POWER FACTOR IMPROVEMENT OF INDUSTRIAL LOAD BY MATLAB SIMULATION

[1]Mangale Prashant B, [2]Mulik Sagar G, [3]Patange Nitish S, [4]Rupnar Jitendra L,
[5]Sutar Madhuri N

[1, 2,3,4,5] Electrical Engineering, SGI, Kolhapur, India

Abstract: **It is a framework considering industrial loads for improvement of power factor of industrial load system. Most of loads in industries are inductive in nature and thus having low power factor. Low power factor is highly undesirable and it increases current and also increases losses of active power. This paper discusses how to calculate the correct value of capacitor to improve power factor to overcome above mentioned problems. Because improving power factor will give efficient utilization of electrical power.**

Keywords: **power factor, industrial loads, improvement, Low power factor, active power, electrical power.**

I. INTRODUCTION

Energy plays a very important role in any organization. In industry there are various problems of lagging power factor, creating harmonics, increasing incoming voltage is more than their requirement. A detailed study of industrial sector to improve power factor has been carried out. Having low power factor is undesirable for any industry from economic point of view. Normally the power factor of whole load on supply system is lower than 0.8.In industries most loads in modern electrical system are Inductive. Examples include ac motors, arc lamps, transformers, gaseous tube lighting ballasts, and induction furnaces.

Inductive loads need a magnetic field to operate Inductive loads require two kinds of current:

- Working power (kW) to perform the actual work of creating heat, light, motion, machine output, and so on.

- Reactive power (kVAR) to sustain the magnetic field.

Reactive power doesn't perform useful work but circulates between the generator and the load. It places a heavier drain on the power source, as well as on the power source's distribution system. Low power factor means you're not fully utilizing the electrical power you're paying for

II. WHAT IS POWER FACTOR?

Power factor is the cosine angle between voltage and current in ac circuit or it is the ratio of working power to apparent power. It measures how effectively electrical power is being used. A high power factor signals efficient utilization of electrical power and greater the efficiency.

A. *What are the disadvantages of low power factor?*

- Due to low power factor the copper losses are more in the system.

- At low power factor the current is large and it causes voltage drop and the supply end voltage is reduced and to overcome this disadvantage e need to insert additional devices to keep voltage in permissible limit.

- From economic standpoint low power factor is not favorable.

B. What can do for improve power factor?

The power factor of system is low due to the fact that most of loads are inductive and therefore, it takes lagging currents. Therefore to improve power factor some device which takes leading power should be connected in parallel with load. To improve power factor by adding power factor correction capacitors to plant system. When apparent power (kVA) is greater than working power (kW), the utility must supply the excess reactive current plus the working current. Power capacitors act as reactive current generators. By providing the reactive current, they reduce the total amount of current your system must draw from the utility. By inserting this power capacitor system's power factor can provide 95% use of utility power.

C. Methodology

1. Visual inspection and data collection.
2. Observations on the general condition of the facility and equipment
3. Identification/verification of energy consumption and other Parameters measurements by power analyzer
4. Analysis and Simulation using MATLAB.
5. Detailed calculation of capacitor required to improve power factor by MATLAB simulation

D. Relevant areas

The relevant industrial area for analysis is M/s SMACO Foundry located at Dr. Babasaheb Ambedkar Co-Operative Industrial Estate, Mangaonwadi, Tal. Hatkanangale, Dist. Kolhapur, Maharashtra State, India.

E. Figuers and Tables

1) Simulation Figures : Power Factor Correction
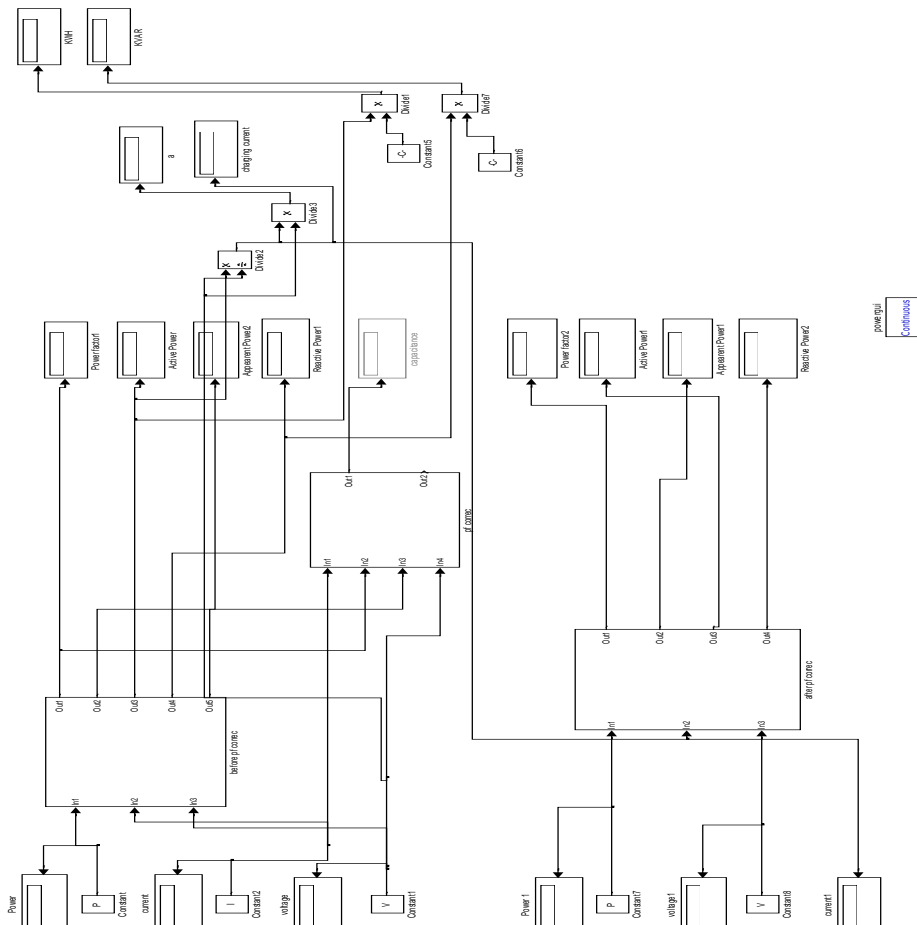
In above MATLAB simulation current, voltage and active power are the input quantities. By giving these as a input we can get the corrected capacitor value for each phase. And this capacitor should be connected in parallel with load to improve power factor.

Table I: Reading analysis of HMC machine

V	I	P	Q	CORRECTED CAPACITOR (MICRO FARAD)
236.6	1.9	240	380.1	21.62
233.5	10.8	1860	1703	99.47
230.3	16.9	3160	2272	136.52
230.4	17.6	3320	2328	139.61
231.5	17.5	3300	2350	139.57
232.2	16.8	3140	2315	136.65

In Sanmati Industry the analysis is done for HMC machine. The respective results are attached here with as shown in above table and the value of capacitor to get improve power factor is suggested to industry to insert corrected value capacitor for full utilization of power.

III. BENEFITS PROVIDED BY POWER CAPACITORS

F. Reduced energy bill

By maintaining the power factor at or above 0.95 lagging under all load conditions any charges for excess reactive power are avoided, a system loss are reduced distribution equipment runs cooler and lasts longer. Lower system losses means reduced electricity consumption, typically in the region of 2% of the total consumption.

G. Capability of system increased

Power factor correction capacitors increase system current-carrying capacity. Raising the power factor on a kW load reduces kVA.

Therefore, by adding capacitors, you can add additional kW load to your system without altering the kVA.

H. Reduced losses

$I^2 R$ losses are more in case of low power factor and due to this the efficiency is very poor. Losses caused by poor power factor are due to reactive current flowing in the system. These are watt-related charges and can be eliminated through power factor correction.

I. Increases handling capacity of system

Power factor improvement utilizes full installed capacity of plant. Reactive components of current will prevent full utilization of installed capacity.

ACKNOWLEDGMENT

REFERENCES

[1] L.C.Witte, P.Schmidt, Dr.Brown,"Industrial Energy Management and Utilization" Hemisphere publishing corporation, New York, USA, 1987.

[2] Avneet Kaur, Prof. S.K Tripathi, Prof. P. Tiwari "Study of Power Factor Correction in Single Phase AC-DC Converter."

[3] Power factor correction: a guide for the plant engineer.