

Minimizing the penalty in industrial sector by engaging the automatic power factor correction panel using capacitor bank

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ABSTRACT

The proposed model automatically corrects the power factor without any human presence. Because of industrialization using inductive load is increases and for this reason the energy device losses its efficiency. So we need to enhance the energy element with suitable method. In case of the fixed load electricity issue correction may be done manually by way of switching of the capacitor but in case of swiftly varying load it grow to be very difficult to preserve the excessive strength thing by way of switching the correct no. of capacitor bank. This downside is triumph over by means of the use of APFC Panel (using capacitor bank).

Keywords: Power factor correction, APFC panel, Power factor correction, Inductive load.

INTRODUCTION

Power factor is the ratio between the Kw and the KVA drawn by an electrical load where the kw is the actual load power a and KVA is the apparent load power. In general the power factor is the capacity of the equipment to do te work. In industry most of the load is inductive in nature which results in lagging power factor that is why there is loss and wastage of energy which results in high power bills and heavy penalties from electricity board. If the load is uneven it is very difficult to maintain unity power factor. To overcome this difficulty APFC panel is used which maintains unity power factor .This panel can be effectively and automatically manage the quickly changing and the scattered load along with the retention of high power factor.

Need for Automatic Power Factor Correction

Normally there may be the varying power demand on the supply gadget. therefore power factor also varies as a function exclusive of the weight requirement and it's miles very tough keep a steady strength component by the usage of fixed

compensation i.e fixed capacitor, no manual intervention is needed, leading power factor under the light load condition (Fixed compensation) results in overvoltage and so the industry penalties by electric supply

However in case of APFC panel because of automatic variant, the repayment to appropriate load requirement and additionally the main power issue is averted. Because of the inductive load and the capacitive load within the industrial premises or in the consumer's premises the strength component can both be main or lagging. So we must keep in the restriction i.e he need to offer reimbursement or supply KVAR in line with the requirement, the reactor or capacitor in case of lagging or main PF that's connected across to the system. The APFC panel comprises of the inductor or capacitor segregated in various steps, the contactors (ON/OFF) , energy aspect manage relay. The APFC relay monitors the numerous parameters along with energy issue ,contemporary, KVAR requirement , electricity consumption and the voltage of the system and to govern

real parameter within required restrict. with the aid of sensing the actual cutting-edge and voltage of the machine the relay computes the energy factor and the specified KVAR and thus by means of the control sign relay will connect/disconnects the capacitor financial institution to the system with the help of contactors.

Detail Information about the main components used in the Automatic Power Factor Correction Panel.

1. MCB (Miniature Circuit Breaker)
2. CAPACITOR DUTY CONTACTOR
3. APFC RELAY
4. CAPACITOR BANK
5. AUXILLARY CONTACTOR

MCB (Miniature Circuit Breaker)

MCB is the most commonly used in low voltage electrical network. This device operates as automatic switch which open in the event of the excessive current flowing through the circuit and as the circuit returns to the normal, the MCB can be closed without any manual replacement. The MCB is more sensitive

to the over current. It cane manually switched ON/OFF as similar to the normal switches if necessary. The faulty zone can be easily identified in MCB. The MCB are the time delay tripping device in which the magnitude of the over current can be control at the operating time. This device is designed such that it can operate at less 2.5 millisecond during the fault condition and 2 second to 2 minute in case of the overload condition. The rated ampere contemporary rating of the MCB is need to be lower than the modern-day wearing capacity of the wiring device and better than or identical to the maximum complete load modern-day within the wiring gadget. The rating should the 125 percent of the continuous load as well as the non continuous load.

Types of the MCB

These are classified into the three major according to their instantaneous tripping current.

1. *Type B MCB*
2. *Type C MCB*
3. *Type D MCB*

MCB TYPES	MINIMUM TRIP CURRENT	MAXIMUM TRIP CURRENT
TYPE B	3 Ir	5 Ir
TYPE C	5 Ir	10 Ir
TYPE D	10 Ir	20 Ir

CAPACITOR DUTY CONTACTOR

This device is especially designed for the capacitor switching application. The switching of the capacitor is associated with the excessive inrush present day; the contactors are furnished with the damping resistor which limits the value of inrush cutting-edge to the secure fee. In APFC panel the contactors are used for the switching of the strength capacitor. The selection of the capacitor bank depend upon the amount of reactive power compensation is to be required for the system. The contactor is used to improve the switching performance of the panel.

They have higher electrical life and enhanced the product safety.

APFC RELAY

The offered relay is used for controlling power supply for defensive business packages for fluctuating electricity deliver. it is procured from actual companies inside the marketplace who're counseled for his or her product satisfactory on the grounds that several years. This are easy to installed and have long durability.

CAPACITOR BANK

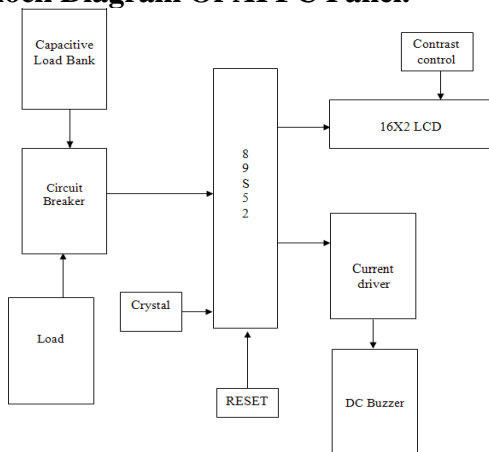
The capacitors are the electric or electronic issue which shops the electrical energy. It

encompass two conductor that are separated by a dielectric or insulating fabric. AS the electric contemporary passes through the conductor's pairs, static electric discipline is generated in the dielectric, which represents the stored power. A capacitor bank is the grouping of numerous same capacitor inter related in parallel or in series with the one another as required.

AUXILLARY CONTACTOR

These are used to connect or disconnect the generator, yaw motor, hydraulic pump motor and the brake magnetic coil. These contactors are used to feed the information to the control system about the status of the different component and the contactor. They are designed for the switching current up to 6 Amp. This contactor is like regular relay but built like regular contactor and the when used together with another contactor. The auxillary contactor usually only have auxillary contact and no main contact.

Block Diagram Of APFC Panel.



This the block diagram of the APFC panel. The supply to the circuit is applied from the regulated the power supply. The main supply is stepped down by the transformer to 12 volt and it is fed to the rectifier. The current and voltage signal are taken from the PT's and CT's. These two waveform are being change to the square wave through the zero crossing detector .Now

these waves are used by the microcontroller to calculate the phase difference and thus the power factor. The bank is used to develop a power source and dissipate or convert the resultant power output of the source and thus we get improve power factor. The status of the panel is displayed on the LCD. Whether it is lagging or leading calculated the power factor by the panel.

ADVANTAGES OF APFC :

1. It reduced the line current and the KVAR demand.
2. It avoid the power factor penalties and also reduces the switch gear rating.
3. It continuously sense and monitor the load.
4. It is easy user interface and also protect under any internal fault.
5. Its use friendly and designed enclosure dust.

APPLICATION :

1. Chemical and fertilizer plant, Pharmaceutical Industries.
2. Railway / ordinance workshop / MES.
3. Power station, Crusher, Windmill, DG station.
4. Cement Industries, Metal Industries, Automobile Industries.
5. Hospital , Mall .

CONCLUSION:

This model proposed that it correct the power factor automatically without any human intervention. The targeted power factor can also improve much better from 0.88 to approx. 0.98 . Thus it reduces the effect of the heavy penalties and high power bill from electricity boards.

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