



Low Voltage Reactive Power Management

Advantages

- Bi-axially oriented double hazy film to ensure good oil impregnation Suitable for flexi banking
- High peak inrush current withstand capability
- Specially vacuum processed, oil impregnated design
- Robust & Highly reliable capacitor performance



1Ø / 3Ø APP (Film + Foil) type for Power Factor improvement & Harmonic Filtering



Medium & High Voltage Power Capacitors



Advantages

- World Class Raw Materials
- Mfgd in State of art infrastructure
- Low Loss
- Highly Reliable
- Long Life Performance
- Environmental Friendly

For Power Factor improvement & Harmonic Filter Capacitors



WORLDTEK CAPACITORS



Low Voltage Reactive Power Management

Principles of Power Factor Correction

A vast majority of electrical loads in low voltage industrial installations are inductive in nature.

Typical examples are motors, transformers, drives & fluorescent lighting. Such loads consume both active and reactive power.

The active power is used by the load to meet its real output requirements whereas reactive power is used by the load to meet its magnetic field requirements.

The reactive power (inductive) as always 90 deg lagging with respect to active power as shown in figure 1, figure 2 & 3 show the flow of kW, kVAr and kVA in a network.

Flow of active and reactive power always takes place in electrical installations. This means that the supply system has to be capable of supplying both active and reactive power. The supply of reactive power from the system results in reduced installation efficiency due to :

- Increased current flow for a given load
- Higher voltage drops in the system
- Increase in the losses of transformers, switchgear and cables
- Higher kVA demand from supply system as given in figure 2
- Higher electricity cost due to levy of penalties / loss of incentives

It is therefore necessary to reduce & manage the flow of reactive power to achieve higher efficiency of the electrical system and reduction in cost of electricity consumed.

The most quick & cost effective method of reducing and managing reactive power is by power factor improvement through power capacitors. The concept of reduction in kVA demand from the system is shown in figure 3.

Heavy Duty Capacitors

APP (Film + Foil) type

Application

- PF correction in LV network

- Automatic power factor correction (Contactor / Thyristor switching).
- Fixed power factor correction
- Harmonic filters

Features

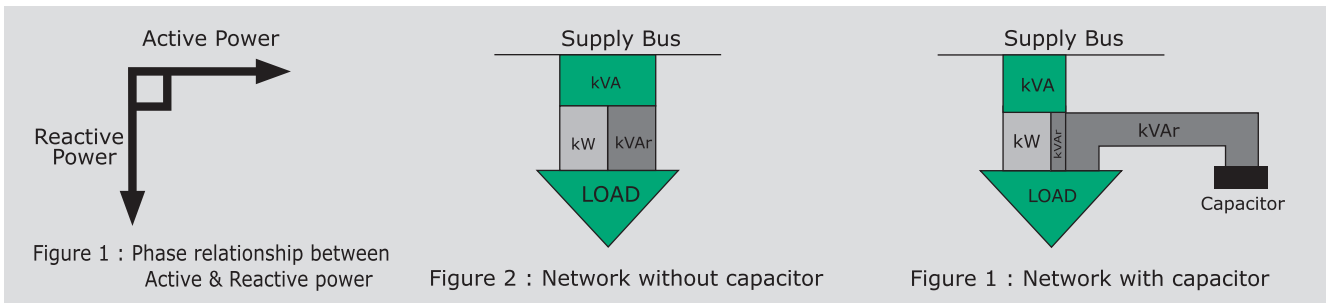
- Bi-axially oriented double hazy film to ensure good oil impregnation
- Suitable for flexi banking
- High peak inrush current withstand capability
- Specially vacuum processed, oil impregnated design
- Robust & Highly reliable capacitor performance

Safety

- Internal element fuse design
- Non polluting Non PCB oil
- Externally fitted Discharge resistors
- Protective steel enclosure

Life

- Life Expectancy min 20 Years



Standards	IS 13585-1994
Rated Voltage	415 / 440V (Other ratings on request)
Over Voltage	+10% (12h/24h), + 15% (30m/24h), +20% (5m) +30% (1m) As per clause 6.1 of IS 13585-1994
Over current	2.0 x In
Peak Inrush current	350 x In
Operating losses (dielectric)	< 0.2 W / kVAr
Operating losses (total)	< 0.45 W / kVAr
Ambient temperature	-25° C to 55° C (other categories on request)
Impregnation	Non PCB insulating oil
Terminals	Bushing terminals designed for large size cable termination and direct busbar mounting for banking
Switching operations	8000

General Technical Information

Effect of temperature rise

Every capacitor has a specific lowest and highest ambient temperature. Life of capacitor decreases when operated above that limit. Capacitor should not be exposed to heat and must be kept in a well ventilated position to avoid overheating.

In detuned reactor application, the location of reactor affects the temperature of the air surrounding the capacitor. The reactor radiates heat and should be placed always above the capacitor, preferably on top or in a separate column.

The connecting cable between reactor and cables should be kept long to avoid heat transfer. It is always recommended to implement forced air cooling in detuned reactor filter panels. We should also consider the IP rating before opting for forced cooling.

Effect of current rating

The maximum allowed RMS current is given in technical data of the capacitor. Operating the capacitor beyond that level will reduce the life of the capacitor. Higher current drawn by capacitor means increased losses. This results in heating of the capacitor, thereby, reducing its life.

Effect of over voltage

Operating the capacitor beyond permissible limits of over voltage will damage the capacitor. Some levels of over voltages are accepted only for a short duration but they reduce the life of the capacitor. Such levels must not occur for more than 200 times in the life time of a capacitor.

Protection of capacitors

Capacitors have to be protected against short circuit currents by using fuses or thermal relay. The fuse & thermal relay should not operate for high inrush currents of the capacitor. HRC fuse should never be used for switching. It will result in capacitor failure and possible safety hazard for the operating personnel.

Switching capacitors

When the capacitor is switched to the network, high inrush currents flow. Fast acting contactors which are capable of handling the high currents level should be used. Capacitor contactors (connected with resistors) are better suited since they can damp the high currents.

Discharging Capacitors

Capacitor must be discharged before it is switched ON again.

This helps to maintain the life of capacitor. This also reduces the possibility of electrical shock or capacitor failure. The capacitor voltage must reduce to 75V within 3 mins. This is done by connecting a external discharge resistor across the capacitor terminals. No disconnecting device must be connected between the capacitor and discharge resistor.

Earthing of Capacitor

An earthing terminal has been provided at the lower side of the capacitor has to be used for earthing.

Mechanical Damage

A capacitor with any kind of damage should not be used. Any leakages and physical deformity should be reported to the manufacturer.

Resonance

Capacitors connected in harmonic rich environment face problems regarding resonance, current amplification and ultimately its failure. To avoid such problems, we need to use detuned reactor along with capacitor.

Surroundings

The capacitors should be kept in an ventilated atmosphere, free from any corrosive medium. They should be cleaned regularly to prevent build up of dust on the terminals.

Filter Reactor

Standards	IEC : 60289 / VDE 0532 / EN 61558 / IS : 5553
Rated voltage and frequency	Un = 440V, 50 Hz
Series resonance frequency	210 Hz (5.67%), 189 Hz (7%) and 134 Hz (14%)
Max. permissible operating voltage	1.05 x Un continuously & 1.1 x Un for 8 hours daily
Max. permissible operating current	I = 1.60 x In, High linearity 1.75 x In continuously
Duty cycle (Ims)	100%
Class of protection	I
Ambient temperature	40° C
Temperature class	Class F (other class on request)
Fuse Protection	Internal Element Fuse provided

De-tuned Harmonic Reactor Iron Cored Reactors are used along with Capacitors to De-Tuned harmonic filter Capacitors can be any of the following types :

Application : Detuned filters for mitigating harmonics

- Available in 5.6, 7 & 14 %

Features

- High linearity
- Compact size and convenient mounting
- Low losses
- Low noise level

- Tested as per IS : 5553

Safety

- Temperature protection by providing thermal switch
- High insulation level

Medium & High Voltage Power Capacitors

General Information

WORLDTEK make capacitors are manufactured to comply IEC 60871 and BIS 13925 standards using latest technology, materials and state of art plant and machinery.

Experienced and skilled workmanship enable's to manufacture highly reliable and long life performance capacitors in line with International standards.

Applications

- Automatic Power Factor Correction (PFC).
- Fixed Power Factor Corrections. (Individual)
- Group fixed Power factor correction (several equipment connected in a group)
- Capacitor banks of tuned and detuned.
- Harmonic Filter applications (e.g. UPS, VFD, Furnaces and converters, etc)

Features

- Latest technology
- Non-PCB
- Maintenance - free
- Easy disposal
- Internal / External fuse & Internal discharge Resistor.
- Long useful life
- Environmentally friendly.

Rated Voltage Capacitor	1000 volts up to 20,000 volts .			
Rated kVAr	Up to 800 Kvar.			
System Voltage	For the power system voltage 145KV application			
Frequency	50 / 60 Hz			
Standards	IEC 60871 & BIS 13925			
Max. Over Voltage (V)	1.1UN (12 hours), 1.15UN (30 mins), 1.2UN (5 mins), 1.3UN (1 min)			
Over Current (A)	1, 3 * IN			
Capacitance tolerance (uF)	-5 / +10%			
Test Voltage	4, 3 * UN DC, 10 s			
AC Test Voltage	According to relevant IEC standard for 10 s terminals / case: only for 2 bushing type			
Insulation Levels (KV) BIL	10/40 kV, 20/60 kV, 28/75 kV, 38/95 kV, 50/125 kV			
Dielectric & Capacitor Losses	0.05 W / kvar & 0.15 W / kvar max (with discharge resistors & Internal Element Fuse)			
Life expectancy	20 years min.			
Installation	Indoor and outdoor			
	-40 / D			
Ambient temperature category	Symbol	Maximum	Highest over any period of	
			24 ahours	1 Year
	D	50°C	D	30°C
Cooling	Oil Natural.			
Humidity	95 % max.			
Max. attitude	1000 mtrs above sea level			
Mounting Position	Any position			
Mounting	Side brackets			
Safety features	Internal Element fuse for each element.			
Case	Mild Steel / SS409L / or SS304 grade			
Dielectric	Double hazy Polypropylene			
Impregnation	Environmentally friendly, non-toxic (non-PCB).. Jarylec C-101 D			
Terminals	Wet Process Porcelain bushings, welded			
Discharge Resistors	Internally Fitted. - 75 V, 5 min or 50V, 5min			

Manufacturing and Quality Control Imported bi-axially oriented double hazy Polypropylene film and 99.9% pure aluminum foil are used as dielectric and electrode. Wrinkle free winding is carried in a Class 100 environment on a Semi-Automatic winding machine with edge and end folding of the aluminum foil. This is to eliminate over voltage stress at the edges of the buried area of the foil.

Each wound element is tested for DC Over voltage with stand for pin holes and adequacy of margins between Al foils.

Numbers of elements are interconnected in series – parallel to achieve the desired capacitance and voltage rating of the Capacitor. Electrical connections & discharge resistors fitment are carried out.

The dry pack is wrapped with several layers of high quality insulating paper before inserting it into a pretreated / sheet metal container and the embossed top lid is welded by semi-automatic Pulsed TIG welding machine.

Porcelain bushings of desired BIL are leak proof fitted by TIG welding on the lid as required.

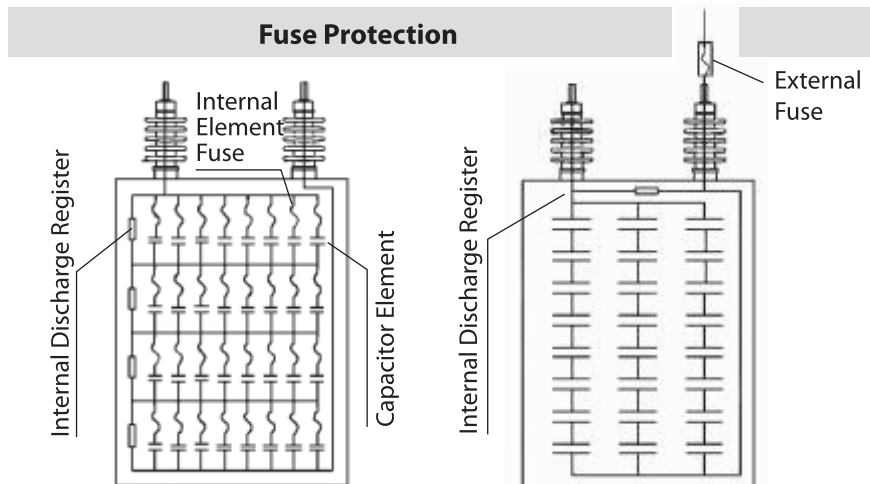
The capacitors are then processed in a PLC controlled autoclave for drying and under heat @ 85°C and vacuum of 0.001 torr for a given period.

After confirming the quality of drying by precision online monitoring instruments, the capacitors are then impregnated under vacuum with highly purified and degassed Jarylec C-101.

Then the capacitors are subjected to all electrical tests.

Electrical Tests

MV & HV Capacitors are tested at regular intervals for Routine, Type Test as per IEC 60871 standards at CPRI Bangalore. These Capacitors have also been tested at CPRI Bangalore for Endurance test as per IEC 60871-2 and have successfully passed.



A - Capacitor with Internal element fuse
B - Capacitor with External fuse

Capacitors are protected by -

- Internal element fuse comply with IEC 60871-4. Each element is protected with an individual fuse placed in between elements. The sizing of fuse is done using specially developed software. Internal fuses are designed and placed to isolate only the faulty elements without affecting the adjacent healthy element fuse in order to allow further operation of the capacitor unit and the bank in which the capacitor is connected. (Refer drg...A)
- External fuse is provided to individual capacitor, which isolates the capacitor in the event of an internal fault, thereby protecting other healthy capacitors in the bank. (Refer drg...B)

Painting

After completion of electrical tests, the capacitors are then loaded on a overhead conveyerised painting system. The capacitors are first subjected to sand blasting which ensure removal of welding burrs, minor scratches etc. making the surface perfect compatible for painting. Thermal spray is also done against specific orders.

The capacitors are then painted in a painting booth with semi-automatic painting gun with two coats of epoxy

primer followed by two coats of epoxy air drying paint.

The paint layers are tested at random for adhesion to the surface of the capacitor.

Life Expectancy

Based on the state of art plant & machinery, quality of raw materials used, manufacturing under strict quality control and process using precision on line instruments, and elevated over voltage test results under extreme temperatures, capacitors are assured of minimum 20 years life.

Capacitor Banks/ MV APFC Panels Indoor Sheet metal cubicles up to 33KV for switched capacitors / Harmonic filters / Automatic P F Control Panels and structural open type substation banks up to 145 KV network can be fabricated and assembled in house.

Magnewin has in house fabrication shop fully equipped with Hydraulic presses, shearing machines, Power Presses, MIG / MAG, & TIG Welding machines, punches, dies and tools which enable us to fabricate both in sheet metal enclosures and structural types for Indoor and outdoor installations.



Product Range

- Low Voltage Shunt capacitors
- Medium Voltage Shunt capacitors in Internal / External fuse
- Medium & High Voltage Surge Capacitors
- Medium / High Frequency Water Cooled Capacitors
- Energy storage Capacitors
- Pulse Discharge capacitors
- Low Inductance Capacitors
- Voltage Dividers up to 1200 KV.
- Any Special capacitor in accordance to client specs

Engineering Services

- Harmonics Measurement, Analysis and mitigation & Power Quality
- Turnkey projects / consultancy in Reactive Power Compensation engineering

WORLDTEK CAPACITORS

