	IEC 60947
Sampling voltage	100V(MV system)/380V(LV system)
Rated frequency	50Hz
No. of output relays	12 outputs
Output rating	250V/5A normally open contact
Switching delay	0-999s
Display	4.3inch touch screen, 2-50 harmonics
Measuring current	5A/1A
Adjustable CT ratio	1~10000
Alarm contact	Yes
Interface	MODBUS RS485
Elevation	≤2500m a.s.l.
Temperature range	-25℃~70℃
Max Humidity	90%
Protection class	Front IP40/Back IP30
Mounting position	no restrictions
Weight	1kg

>>> Active power filters

APF products have the multiple compensation functions including harmonic compensation, power factor compensation and three phase unbalance compensation. They are the perfect solutions in the power grid to filter the harmonics created by the variable speed drives in industrial applications, especially in steel, paper, automotive, chemical industries, and other commercial buildings.

Features

IGBT unit control

7 inches HMI display

Safety design of terminal blocks

Various protections modes

Filtering the harmonics from 2-50 orders

Certified by international standards

Maintenance-free

Recommended installations with THDI>20% pollutions

Technical Data

Specification	Specification of module	50A	75A	100A	150A
	Weight of module	35kg	40kg	50kg	55kg
	Size of module W*D*H (rack type)	420*500*190	500*550*200	500*578*240	500*578*260
	Size of module W*D*H (wall-mounted type)	420*190*500	500*210*550	500*270*578	
	Size and maximum capacity of single cabinet W*D*H	600*600*2200mm (max 300A)			
		800*800*2200mm (max 600A)			
		1000*1000*2200 (max 900A)			
	Color	Black (module); grey, national standard 7035 (cabinet type)			
Input	Working voltage	400V/690V (-20% ~ +15%)			
	Working frequency	50Hz/60Hz (-10% ~ +10%)			
	Power grid structure	3-phase and 3-wire/3-phase and 4-wire			
	CT	100:5 ~ 10000:5			
Function	Filtering range	2-50 orders			
	Harmonic elimination rate	THDI<5% at the 100% load(as agreed)			
	Reactive compensation	-1~+1 adjustable			
	Compensation of three- phase imbalance	100% imbalance complete compensation			
Communication protocol	Communication method	RS232, 485, Modbus protocol, TCP/IP optional			
	Communication interface	RS485, network access			
	Upper computer software	Yes, all parameters can be set up through upper computer.			
	Fault alarm	Yes, 500 pieces of alarm information can be recorded at most.			
	Monitoring	Supporting each module's independent monitoring/centralized monitoring of overall equipment.			
Technical index	Full response time	<10ms			
	Active loss	<2.5%			
	Method of heat dissipation	Intelligent air-cooling			
	Noise	<60dB			
	Sampling/control frequency	20kHz			
	Equivalent switching frequency	20kHz			
	Protection function	More than twenty protections including overvoltage protection, under voltage protection, overheating protection, over current protection and short-circuit protection			
	CT installation position	Load side/grid side, optional			
	Cable entry	Top/bottom(cabinet type)			
	Quantity of capacitor channels available for parallel connection	Unlimited			
Environmental requirements	Working temperature	-10℃~+45℃			
	Storage temperature	0℃~+40℃			
	Altitude	<5000 m (when the altitude is above 1,500m, the capacity will be lowered by 1% for every extra 100m.)			
	Relative humidity	<90%			
	Protection level	IP20 (higher protection level can be customized.)			
	Relevant standard	IEEE519,IEC62477			

>>> Static var generators

SVG products are the ideal solutions to solve the problems of lower reactive powers as well as the lower harmonic current pollutions at the same time. They can dynamically compensate the inductive or capacitive power in a very fast response time, in order to reach the target power factor of 0.99, and avoid any phenomenon of over compensations or under compensations.

Features

IGBT unit control
7 inches HMI display
Safety design of terminal blocks
Various protections modes
Filtering the harmonics from 2-13 orders
Certified by international standards
Maintenance-free

Technical Data

Specification	Specification of module	50kVar	75kVar	100kVar
	Weight of module	40kg	45kg	55kg
	Size and color of module W*D*H (rack type)	500*550*200	500*578*240	500*578*260
	Size of module W*D*H (wall-mounted type)	500*210*550		500*270*578
	Size and maximum capacity of single cabinet W*D*H	600*600*2200mm (max 200kVar)		
		800*800*2200mm (max 300kVar)		
		1000*1000*2200 (max 600kVar)		
	Color	Black (module); grey, national standard 7035 (cabinet type)		
Input	Working voltage	400V/690V (-20% ~ +15%)		
	Working frequency	50Hz/60Hz (-10% ~ +10%)		
	Power grid structure	3-phase and 3-wire/3-phase and 4-wire		
	CT	100:5 ~ 10000:5		
Function	Filtering range	2-13 orders		
	Reactive compensation	-1~+1 adjustable		
	Compensation of three-phase imbalance	100% imbalance complete compensation		
Communication protocol	Communication method	RS232, 485, Modbus protocol, TCP/IP optional		
	Communication interface	RS485, network access		
	Upper computer software	Yes, all parameters can be set up through upper computer.		
	Fault alarm	Yes, 500 pieces of alarm information can be recorded at most.		
	Monitoring	Supporting each module's independent monitoring/centralized monitoring of overall equipment.		
Technical index	Full response time	<10ms		
	Active loss	<2.5%		
	Method of heat dissipation	Intelligent air-cooling		
	Noise	<60dB		
	Sampling/control frequency	20kHz		
	Equivalent switching frequency	20kHz		
	Protection function	More than twenty protections including overvoltage protection, under voltage protection, overheating protection, over current protection and short-circuit protection		
	CT installation position	Load side/grid side, optional		
	Cable entry	Top/bottom(cabinet type)		
	Quantity of capacitor channels available for parallel connection	Unlimited		
Environmental requirements	Working temperature	-10℃~+45℃		
	Storage temperature	-0℃~+40℃		
	Altitude	<5000 m (when the altitude is above 1,500m, the capacity will be lowered by 1% for every extra 100m.)		
	Relative humidity	<90%		
	Protection level	IP20 (higher protection level can be customized.)		
	Relevant standard	IEEE519,IEC61000-3-6		

>>> Reference standards

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Table 2 – Winding temperature–rise limits

Insulation system temperature (see Note 1) ℃	Average winding-temperature rise limits at rated current (see Note 2) K
105 (A)	60
120 (E)	75
130 (B)	80
155 (F)	100
180 (H)	125
200	135
220	150
NOTE 1 Letters refer to the temperature classifications given in IEC 60085. NOTE 2 Temperature rise measured in accordance with Clause 23.	

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Table 4 – Minimum clearances in air (1 of 2)

Highest Voltage for equipment U_m kV	Full Wave Lightning Impulse (LI) kV	Switching impulse (SI) kV	Minimum air clearance	
			Line to earth mm	Phase to phase mm
<1,1	-	-		
3,6	20	-	60	60
	40	-	60	60
7,2	60	-	90	90
	75*	-	120	120
12	75	-	120	120
	95	-	160	160
	110*	-	200*	200*
17,5	95	-	160	160
	125*	-	220	220
24	125	-	220	220
	145	-	270	270
	150*	-	280*	280*
36	170	-	320	320
	200*	-	380	380

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Table 3 – Insulation levels based on European practice

Highest voltage for equipment U_m (r.m.s.) kV	Rated short duration separate source AC withstand voltage (r.m.s.) kV	Rated lightning impulse withstand voltage (peak value) kV	
		List 1	List 2
≦1,1	3	-	-
3,6	10	20	40
7,2	20	40	60
12,0	28	60	75
17,5	38	75	95
24,0	50	95	125
36,0	70	145	170

The choice between list 1 and list 2 should be made considering the degree of exposure to lightning and switching overvoltages,the type of system neutral earthing and,where applicable,the type of overvoltage protective device,see IEC 60071.

Table 4 – Insulation levels based on North American practice

Dielectric insulation levels for dry type transformers used on system with BILs 200 kV and below												
Max LL system voltage kV	Nominal LL system voltage kV	Low frequency voltage insulation level kV r.m.s.	Basic Lightning Impulse Insulation Levels (BILs) in common use(peak value 1,2µs)									
			10	20	30	45	60	95	110	125	150	200
0,25	0,25	2,5	None									
0,6	0,6	3	S	1	1							
1,2	1,2	4	S	1	1							
2,75	2,5	10		S	1	1						
5,6	5	12			S	1	1					
9,52	8,7	19				S	1	1				
15,5	15	34					S	1	1			
18,5	18	40						S	1	1		
25,5	25	50						2	S	1	1	
36,5	34,5	70								2	S	1
Impulse chopped wave: minimum time to flash over(µs)			1	1	1	1,3	2	2	1,8	2	2,3	2,7

S = Standard values
1 = Optional higher levels where exposure to overvoltage occurs and higher protective margins are required.
2 = Lower levels where surge arrester protective devices can be applied with lower spark-over levels.

★ IEEE Std 519–1992 IEEE RECOMMENDED PRACTICES AND REQUIREMENTS

The limits listed in Table 11-1 should be used as system design values for the "worst case" for normal operation (conditions lasting longer than one hour).For shorter periods,during start-ups or unusual conditions,the limits may be exceeded by 50%.

Table 11-1-Voltage Distortion Limits

Bus Voltage at PCC	Individual Voltage Distortion(%)	Total Voltage Distortion THD(%)
69kV and below	3.0	5.0
69.001kV through 161kV	1.5	2.5
161.001 kV and above	1.0	1.5

NOTE - High-voltage systems can have up to 2,0%THD where the cause is an HVDC terminal that will attenuate by the time it is tapped for a user.

★ IEEE Std 519–1992 IEEE RECOMMENDED PRACTICES AND REQUIREMENTS

Table 10-3-Current Distortion Limits for General Distribution Syetems (120V Through 69 000 V)

Maximum Harmonic Current Distortion in Percent of I_L						
	Individual Harmonic Order (Odd Harmonics)					
I_{sc}/I_L	*<11*	*11≤h<17*	*17≤h<23*	*23≤h<35*	*35≤h*	TDD
<20*	4.0	2.0	1.5	0.6	0.3	5.0
20<50	7.0	3.5	2.5	1.0	0.5	8.0
50<100	10.0	4.5	4.0	1.5	0.7	12.0
100<1000	12.0	5.5	5.0	2.0	1.0	15.0
>1000	15.0	7.0	6.0	2.5	1.4	20.0

Even harmonics are limited to 25% of the odd harmonic limits above.

Current distortions that result in a dc offset,e.g.,half-wave converters,are not allowed.

*All power generation equipment is limited to these values of curent distortion, regardless of actual I_{sc}/I_L

where
I_{sc}=maximum short-circuit current at PCC.
I_L=maximum demand load current (fundamental frequency component) at PCC.

>>> Caculations of required capacitor power

Original power factor cosϕ1	Target power factor cosϕ2										
	0.90	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	1.00
0.70	0.536	0.564	0.591	0.625	0.657	0.691	0.729	0.769	0.811	0.878	1.020
0.71	0.508	0.536	0.563	0.597	0.629	0.663	0.701	0.741	0.783	0.850	0.992
0.72	0.479	0.507	0.534	0.568	0.600	0.634	0.672	0.712	0.754	0.821	0.963
0.73	0.452	0.480	0.507	0.541	0.573	0.607	0.645	0.685	0.727	0.794	0.936
0.74	0.425	0.453	0.480	0.514	0.546	0.580	0.618	0.658	0.700	0.767	0.909
0.75	0.398	0.426	0.453	0.487	0.519	0.553	0.591	0.631	0.673	0.740	0.882
0.76	0.371	0.399	0.426	0.460	0.492	0.526	0.564	0.604	0.652	0.713	0.855
0.77	0.345	0.373	0.400	0.434	0.466	0.500	0.538	0.578	0.620	0.687	0.829
0.78	0.319	0.347	0.374	0.408	0.440	0.474	0.512	0.552	0.594	0.661	0.803
0.79	0.292	0.320	0.347	0.381	0.413	0.447	0.485	0.525	0.567	0.634	0.776
0.80	0.266	0.294	0.321	0.355	0.387	0.421	0.459	0.499	0.541	0.608	0.750
0.81	0.240	0.268	0.295	0.329	0.361	0.395	0.433	0.473	0.515	0.582	0.724
0.82	0.214	0.242	0.269	0.303	0.335	0.369	0.407	0.447	0.489	0.556	0.698
0.83	0.188	0.216	0.243	0.277	0.309	0.343	0.381	0.421	0.463	0.530	0.672
0.84	0.162	0.190	0.217	0.251	0.283	0.317	0.355	0.395	0.437	0.504	0.645
0.85	0.136	0.164	0.191	0.225	0.257	0.291	0.329	0.369	0.417	0.478	0.620
0.86	0.109	0.140	0.167	0.198	0.230	0.264	0.301	0.343	0.390	0.450	0.593
0.87	0.083	0.114	0.141	0.172	0.204	0.238	0.275	0.317	0.364	0.424	0.567
0.88	0.054	0.085	0.112	0.143	0.175	0.209	0.246	0.288	0.335	0.395	0.538
0.89	0.028	0.059	0.086	0.117	0.149	0.183	0.230	0.262	0.309	0.369	0.512
0.90		0.031	0.058	0.089	0.121	0.155	0.192	0.234	0.281	0.341	0.484

For Example:

Working load of the plant: 500KW

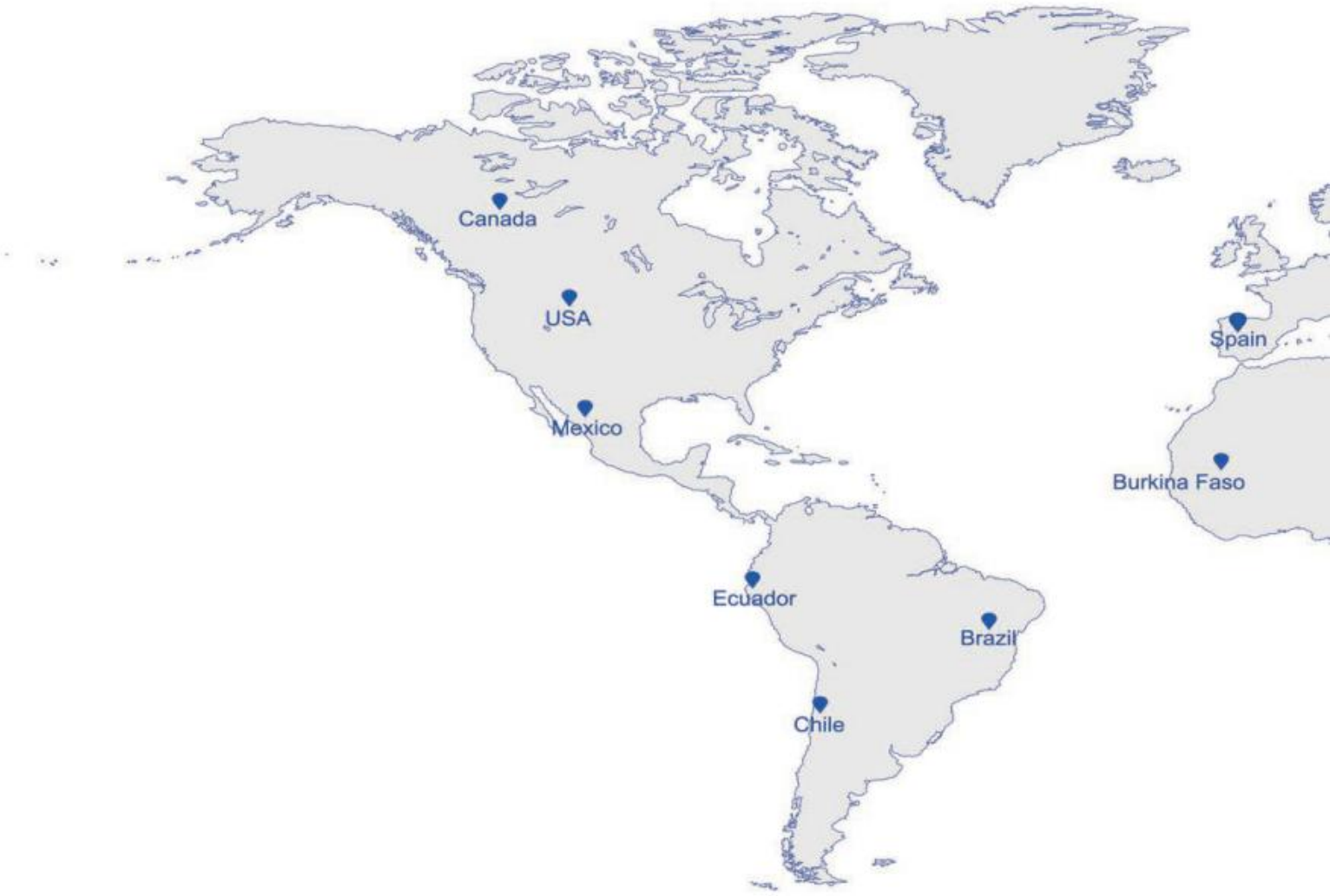
Power factor before improvement: cosϕ1＝0.70

Desired power factor after improvement: cosϕ2＝0.95

Required capacitor power: 500X0.691=345.5kVar.

(Note: 0.691 co-efficient is obtained from the above table)

>>> Market distribution



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