Simulation Of Capacitor Bank For Improvement Of Voltage Profile At Distribution Canter (Implement)

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Abstract:
Step by step the request of power is expanding that is the reason the voltage profile is diminishes, so to enhance the voltage profile of the power framework, capacitor bank ought to be embedded in shunt with the dissemination line after circulation transformer of substation. This misfortunes expands the present and because of warmth expanded above steady then again the limit of gear which is introduced in the substation and load side that will be lessened the life of hardware. In the event that the voltage profile does not keep up control factor is diminished and diminishing force factor coming about power misfortunes. Shunt capacitor bank's are utilized to enhance the power factor amendment, nature of electric supply and effective activity of energy framework. It's generally economical and can be effectively introduced anywhere on the system. Squandered vitality limit, otherwise called poor power factor, is regularly disregarded. It can bring about poor dependability, security issues and higher vitality costs. The lower your energy factor, the less monetarily your framework works.

Keywords — MATLAB, Capacitor bank, Power factor, Power Triangle, Load, Improved Voltage, Reactive Power…

I. INTRODUCTION

The MATLAB is the preplanning programming application for before doing any work in the framework to take result and roll out improvements for introducing equipment hardware in the substation. So we need to utilize this information for introduced that. So by using MATLAB we can reduce the losses of the Electrical system because it gives the complete idea and solution for any error.

Most of the load such as industrial, commercial, industrial and domestic is inductive for example transformer fluorescent lighting so it required magnetic field to produce emf as well as it produce active and reactive power but active power is useful and reactive power is useful for certain limit beyond that limit this causes some losses for neutralizing that reactive power we have to add the capacitive load for neutralizing that. Shunt capacitor bank are used to improve the quality of electric supply the electric supply and reduce and line losses. Shunt capacitor bank are relatively inexpensive and can be easily installed in the network. The main disadvantages of shunt capacitor bank is that its reactive power output is proportional to the square of voltage.

A. CAPACITOR BANK AND IT'S USE

Capacitors are electrical/electronic segments which store electrical vitality. Capacitors comprise of two transmitters that are isolated by a protecting material or dielectric. At the point when an electrical current is gone through the conduit match, a static electric field creates in the dielectric which speaks to the put away vitality. Not at all like batteries, this put away vitality isn't looked after uncertainly, as the dielectric takes into account a specific measure of current spillage which brings about the steady dispersal of the put away vitality.

A capacitor bank is a gathering of a few indistinguishable capacitors between associated in parallel or in arrangement with each other as required.

The interest for control is communicated in units of Kilo watt (kW) or Mega watt (MW). This power is provided by an electrical producing station. In rotating power framework (AC), responsive power dependably comes in to picture. This responsive power is communicated in Kilo VAR or Mega
VAR.. The request of this receptive power is basically begun from inductive load associated with the framework.

These inductive burdens are for the most part electromagnetic circuit of electric engines, electrical transformers, inductance of transmission and circulation systems, acceptance heaters, and so forth. This receptive power ought to be legitimately adjusted, generally the proportion of genuine power devoured by the heap, to the aggregate power expended i.e. vector total of dynamic and responsive power, of the framework turns out to be very low. This proportion is known as electrical power factor, and lower proportions shows poor power factor of the framework. In the event that the power factor of the framework is poor, the ampere weight of the transmission, dispersion organize, transformers, alternators and different supplies associated with the framework, turns out to be high for required dynamic power. Then again, the client will pay for considerably more than what is really being utilized. What's more, subsequently receptive power remuneration turns out to be so imperative. This is regularly done by expansion of capacitor bank.

B. TYPES OF CAPACITOR BANK

Unit of a capacitor bank is normally called capacitor unit. The capacitor units are manufactured as single phase unit. These single phase units are connected in star or delta to farm a complete 3 phase capacitor bank. Although some rare manufacturers 3 phase capacitor unit but normally available capacitor units are single phase type. The

1. Externally fused capacitor bank.
2. Internally fused capacitor bank.
3. Fuse less capacitor bank.

C. Capacitor Bank’s Benefits

- Shunt capacitor banks are used to improve the quality of the electrical supply and the efficient operation of the power system.
- This helps to improve voltage profile on the system to significantly reduce line losses.
- Shunt capacitor banks are relatively inexpensive and can be easily installed anywhere on the network.
- Shunt capacitor banks (SCB) are mainly installed to provide capacitive reactive compensation/power factor correction.

II. POWER TRIANGLE

Power Triangle is the portrayal of a correct edge triangle demonstrating the connection between dynamic power, responsive power and evident power. At the point when every segment of the present that is the dynamic part (Icosϕ) or the receptive segment (Isinϕ) is duplicated by the voltage, control triangle is gotten appeared in the figure underneath.

The power which is really expended or used in an AC Circuit is called True power or Active Power or genuine power. It is estimated in kilowatt (kW) or MW. The power which streams forward and backward that implies it moves in both the bearing in the circuit or respond upon it, is called Reactive Power. The receptive power is estimated in kilovolt-ampere responsive (KVAR) or MVAR. The result of root mean square (RMS) estimation of voltage and current is known as Apparent Power. This power is estimated in KVA or MVA.

- When a dynamic part of current is increased by the circuit voltage V, it brings about dynamic power. It is this power which produces torque in the engine, warm in radiator, and so forth. This power is estimated by the wattmeter.
• When the responsive segment of the current is increased by the circuit voltage, it gives receptive power. This power decides the power factor, and it streams forward and backward in the circuit.

• When the circuit current is duplicated by the circuit voltage, it brings about clear power.

• From the power triangle appeared over the power, the factor might be dictated by taking the proportion of genuine energy to the obvious power.

As we probably am aware just power implies the result of voltage and current however in AC circuit with the exception of unadulterated resistive circuit there is normally a stage distinction amongst voltage and current and in this manner VI does not give genuine or genuine power in the circuit.

D. Power Factor

The power factor is the proportion of genuine power that is utilized to do work and clear power that is provided to the circuit.

The power factor can get values in the range from 0 to 1. When all the power is receptive power with no genuine power (typically inductive load) the power factor is slacking. At the point when all the power is genuine power with no receptive (resistive load) the power factor is solidarity.

III. BLOCK DIAGRAM

![Block Diagram](image)

The above figure shows the block diagram of power system which is from substation consumer load all over the equipments are connected in the circuit which is as follows

1. synchronous generator
2. three transformer delta/delta 33/11KV
3. three phase parallel RLC load
4. voltage and current measurement instrument
5. scope
6. capacitor bank
7. circuit breaker
8. consumer load equipment.

Mechanical power input is given to the synchronous generator. Generator converts into mechanical energy which is provided to three phase delta/delta transformer 33/11KV and supply voltage and current is measured by voltage and current measurement instrument respectively, Which is display on scope also voltage gain is before the scope to convert voltage in per unit quantity.

Transformer is connected in delta/delta system to get supply in three phase three wire in transmission line then after 50km three parallel load is connected through a pie section transmission line to common bus bar. To maintain the constant power supply and minimum current by capacitor bank installed before the consumer load and after distribution transformers.

This capacitor bank is shunt connected maintain voltage profile because current is increased if load variations are occurred and maximum voltage drop will be produce and above the permissible limit of equipment heat will be increase and power losses will be produced so power factor decreases and equipment may suffer from damage condition and reduces the life of equipment because of KVA is increased so size of equipment also large it is costly to system consequently system become expensive so that we have to used the capacitor bank in shunt with the load so this will reduce the all above losses of the system.
E. SIMULATION CIRCUIT

Fig. : - Simulation Circuit of power supply equipment connected from substation to consumer load.

This circuit is made in the MATLAB to get come about by embeddings capacitor bank in the supply framework after the dispersion transformer to enhance the voltage profile and keep up control factor close to solidarity on account of inductive load control factor is slacking and does not keep up closer to solidity so we need to include the capacitive load in the circuit this is driving that is the reason it kill to slacking power factor and turns out to be closer to solidity.

F. Result

Fig. :- Waveform of MATLAB result using capacitor bank.

This waveform speak to the outcome utilizing MATLAB programming for capacitor bank actualize in the substation after the transformer which keep up the voltage profile steady and power factor closer to solidarity. These waveform gives the thought for future development of load and does not influence voltage to drop so misfortunes will be decreased thus life of hardware will be increment and framework end up reasonable and stay away from people in general pass out day.

G. Saving by Installation of Capacitor bank
1. Reduction in losses in the distribution system.
2. Extra KVA available from the existing supply.
3. Reduction of $I^2R$ losses in transformers and distribution equipment.
4. Reduction of voltage drop in long transmission line.
5. Extended equipment life and reduced electrical burden on transmission line and electrical equipment.

H. Advantages of Good Power Factor
1. Eliminate Power Factor Penalties.
2. Increase System Capacity.
3. Reduce Line Losses in distribution systems.
5. Improve voltage profile.
6. Improved voltage regulation due to reduced line voltage drop.
7. Reduction in size of transformers, cables and switchgear in new installations.
8. Less total plant KVA for the same KW working power.
9. Improve energy efficiency.
10. Increase life of equipment and becomes inexpensive.

IV. CONCLUSIONS

The poor power factor is only the wastage of electric vitality as power misfortune. i.e. $I^2R$ misfortune which will cause the variety of load amid the pinnacle stack period. This variety will cause voltage drop in conveyance line and current is increment. Because of expanding current warmth will deliver and result in misfortunes. These may harm the line gear the fundamental driver of poor power factor is available of inductive load in the circuit. Because of inductive load it draws bothersome
receptive power for killing this power we need to include the capacitor bank after the dispersion transformer and misfortunes will be diminished.

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