metal-enclosed MV capacitor banks

Power factor correction and harmonic filtering

ENERGI

- Ready for quick assembly and Erection
- Manufactured with standardized parts
- Completely assembled in factory
- Economical

Hydro

Thermal

Wind

Nuclear

Substation

Chemical Factory

Cement Factory

Steel Factory

metal-enclosed MV capacitor banks

General

' Energi ' Metal-enclosed medium voltage capacitor systems and harmonic filters are designed for indoor and outdoor applications in commercial, industrial, and utility power systems requiring power factor correction, motor start support, harmonic filtering, as per IEC compliance, can increase systems capacity.

A " capacitor bank " generally consists of several single-phase or three-phase capacitor units assembled and interconnected to produce very powerful system.

Fixed Bank

Qc/Sn < 15% the reactive power of the capacitor banks is constant and they are started up or shut down when a predetermined KVAr value is reached. It is an " on/off " type of operation.

Automatic Bank

Qc/Sn > 15% the customer specifies automatic startup or shutdown for the capacitor bank (controlled by relay). The reactive power of the capacitor bank is split into " steps " with the possibility of starting or stopping more or fewer steps. The reactive power corresponds to the change in load requirements.

Harmonics

Harmonics are an important aspect when considering power factor correction. The range includes a number of options to overcome these harmonics.

Modern electrical equipment consists of nonlinear devices which generate harmonics. Examples of these devices include the following:

- Equipment containing electronics that control other apparatus. Eg. variable speed drives, soft starters, static compensators, rectifiers, etc.
- Arc furnaces
- In certain cases, transformers, reactors and rotating machines
- Domestic appliances

Harmonics are not only found in industrial networks, they can also spread into the distribution network and cause problems for other power users. Common problems that harmonics can produce include:

- Overloading of capacitors, leading to malfunctioning and premature aging
- Increased losses, eg. machines will operate at increased temperatures
- Resonance problems between the inductive and capacitive parts of the network
- Malfunctioning of control systems
- Interference with telecommunication and computer equipment
- Disturbances in ripple control systems
- High currents in neutral conductors

Harmonics distort the sine wave (50 Hz or 60 Hz) sign which becomes apparent when a distorted sine wave mathematically analysed.

Structure and Enclosure

The upper part of the capacitor bank consists of hot-dip galvanized steel profiles bolted together to a robust structure. They are covered on the outside with painted or powder coated sheet-steel enclosure.

Roof

The roof is made of double sheet-steel panels with powder coating. It is equipped with a surrounding cover made of steel, and rain water drainage.

Doors

The doors consist of a sheet-steel construction with insulation and neoprene sealing. The hinges and fixing screws are made of stainless steel. Every door features a central lock for profile cylinders, a three-point rod interlocking.

Ventilation

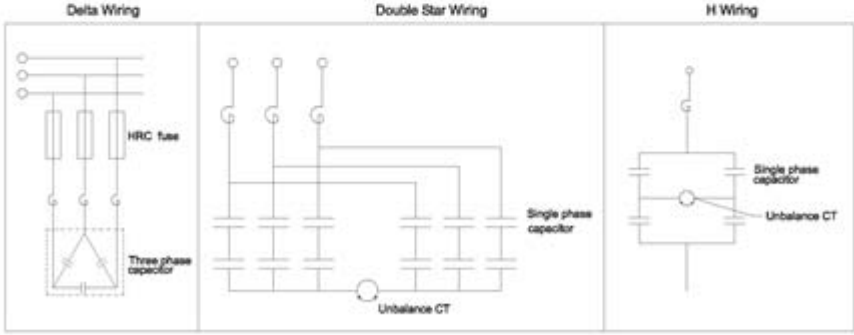
The outside walls of the capacitor bank are designed as small ventilation elements. They are composed of steel profile elements with insect profile elements with insect protection, staggered with intermediate spaces.

Base frame

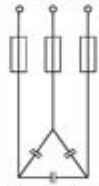
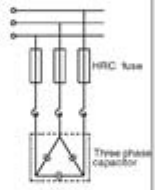
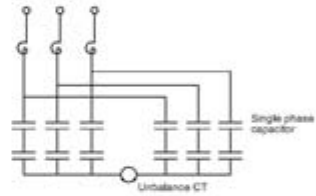
The capacitor enclosure consists of a self-supporting base frame made of sheet-steel girders. Cables are introduced from below through the corresponding openings. For installation and sealing towards the ground, a foundation is required that has to be constructed locally.

Circuit diagram

To form banks of great power, there are several possibilities for cabling or connection by combination of capacitor units, namely:

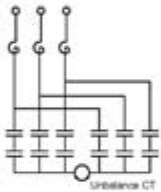
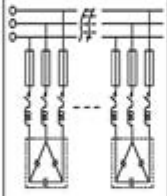
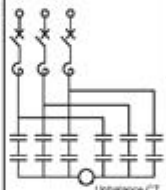
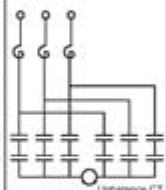
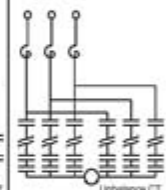


Overview

Applications	For motor compensation		Industrial compensation	
Design	Fixed bank		Fixed bank	
Model	FCB 7.2B	FCB 7.2S	FCB 12S	FCB 12H
Maximum Voltage	Upto 7.2 kV		Upto 12 kV	
Location	Indoor / outdoor		Indoor / outdoor	
Circuit Connection				
Type of protection	HRC fuses		HRC fuses and Unbalance CT and Relay	
Components	Enclosure terminal box HRC fuses Inter connection busbar	Steel enclosure HRC fuses Inrush reactor Inter connection busbar	Steel enclosure HRC fuses Inrush reactor Inter connection busbar	Neutral current transformer Voltage transformer Protection relay Line disconnector / Earth switch

FCB - Fixed Capacitor Bank
ACB - Automatic Capacitor Bank
OFCB - Open Fixed Capacitor Bank
B - Basic
S - Standards
H - Harmonic Filter

Metal-enclosed banks

Industrial and distribution Network		Industrial and distribution Network		Transmission and Distribution Network	
Fixed bank		Automatic bank		Fixed bank	
FCB 36S	FCB 36H	ACB 12S ACB 12H	ACB 36S	OFCB 36	OFCB 132S
Upto 36 kV		Upto 12 kV	Upto 36 kV	Upto 36 kV	Upto 132 kV
Indoor / outdoor		Indoor / outdoor		Outdoor	Outdoor
					
HRC fuses and Unbalance CT and Relay		HRC fuses and Unbalance CT and Relay		As per Design	
Steel enclosure HRC fuses Inrush reactor Inter connection busbar Line disconnector / Earth switch Harmonic filter on request	Neutral current transformer Voltage transformer Protection relay	Steel enclosure HRC fuses Inrush reactor Inter connection busbar Neutral current transformer	Vacuum contactor Voltage transformer Protection relay Line disconnector / Earth switch Control units		

Mobile banks

Substation banks

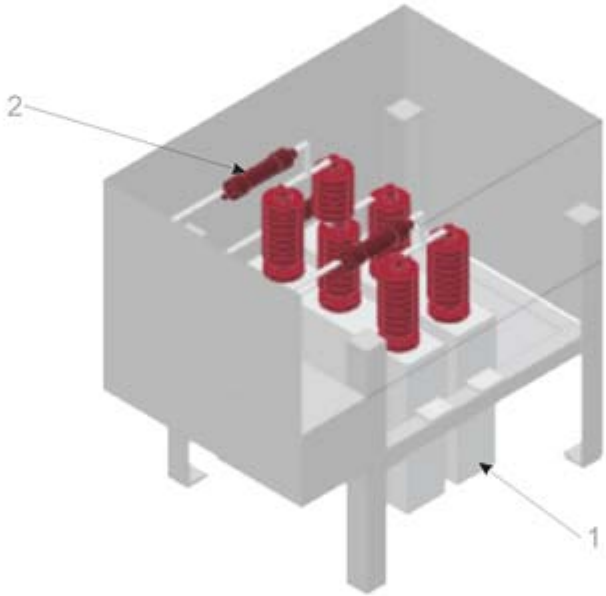
Single component FCB 7.2B

MV Capacitor Bank with terminal enclosure upto 7.2 kV - - - 50 Hz / 60Hz

Product description

These units are useful in industrial installations, since they are capable of hosting low and medium-powered applications in small dimensions.

The capacitor banks are used for individual reactive compensation in MV motors Capacitor for indoor or outdoor use.



1. Capacitors
2. HRC fuse

- Lower installation cost
- Top and side entry
- Large size for easy cable connections
- Floor mounting

Technical data

Voltage	1.....7.2 kV
Frequency	50Hz or 60Hz
Normal Power	100.....500 KVAr
No.of Phases	Three Phase unit
Location	Indoor / Outdoor
Protection	Internal fuses / HRC fuses

Applications

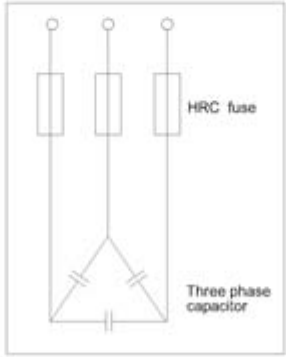
- Large motors
- Motor control center
- Branch Circuits

Composition

Each capacitor bank comprises the following components

- Three phase capacitor unit
- Free Standing - Steel Enclosure
- HRC fuses

Delta Wiring



Industrial compensation FCB 12S or H

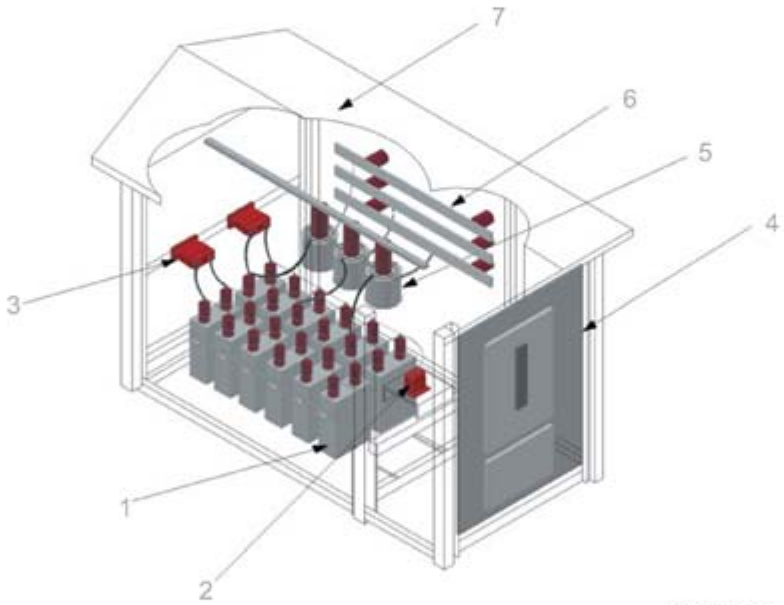
Fixed Capacitor Bank upto 12 kV - - - 50 Hz / 60 Hz

Product description

A capacitor bank generally made up of several individual single phase capacitor assembled throughout and inter connected to create the fixed bank.

To Manufacture in advance, especially in standard capacitor bank sections that can be shipping and assembled

The capacitor banks are created before being brought to site where it is properly assembled, or installed thereafter.



1. Capacitors
2. NCT
3. Quick discharge coil
4. Isolator with Earth switch
5. Inrush reactor
6. Bus Bar
7. Top roof

- Factory Tested and ready for interconnection
- Grounding switch available
- Internal protection and control systems
- Harmonic tuned, de-tuned filters available

Technical data

Voltage	Upto 12 kV
Frequency	50Hz or 60Hz
Normal Power	300 to 4500 KVAr
No. Of Phases	Single Phase unit
Location	Indoor / Outdoor
Protection	Internal fuse / HRC fuse

Applications

- Industrial
- Critical power substation
- Utilities

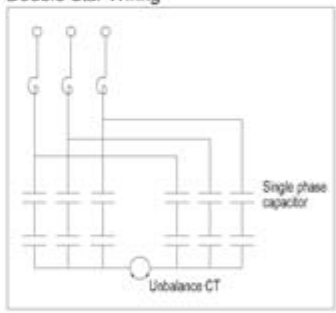
Composition

A pre-fabricated capacitor bank comprises the following main components

Capacitor units 6 or 12 units provide as depending on the power rating

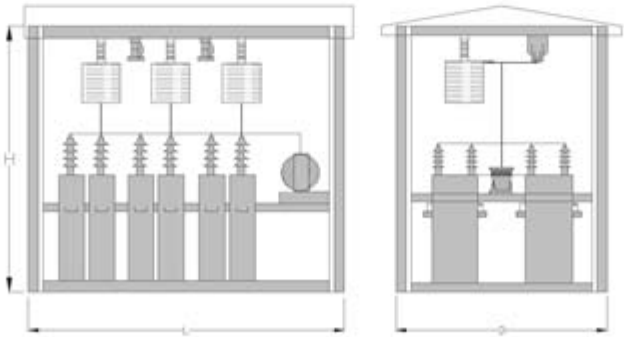
- Inrush reactor provided for current limiting
- Neutral current transformer
- Protection relay
- Doors with Lock and Key
- Line Disconector with earth switch for human safety
- HRC fuse

Double Star Wiring



Options

- Harmonic filter reactors
- Two set of quick discharge transformer
- Fuse blown indicator
- Voltage transformer
- Digital voltage measuring meter



Technical data

Voltage	Upto 7.2 kV
Frequency	50Hz or 60Hz
Normal Power	100 to 800 KVAr
No. of Phase	Three Phase unit
Location	Indoor / Outdoor
Protection	Internal fuse / HRC fuse

Applications

- Pumping Stations
- Mining
- Cement and Steel Industries

Composition

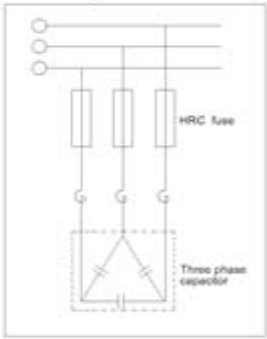
A pre-fabricated capacitor bank comprises the following main components

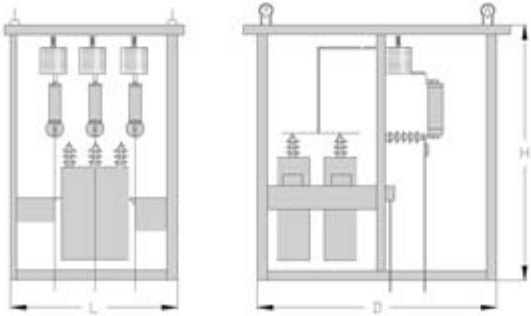
- Three phase capacitor units
- Inrush Current limiting reactors
- HRC fuse
- Steel Enclosure
- Door with 3point pad lockable and SS hinges

Options

- Two set of quick discharge transformer
- Fuse blown indicator

Delta Wiring





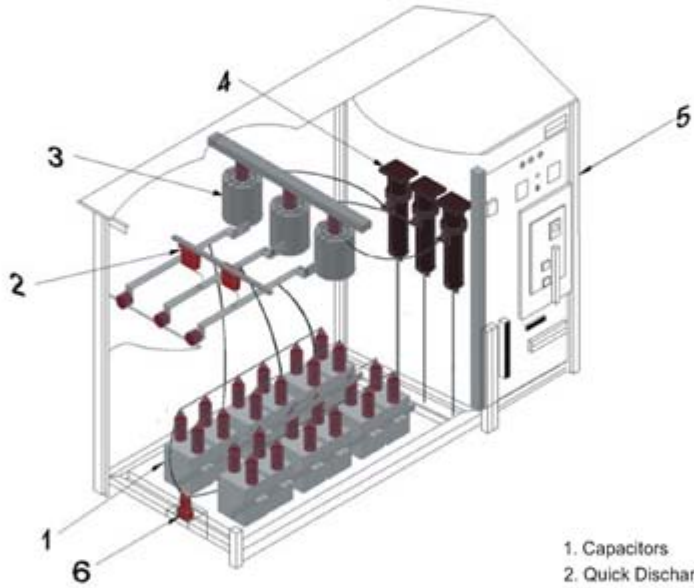
Large Automatic capacitor banks ACB 36S

Capacitor Banks upto 36 kV - - - 50 Hz / 60 Hz

Product description

The MV automatic capacitor banks designed to use in electrical network upto 36kV. The capacitor bank made of galvanized steel panels which equipped with capacitors, vacuum / SF 6 circuit breaker, Unbalanced current transformer and inrush current limiting reactors.

These banks used for automatic reactive compensation in medium voltage network with a high harmonic Levels. The bank is arranged in double star connection and the unbalance current transformer has to be connected a relay to insure the protection against capacitor internal fault.



1. Capacitors
2. Quick Discharge coil
3. Inrush reactor
4. Circuit bearker
5. Control panel
6. NCT

- Space Economic
- Fluxating load level
- Factory tested and ready to use
- Suitable for high harmonic levels
- Protection against direct contacts for active parts

Technical data

Voltage	12 to 36 kV
Frequency	50Hz or 60Hz
Normal Power	600 to 12000 KVAr
No. Of Phases	Single phase unit
Location	Outdoor
Protection	Internal fuses

Applications

- Compensation of HV and MV transformers
- Used in transmission and distribution systems
- Industrial plant

Composition

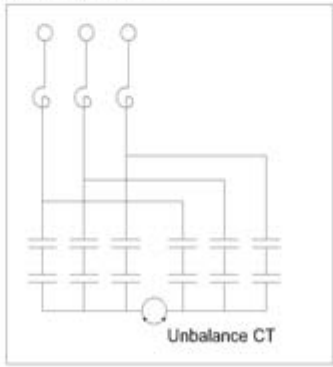
Each capacitor banks comprises the following components

- Single phase capacitors units with double star arrangement.
- Inrush reactor for current limiting
- Open rack GI steel structures
- Bus bars and interconnecting wires
- Support insulators

Options

- As per the custom design and request.

Double Star Wiring

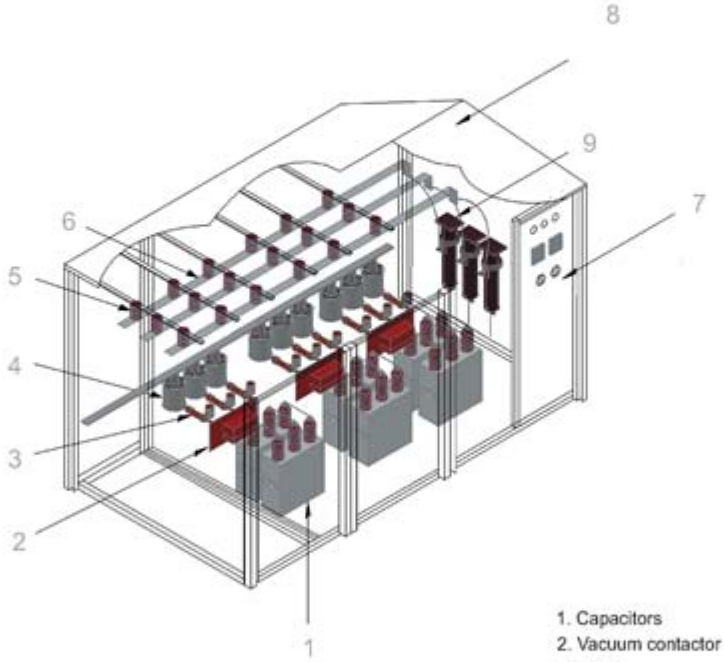


Automatic capacitor banks ACB 12S or H

Capacitor Banks upto 12 kV - - - 50 Hz / 60 Hz

Product description

The Automatic capacitor banks are designed for power factor correction in applications where plant power factor can be constant or changing and a custom solution is required. These systems can be a fixed amount of capacitance with a disconnect, a number of switched capacitance stages, or a combination of both. The Automatic medium voltage capacitor system can switch stages of capacitance in and out automatically based on information collected by the power factor controller on the door-in-door control panel.



1. Capacitors
2. Vacuum contactor
3. HRC fuse
4. Inrush Reactor
5. Support insulations
6. Bus Bar
7. Control panel
8. Top roof
9. Circuit breaker

- Harmonic tuned, detuned filter design available
- Factory tested and ready to use
- Integral protection and control systems
- More accurate regulation
- Easy installation

Technical data

Voltage	Upto 12 kV
Frequency	50Hz or 60Hz
Normal Power	500 to 4500 KVAr
No. Of Phases	Three phase unit
Location	Indoor / Outdoor
Protection	Internal fuses / HRC Fuses

Applications

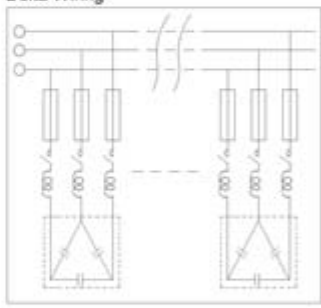
- Large Industries
- Load center's
- All kind of industries

Composition

A pre-fabricated capacitor banks comprises the following main components

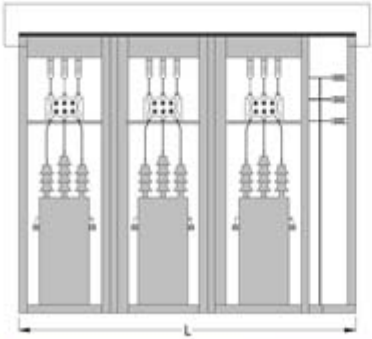
- Three phase capacitor-1 or 2 units per step.
- Vacuum contactor
- Circuit breaker
- Inrush reactor or harmonic filter reactor per step
- Protection relay
- Doors with Lock and Key
- Line Disconnector with earth switch for human safety
- HRC fuses per step

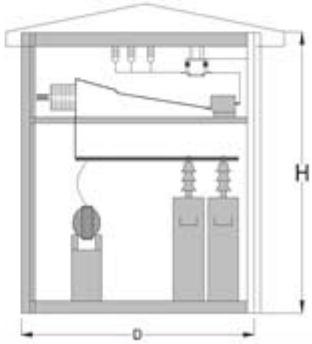
Delta Wiring



Options

- Two set of quick discharge transformer
- Control and monitoring cubicle
- Voltage transformer
- Digital voltage measuring meter
- Step auto/manual selector switch





Large Industrial compensation FCB 36S or H

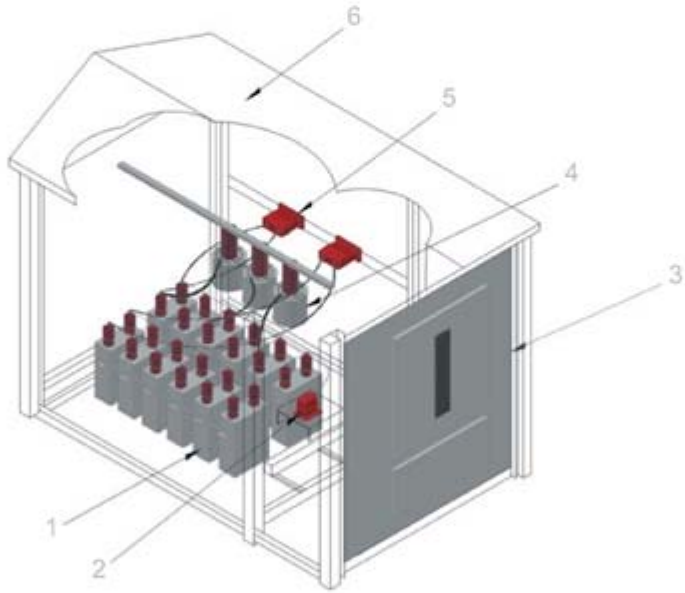
Fixed Capacitor Bank upto 36 kV - - - 50 Hz / 60 Hz

Product description

The capacitor banks are connected in double star with unbalance current transformer for safety protection against internal Parts.

All the components and equipments shall be suitable for use in tropical climate and shall be capable of operating at its full rating in service conditions specified.

Pre Fabricated capacitor banks are built in with parts which have been made in fatcory, so that they can been easily carried and put together.



1. Capacitors
2. NCT
3. Isolator with Earth switch
4. Inrush Reactor
5. Quick discharge coil
6. Top roof

- Made in factory and can the put togther quickly
- Easy assemble
- Minimize the work at site
- High Quality insullation

Technical data

Voltage	12 to 36 kV
Frequency	50Hz or 60Hz
Normal Power	600 to 6000 KVAr
No. Of Phases	Single phase unit
Location	Indoor / Outdoor
Protection	Internal fuses / Circuit Breaker

Applications

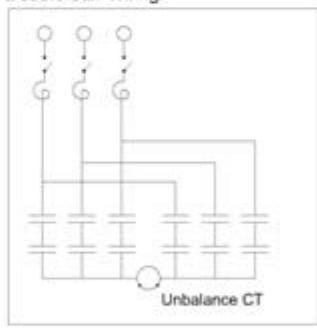
- Large industrial loads
- Distribution networks
- Substations

Composition

A pre-fabricated capacitor banks comprises the following main components

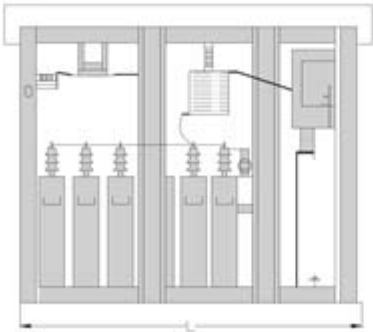
- Single phase capacitors 6 , 9 or 12 units per step.
- Inrush reactor or harmonic filter reactor per step
- Neutral current transformer
- SF 6 Circuit breaker
- Protection relay
- Doors with Lock and Key
- Line Disconnect or with earth switch for human safety

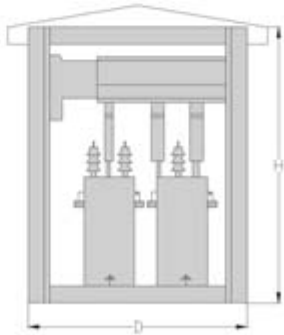
Double Star Wiring



Options

- Two set of quick discharge transformer
- Control and monitoring cubicle
- Voltage transformer
- Digital voltage measuring meter
- Step auto/manual selector switch
- Surge arrester



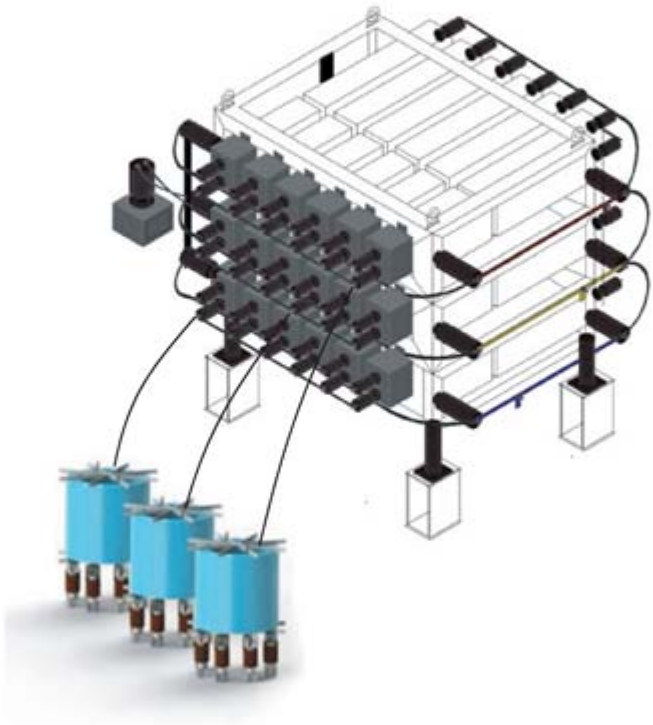


Distribution Network banks OFCB36

Fixed banks upto 36 kV - - - 50 Hz / 60 Hz

Product description

The Medium voltage capacitor banks are use in Electrical distribution network upto 36kV. These banks are connected in double star wiring and the unbalance current detection system provides protection against internal faults.



- Total factory compensation
- Fast economical pay back
- Suitable for outdoor applications
- All industries

Technical data

Voltage	12 to 36 kV
Frequency	50Hz or 60Hz
Normal Power	600 to 6000 KVAr
No. Of Phases	Single Phase unit
Location	Indoor / Outdoor
Protection	Internal fuse / Circuit Breaker

Applications

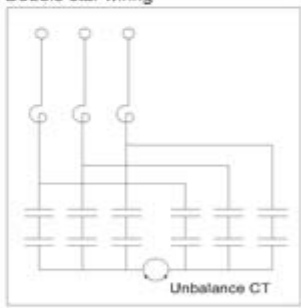
- Steel industry
- Heavy Engineering
- Cement and chemical Industry

Composition

A pre-fabricated capacitor banks comprises the following main components

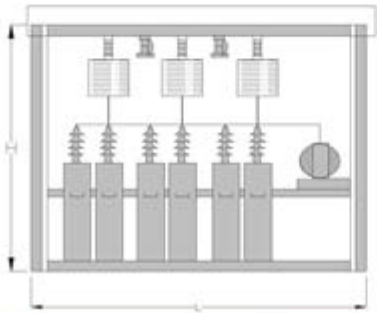
- Capacitor units 6, 9 or 12 units provide depending on the power of the bank
- Inrush reactor provided for current limiting
- Neutral current transformer
- Protection relay
- Doors with Lock and Key
- Line Disconnect and with earth switch for human safety
- Integral protection and control systems

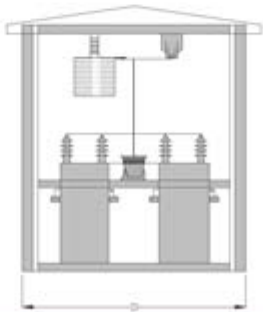
Double star wiring



Options

- Current transformer
- Surge arrester
- Two set of quick discharge transformer
- Voltage transformer
- Digital voltage measuring meter



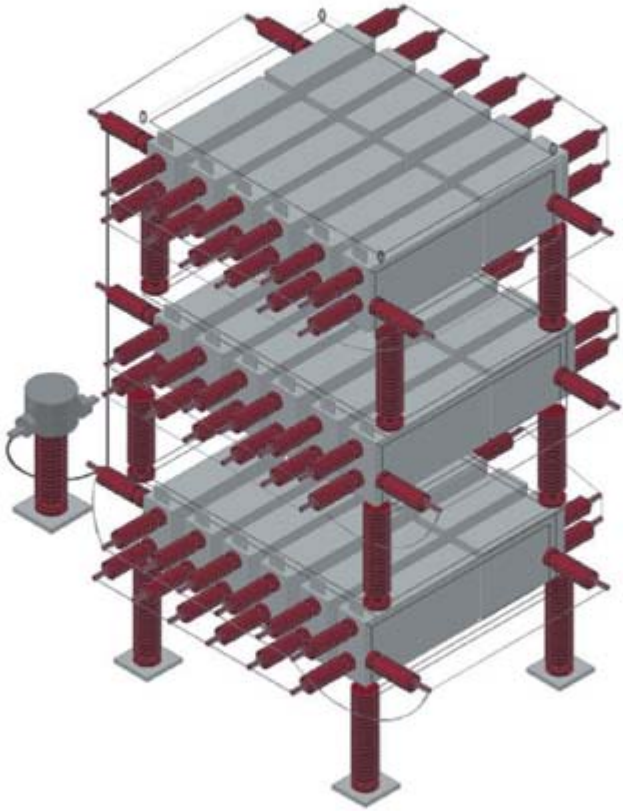


Large substation capacitor banks OFCB 132S

Fixed banks upto 132 kV system - - - 50 Hz / 60 Hz

Product description

The High voltage capacitor banks are use in transmission network in accordance with customer specification. Mostly these banks used for high voltage network to increase the line capacity and reduce the transmission loss.



- HV compensation
- Design for customer's specifications
- Suitable for outdoor applications
- Easy arrangement to the site conditions

Technical data

Voltage	Upto 132 kV
Frequency	50Hz or 60Hz
Normal Power	As per the custom design
No. Of Phases	Single phase unit
Location	Outdoor
Protection	Internal fuses

Applications

- Compensation of HV and MV transformers
- Used in transmission distribution systems
- Used in large substation lines

Composition

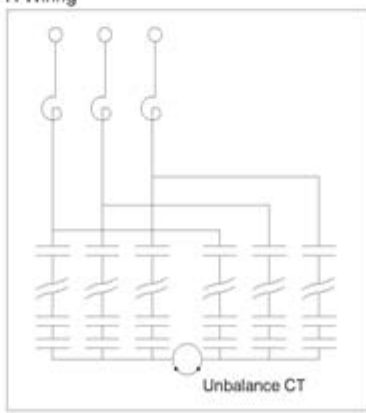
Each capacitor banks comprises the following components

- Single phase capacitors units with H connections
- Inrush reactor for the current limiting
- Open rack GI steel structures
- Bus bars and interconnecting wires
- Solid insulators

Options

- As per the custom design and request.

H Wiring



Design Data - General

For metal enclosed capacitor banks

General characteristics

Type of bank (STD , Harmonic filter)		☐ STD ☐ Filter
Rated Voltage (kV)		
Power (KVAr)		
Rated frequency (Hz)		☐ 50 ☐ 60
Insulation level		
Max. voltage for the equipment	kV	
Power-frequency test voltage (50Hz-1mn)	kV rms	
Impulse test voltage (1.2 / 50 µs)	kV peak	
Connection		
		Double star wiring ☐
		Delta wiring ☐
		H wiring ☐
Short-circuit current withstand capacity		Depending on site conditions ☐
	kA	
	sec	☐ 1 ☐ 3
Auxiliary voltage	VDC	☐ 24 ☐ 48 ☐ 60 ☐ 110 ☐ 125 ☐ 220
	VAC	☐ 110 ☐ 127 ☐ 220-230

Standards

Capacitor	IEC - 60871-1 ☐
Reactors	IEC - 60076-6 ☐
Circuit Breakers	IEC - 62271-100 ☐
Instrument transformer	IEC - 60044 - 1 & 2 ☐
Relays	IEC - 61010-1 ☐
power factor control	IEC - 61010-1 ☐
Fuses	IEC - 60282 - 1 ☐
Contactors	IEC - 420 / IEC-470 ☐

Site conditions

Country		
Altitude	≤ 1000 m	☐
	> 1000 m	☐
Atmosphere	Normal	☐
	Saline	☐
	SO_2	☐
	Other	☐
Pollution / Creepage distance, Insulators and bushing	Low I (16mm / kV)	☐
	Moderate II (20 mm / kV)	☐
	High III (25 mm / kV)	☐
	Very high IV (31 mm / kV)	☐
Short - Circuit Current power (kA)		
Temperature (°C)	> -25° C	☐
	≤ 40° C	☐
	45° C	☐
	50° C	☐
	55° C	☐

Enclosure

Type	Indoor	☐
	Outdoor	☐
Atmosphare	IP 00	☐
	IP23	☐
	IP54	☐
	Other	☐
Frame material	Steel	☐
	Galvanised steel	☐
	Alminium	☐
	Stainless steel	☐
Panel material	Steel	☐
	Galvanised steel	☐
	Alminium	☐
	Stainless steel	☐
Panel coating	Powder coated	☐
	Painted	☐
Double roof	Yes	☐
	No	☐
Colour	Supplier standard	☐
RAL	Other	☐
Door	Supplier standard	☐
	Other	☐
Lock (type)	Supplier standard	☐
	Other	☐

ENERGI Capacitor

Type		Three-Phase	☐
		Single-Phase	☐
Design voltage (kV)			
Rated Frequency (Hz)		50	☐
		60	☐
Specification of step for ACB	No of step's	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	
	KVAr		
	sequence		
Insulation Level			
Max. voltage for the equipment	kV		
Power-frequency test voltage			
(50Hz-1mm)	kV		
Impulse test voltage (1,2 / 50 us)	kV peak		
Internal fuses		Yes	☐
		No	☐
Terminal creepage distance		Supplier standard	☐
		Other	☐
	mm		
	mm/kV	☐ 16 ☐ 20 ☐ 25 ☐ 31	
Internal discharge resistors		75 V /10 Min.	☐
		50 V / 5 Min.	☐
Temperature	Max. (°C)	☐ ≤ 40°C ☐ 45 ☐ 50 ☐ 55	
	Min. (°C)	☐ - 25°C ☐ Other	

Design Data - Additional equipments

Inrush Reactors

Inrush Reactors reduce the current surge when switching capacitor stage in parallel, as defined by international standards. These inrush reactors are aluminum wound and resin encapsulated. The inductance value is calculated, so that the peak inrush current value is lower then 100 times of the normal current of the bank.

Type		
Dry type Natural Air Cooling Single phase	Yes ☐	No ☐
	Air core	☐
	Indoor	☐
	Outdoor	☐

Detuning Reactors

Detuning Reactors prevent series and parallel harmonic resonance which can occur when capacitors are connected to a network where **high levels of harmonic currents are prevent**. The reactors are tuned according to the application.

Type	Resin-impregnated ☐	Resin-encapsulated ☐
	Oil-immersed ☐	Air core ☐
	1-phase ☐	3-phase ☐
Installation	Indoor ☐	Outdoor ☐
	In enclosure ☐	Outside the enclosure ☐
Harmonic order		

Circuit Breaker

The circuit breaker is designed to protect medium voltage capacitor banks. The breaker is basically fixed version with three pole arrangement for indoor-use.

Type SF 6 / Vacuum	Yes ☐	No ☐
Brand		
Model		
Data's		

Isolator / Earth switch

The isolator and with earth switch provides the **capacitor bank with visual isolation from the incoming** cables and general earthing for the capacitor bank. The isolator and earth switch, when used together are mechanically interlocked for human safety.

Type	3-pole ☐	4-pole ☐	5-pole ☐
Earthing switch connection	Line side ☐		Load side ☐
Quantity	1 per step ☐		1 per bank ☐

Vacuum contactor

The installation of a contactor at the input of the capacitor bank enables it to be controlled by a PLC or a regulation system (for example a power factor controller). This contactor is designed to switch capacitive currents and is generally of vacuum type **A contactor must always be used with three damping** reactors, or a detuned reactor in order to damp the inrush currents.

Type	Yes ☐	No ☐
		Vacuum ☐
Indoor Three pole	Aux. Voltage :	
	Aux. Contacts :	

HRC Fuses

The HRC fuse links are used to protect capacitor **banks and associated equipment against short - circuits. They protect against thermal and electromagnetic effects of heavy short-circuit current** by limiting the peak current values and interrupting the currents in several milliseconds.

Type	Yes ☐	No ☐
Indoor		

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Protection CT (NCT) (Unbalance protection)

Unbalance or differential protection is sensitive, capable of detecting and reacting to a partial fault in a capacitor. It consists of a current transformer, **connected between two electrically balanced points, combined with a current relay. When there is a fault** in a capacitor there is an unbalance and therefore a current circulating in the current transformer, **which will cause, by means of the relay, the bank's operating device (circuit breaker, switch, contactor,** etc.) to open.

Type	Supplier standard ☐ Other ☐ ☐
Resin cast	
Mounting	supplied separately ☐ In bank ☐ In enclosure or cabinet with the control and mounting components ☐

Quick discharge transformer (VT)

Installing two quick discharge reactors or voltage transformers between the phase of the capacitor bank reduces the capacitor discharge time from 10 minutes to approximately 10 seconds.

Type	Yes ☐ No ☐
Resin cast	

Measuring PT

Potential transformers are designed to perform protection and monitoring functions. Detections of over / under-voltage in capacitor **banks and supply of a signal to the protection relay** Supply of a signal to the power factor controller.

Rated voltage (V/V) (primary/secondary)	
Discharge function	yes ☐ No ☐
Quantity	2 ☐ 3 ☐

Measuring CT

The current transformers are designed to detect overcurrents in capacitor banks and provide a signal to a protection relay.

Power (VA)	
Precision class	5P ☐ 3P ☐
Number of protected phases	1 ☐ 2 ☐ 3 ☐

Control / Monitoring

The function of these units are **to control and protect** capacitor bank.

	Yes ☐ No ☐
Installation	Cabinet ☐ Cubicle ☐ In bank ☐

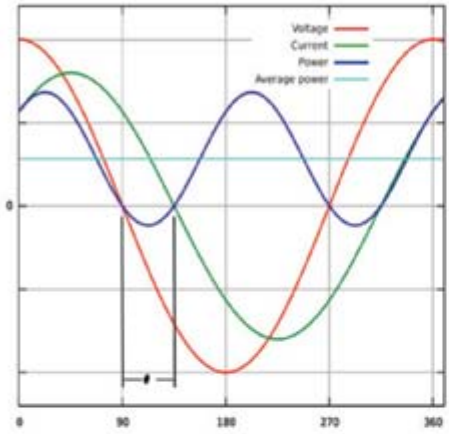
I. Protection Relay (unbalance relay)

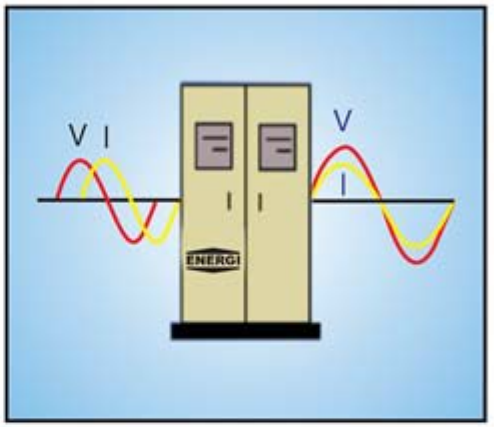
The protection relays maximize energy availability and the profits generated by your installation while protecting people and property. This relay is self monitoring function with own alarm contact.

Protection relay	Yes ☐ No ☐
Function	Unbalance ☐ Over current ☐ Over Voltage ☐ Other ☐
Type	
Other	

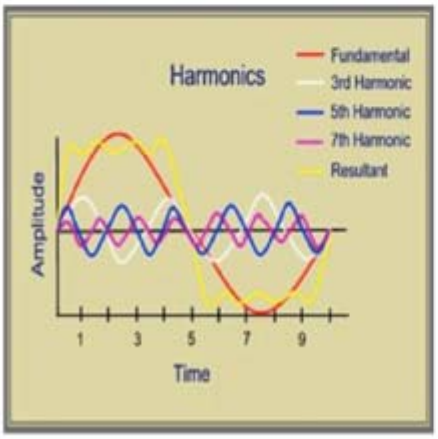
	**II. Power factor controller** **The PF controllers constantly measure the installation's** reactive power and manage to obtain the desired **power factor. The automatic control unit will initiate switching the appropriate numer of stages in or out of service. The control units shall select the capacitor stage to be switched in and means shall** be provided to vary the duty cycle to ensure a reasonable distribution of switching operation between different capacitor stages.	Controller Type Sequence Modbus com. U (V) measurement I (A) measurement	Yes ☐ No ☐ Yes ☐ No ☐ 1 A secondary ☐ 5 A secondary ☐
	Fuse Failure Indication The fuse failure indicator can be fitted to provide the customer with indication of fuse operation under fault conditions.		
	**Surge Arresters** Optional heavy-duty distribution intermediate or **station class** lightning **arresters protect the capacitor** system from lightning and switching transients.	Type Surge counter	Yes ☐ No ☐ Indoor type ☐ Outdoor type ☐ Yes ☐ No ☐
	**Busbars** The busbar support system used in our factory is made from tinned copper and mechanically rated to withstand an unconditional fault level of 25kA and thermally rated to withstand 20kA for 3 seconds.		
	**Safety Interlocking** **The range offers a mechanical/solenoid interlocking scheme.** **This eliminates the possibility of a technician accessing live equipment.**		Supplier standard scheme ☐ Other, to be defined ☐
	**Accessories** 	Ventilation Type Lightning in bank Cooling fan Anti condensation heaters	Supplier standard ☐ Other ☐ Yes ☐ No ☐ Yes ☐ No ☐ Yes ☐ No ☐

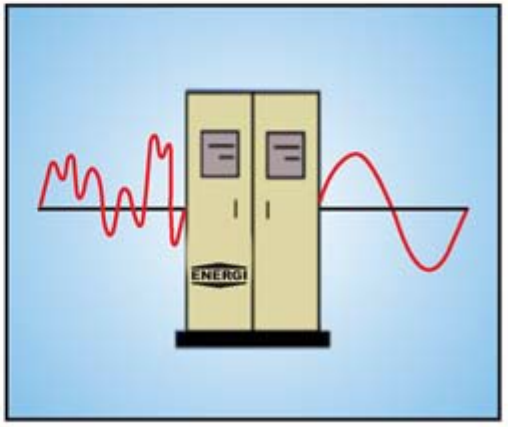
Power factor





Harmonic Filtering





Dept. of Automatic Energy
HWP - Thal

12kV Harmonic Filter Capacitor Bank

MSETCL

132 kV Capacitor Bank

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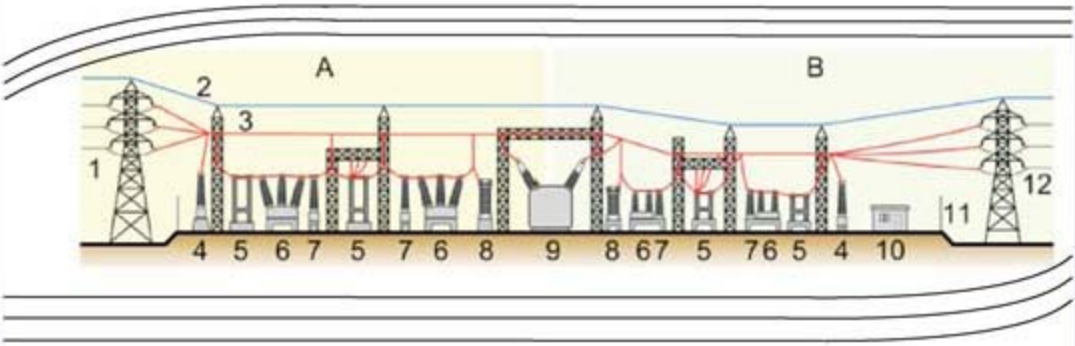

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