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To Design Automatic Power Factor Correction Panel (APFC) for CNG outlet

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Abstract: *In modern days the power demand is increasing as the industrial load is increasing. There are various types of electrical and power electronic loads. These loads are fluctuating without manual interventions. These fluctuating loads can be stable with the use of a suitable capacitor. Majority of load are inductive in nature in industries. This inductive load consumes reactive power which affect the generation of the plant. Basically inductive load means lagging of power factor. To increase power factor there is a need of APFC Panel. Many industries use a lot of power from the grid but failed to utilize in an effective way. In many cases, consumer draws access to power than their sanctioned load. Therefore, the consumer has to pay a penalty. So, this penalty can be reduced by APFC Panel. A strategy for optimizing the operation of a Compressed Natural Gas (CNG) station in order to minimize the energy cost is presented in this paper. The study seeks to schedule the activity of the station CNG compressor so as to achieve minimum cost of electricity purchased under a Time-of-Use (TOU) tariff. A linear control approach is employed to restrict damage to the compressor by minimizing the switching frequency. The proposed approach shows great potential to deliver lower operating costs through shifting of the station compressor load to lower electricity price time bands while also minimizing wear and tear effects on the compressor.*

Keywords: Power Factor, APFC Panel, Power factor correction, Inductive, Fixed capacitors, Penalty

I. INTRODUCTION

In a current scenario, it has been observed that power is very prized for all and also demand of power is always high. The electric power system has grown in size and complexity with a huge number of interconnections to meet the increase in electric power demand. Most of the industrial plants are using the induction loads in infrastructure such as transformers and motors. Hence the use of more inductive load results in a lagging power factor i.e. the system power factor gets poor, due to access of reactive power consumed by inductive load such as induction motors which increases the reactive losses. Also, the reactive power consumption causes the reduction of voltage and power factor in networks. Power factor correction is the process of compensating a lagging current by a leading current through connecting capacitor to the supply. Practically, correcting power factor much nearer to the one may result in harmonic distortion. APFC or Automatic Power Factor control panels are mostly used in the improvement of power factor.

Need for Power Factor Correction

- Varying power demand on the supply system.
- Power factor (cos) also varies as a function of the load requirements.
- Difficult to maintain a consistent power factor (cos) by use of fixed compensation.
- Leading power factor under light load condition.
- Automatically variation without manual intervention, the compensation to suit the load requirement.
- Increase available power
- Reducing the installation size
- Reducing the voltage drops on installation

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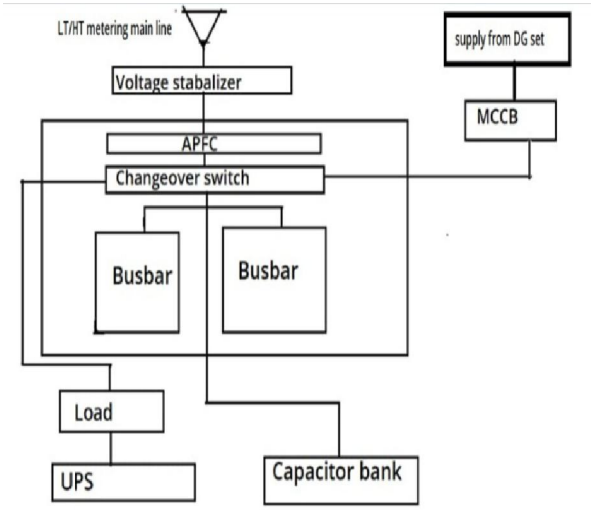
Figures



1.1 LT (Low Tension) Energy Meters

LT (Low Tension) Meters are those which can handle large load currents through externally present CT (current transformers). They are called as LT meters because they operate on not more than 440 volts. These meters are exactly same as WC meters but the only difference is their CT is not present inside the meter.

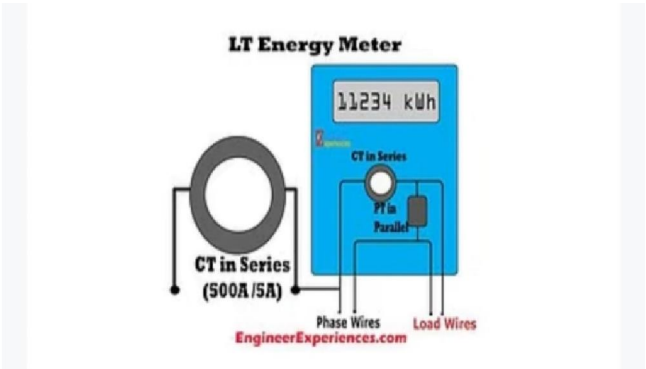


Fig.2. LT Energy Meters

1.2 HT (High Tension) Energy Meters

HT meters are those meters in CT (Current Transformer) as well as PT (Potential Transformer) present outside the energy meter. The reason behind calling them HT (High Tension) Meters because they normally installed on the feeder (11 kV) line. They are same Energy Meters as other meters but they have a combination of bulky CT and PT present outside the meters. PT is present there to step down the voltage from 11kV to 110 volts and then this voltage is given inside the meter to the PT or voltage divider depending upon the type of Energy meter.

1.3 Voltage Stabilizer (60KVR)

It is an electrical appliance which is designed to deliver a constant voltage to a load at its output terminals regardless of the changes in the input or incoming supply voltage. Voltage stabilizers are preferred for costly and precious electrical equipments to protect them from harmful low/high voltage fluctuations. Some of these equipments are air conditioners, offset printing machines, laboratory equipments, industrial machines, and medical apparatus. In a voltage stabilizer, voltage correction from over and under voltage conditions is performed through two essential operations, namely boost and buck operations. These operations can be carried manually by switches or automatically through electronic

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circuitry. During under voltage condition, boost operation increases the voltage to a rated level while buck operation reduces the voltage level during over voltage condition. The concept of stabilization involves in adding or subtracting the voltage to and from the mains supply.

Fig.3. Voltage Stabilizer

1.4 MCCB

MCCB stands for Molded Case Circuit Breaker. It is another type of electrical protection device which is used when load current exceeds the limit of a miniature circuit breaker. The MCCB provides protection against overload, short circuit faults and is also used for switching the circuits.

Fig.4. MCCB

1.5 APFC

APFC is an automatic power factor control panel which is used to improve the power factor, whenever required, by switching ON and OFF the required capacitor bank units automatically

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1.6 Changeover Switch

A changeover switch is a switching arrangement or device that is used to interchange the source of power supply to an electrical load. There are different types of changeover switches into two types - 1. Manual 2.Automatic. This handle type of changeover switch has metallic paths and handles. The metallic paths of the changeover switch are arranged in such a way that they will connect to each other when we change the position of the handle. we can connect two different power sources to the changeover switch and one load. The handle of the changeover switch can be moved in three positions - source 1, source 2, and off position. This handle type changeover switch is also available in three types.

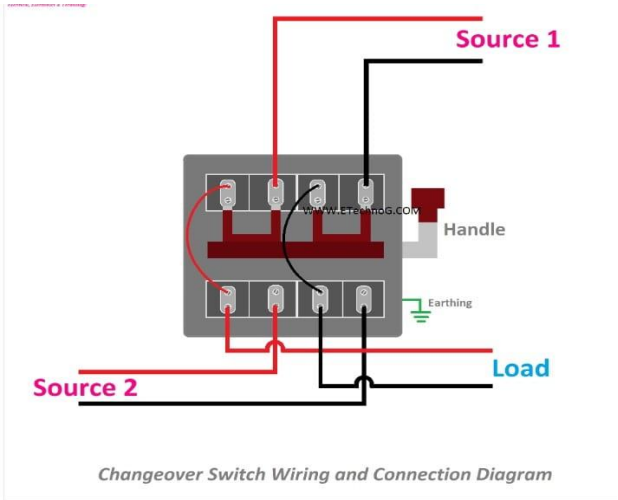

Fig. 5. Changeover switch

1.7 Busbar (200A,415V,50Hz)

A busbar is a metallic bar in a switchgear panel used to carry electric power from incoming feeders and distributes to the outgoing feeders. In simple terms, busbar is a electrical junction where incoming and outgoing currents exchange. Electrical Busbar consists the number of lines electrically, which are operating at the same voltage and frequencies. Generally, copper or aluminum conducting material is used in the construction of bus bars.

A. Types of Bus Bars

Important bus-bar arrangements are discussed in this article. Based on the construction of the bus bar, they are divided as follows.

1. Single bus-bar system
2. Double bus-bar system
3. Ring bus-bar system

1.8 Capacitor Bank Pannel (415v, 30KVAR)

Fig.6.Capacitor Bank Pannel

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1. It is a group of capacitor of the same rating capacitor bank may be connected in series or parallel depends upon desired rating.
2. Sotring energy & Smoothing out electric enegy.
3. commonly used in electronic device to maintain power supply, while batteries are being charged.
4. Increasing the number of capacitor in capacitor bank will increases the capacity of energy that can be stored on a single device.

Advantages

- Save energy
- Low efficiency
- Reduce harmful emissions thus reducing the effect of globle warming
- Cost-effectiveness
- Lower maintenance cost
- Environment friendly
- Safe Fuel
- Easy to use and flexibility
- CNG is Safer

Applications:

1. Used for low efficiency and energy saving purposed
2. Used for power leg
3. It reduces the electricity bill

II. CONCLUSION

The potential for a significant reduction in operating costs for a CNG fuelling station through the optimization of compressor operation is demonstrated in the present study. The significant savings are an important contribution to the efficient
delivery of CNG to end users. The study also shows how the CNG industry can participate in DR programs and thereby increase the reliability of electricity networks and further reduce carbon emissions which is one of the benefits achieved when power utility generation capacity is efficiently utilized. This project study describes one of the ways for overcoming various power losses caused by low power factors in many general households and smaller industrial units. The power factor is measured inthe system and then capacitors are added as needed. The influence of switching automated power factor panels has been evaluated at quickly fluctuating loads and distributed loads, according to APFC research. When compared to the absence of the capacitor, the intended power factor improved significantly from 0.78 to around 0.95,virtually unity, reducing the effect of high power bills as well as substantial penalties from the electricity board.

III. FUTURE SCOPE

The future APFC panel technology will continue to progress around the innovation of APFC panel equipment, APFC panel materials and APFC panel technology. The APFC panel equipment will combine with the development of science and technology to develop more intelligent and precise equipment. Reduces cost, unplanned outages and increases power availability. The automatic power factor controller is now more widely accepted in sectors like business, manufacturing, commercial, military, and utilities, which could accelerate the expansion of the global market over the forecast period.

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