CALCULATION FACTOR POWER WITHUSING BANK CAPACITORS ON LOAD INDUSTRY

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ABSTRACT

In an electric power system there are three types of power, namely active power, apparent power and power reactive. Some industrial loads such as induction motors operate at a power factor quite low. If this problem is not solved it will cause power loss and drop voltage. Wrong one method resolve problem the that is with adding a capacitor bank as a reactive power compensator. On the installation of capacitors with the power factor increased from 85%, the capacitor rating results are 321 kVAR andon moment raised 90% obtained results rating capacitor 428 kVAR and on moment raised 95% obtained results rating capacitor 553 kvar.

Keywords: Power Factor, Capacitor Bank, Correct Power Factor

INTRODUCTION

In an electric power system there are three types of power, namely active power, apparent power and power reactive. Many things affect the need for electrical power, namely the amount of load, type of load, type of conductor and the distance between the power source and the load. getting smaller the power factor is economically less effective. One of the causes of low power factor that is loss power and drop voltage. For burden industry alone have reactive power requirements are very large, causing the power factor to be lower. One way to improve the power factor is to add a capacitor bank as compensator power reactive. [3],[7]

The addition of a capacitor bank acts as a supplier of the required reactive power by load. An inductive load is a group of loads which have a constant demand for power reactive.

LITEARTURE REVIEW

Factor Power and Factor Improvement Power

Factor power (PF) is comparison Among power active or power average (P) the unit is watt (W) with apparent power (S) the unit is volt ampere (VA) Angle q is difference phase Among voltage and current. Power active is big power which used by electrical equipment in order to operate optimally. Apparent power is big power which transmitted from source energy electricity. the size power pseudo is the trigonometric sum of active power with reactive power, the unit of reactive poweris volt ampere reactive (VAR). If described in the form of a power triangle, then power apparent is represented by the hypotenuse while the active and reactive power is represented by sides triangle which each other upright straight, like showed on Figure 1 following [9]:

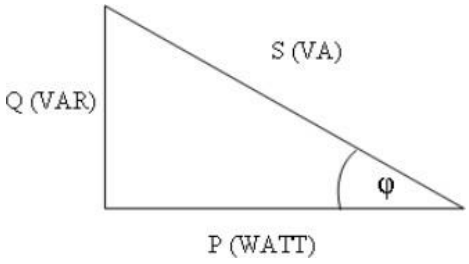

Figure 1. Triangle Power

Connection power on triangle power could explained with equality like ontable 2.1 Equality Triangle Power.

Table 1. Power Triangle Equation

No	Name Power	Formula	Unit
1	Power Active (P)	P = V. I. cos □	Watt
2	Power reactive (Q)	P = V. I. Sin □	VAR
3	Power pseudo (S)	P = V. I	VA

The cosine angle between the voltage and current in an AC circuit is known as power factor. In an AC circuit, there is generally a phase difference between the voltages and current. The term cos is referred to as the power factor circuit. Power factor analysis can made in the form of power drawn by an AC circuit. Where to look for the formula factor power (cos) _ that is

Factor Power = cos □ _= (
□ [1]

The low power factor is mainly due to the large power load character inductive or called with current lagging. For increase factor power, multiple power master devices which must be connected in parallel with the load. Wrong one device the could in the form of capacitor.

Lagging Dan Leading Factor Power
Lagging On Factor Power
Lagging on the power factor, namely the lagging power factor which indicates that the load is inductive, because the load will consume reactive power, and therefore the reactive power component (Q) is positive because reactive power flows through the circuit and consumed by burden inductive. Could seen on Figure 2 lagging on factor power.

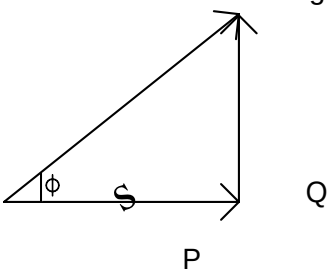

Figure 2. Draft lagging on Factor Power

Leading on Factor Power
Leading on the power factor is the main power factor which indicates that the load is capacitive, since the load supplies reactive power, and therefore the power component

reactive (Q) is negative because power reactive supplied to circuit. Could seen on figure.

Leading on factor power

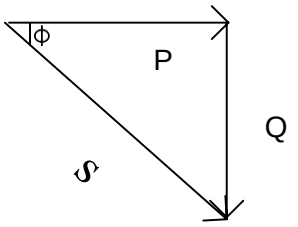

Figure 3. Draft Leading on Factor Power

Capacitor Bank

Deep Capacitor (Condenser) electronic circuits are denoted by "C" is a device that can store energy / electric charge in an electric field, with method gather imbalance internal from payload electricity.

The capacitor that will be used to increase the power factor is installed in parallel with load circuit. When the circuit is given a voltage, electrons will flow into the capacitor. When the capacitor is full of electrons, the voltage will change. Then electron will to outside of capacitor and flow to in the network which need it, thus at that time the capacitor generates reactive power. When voltage which changed that return normal, so capacitor will keep return electron. To increase the cos then it is necessary to add a capacitor that is installed in parallel and normal called compensator power reactive so that [7].

$$Q_C = 1\_ \square_2 \qquad (2)$$

where :

Q_C = Power reactive which needed capacitor bank

1 _ = Power motor reactive before repair

2 _ = Power reactive motorcycle which want to achieved

Method Installation Capacitor

by theoretical, part big method for repair factor power couldcategorized as as following [5]:

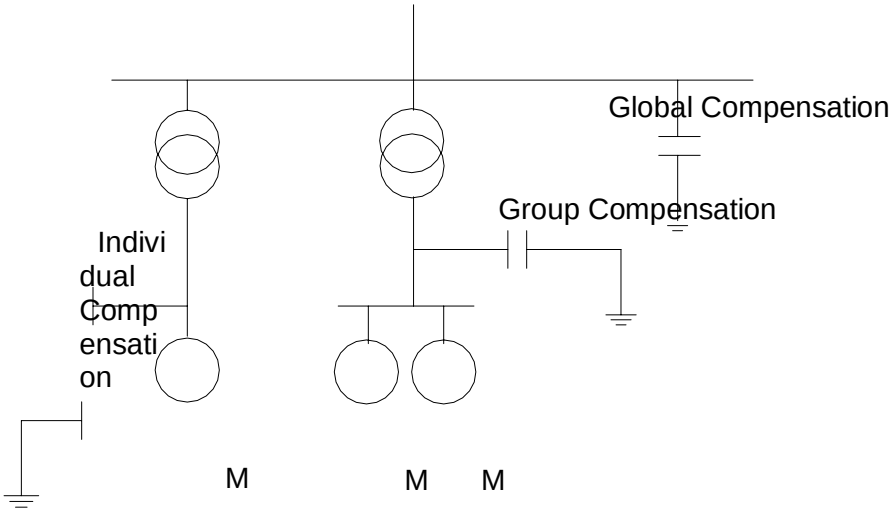

Figure 4. Installation Method Capacitor Bank

Method *Global Compensation*

Method installation capacitor on parent panel *play distribution panel* (MDP), so that current which down only in carrier Among panel MDP and transformer, while current which past after MDP no down.

Method *Group Compensation*

Group mounting method, compensating for the amount of load connected to switchgear which same. In here capacitor bank controlled by device which could programmed and also protection.

Method *Individual Compensation*

Capacitors are directly installed on each load, especially those that have power which big, way this more effective and more good from aspect technical. However the drawbacks is must provide room or the place special for put capacitor the.

METHODS

Methodology Study

Most industrial loads such as induction motors operate at low power factors quite low. About 60% of the utility load consists of the motor and hence the power factor the whole power system low. Depends on level burden. Relationship between power factor and Q/P ratio are shown in Table 3.1. From Table 3.1 it can be seen that at 90% power factor, reactive power requirement is 48% of real power. On power factor low, the reactive power demand is much higher. Therefore, it is necessary to correct the factor power on burden industry.[4],[1].

Data collection Factor Power and Ratio Q/P on Industrial Load

Table 2. Factor Power and Ratio Q/P

Factor Power %	Angle Degree	Ratio Q/P
100	0	0.00
95	11.4	0.20
90	26.8	0.48
85	31.8	0.62
80	36.8	0.75
70	45.0	1.00
60	53.1	1.33
50	60.0	1.73

RESULTS AND DISCUSSION

Model Calculation Factor Power with Capacitor Bank

Following model calculation factor power with capacitor bank which taken in 3simple calculation factor power with data as following [4] :

Load	:800 kW
KVA	:1143 kVA
Factor power	:0.7
Factor Power which desired	:0.95

If the power factor is increased Becomes 85%

Kva which desired : load/factor power which raised
: 800/0.85
: 941 kVa

Size capacitor which required for reach Thing this is determined from Kvar ontwo values factor power as following:

kVAR : $(kVA^2 - kW^2)$

kVAR 1 70% Power factor : $(\overline{kVA^2 - kW^2})$

: $(\overline{1143^2 - 800^2})$
:861 kVAR

kVAR 1 85% Factor power : $(\overline{kVA_1^2 - kW^2})$

: $(\overline{941^2 - 800^2})$
:495 kVAR

Rating Capacitors : $kVAR_1$ (uncorrected) $kVAR_2$ (corrected))
: 861 495)
:321 kVAR

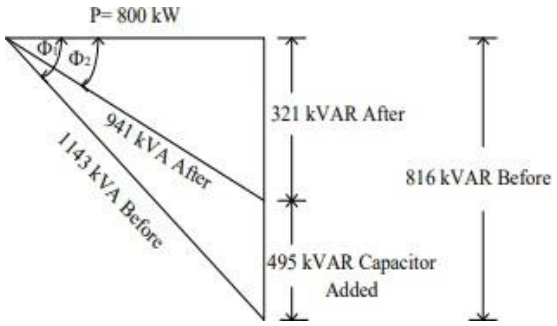

Figure 5. Power Triangle Before and After Installation Capacitor (On FactorPower 0.85)

If factor power raised Becomes 90%

Kva which desired : load/power factor which raised
: 800/0.9
: 889 kVa

Size capacitor which required for reach Thing this is determined from Kvar ontwo values factor power as following:

kVAR : $(\overline{kVA^2 - kW^2})$

kVAR 1 70% Power factor : $(\overline{kVA_1^2 - kW^2})$

: $(\overline{1143^2 - 800^2})$
:861 kVAR

kVAR 1 90% Factor power : $(\overline{kVA_1^2 - kW^2})$

: $(\overline{889^2 - 800^2})$
:388 kVAR

Rating Capacitors : $kVAR_1$ (uncorrected) □ $kVAR_2$ (corrected))
: 861 □ 388
:428 kVAR

If factor power raised Becomes 95%
Kva yang desired : load/factor power that raised
: 800/0.95
: 842 kVa

Size capacitor which required for reach Thing this is determined from Kvar ontwo values factor power as following:

kVAR : $(\overline{kVA^2 \square kW^2})$

kVAR 1 70% Power factor : $(kVA^2 \square kW^2)$

: $(\overline{1143^2 \square 800^2})^{\frac{1}{2}}$
:861 kVAR

kVAR 1 95% Factor power : $(\overline{kVA_1^2 \square kW^2})$

: $(\overline{842^2 \square 800^2})$
:263 kVAR

Rating Capacitors : $kVAR_1$ (uncorrected) □ $kVAR_2$ (corrected))
: 861 □ 263
:553 kVAR

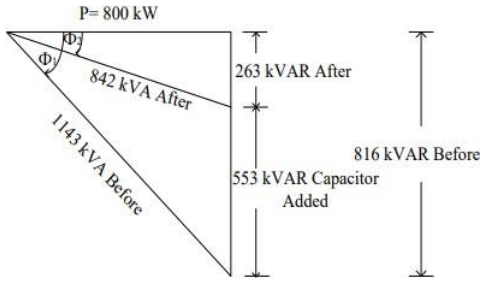

Figure 6. Triangle Power Before and After Installation Capacitor (On FactorPower 0.95)

CONCLUSION

1. Repair factor power on burden industry could conducted with installationcapacitor.
2. On installation capacitor with factor power which raised from 85% obtained the result of the capacitor rating is 321 kVAR and when it is increased to 90% the rating results are obtained capacitor 428 kVAR and when it is increased to 95% the results of the capacitor rating are obtained 553 kVAR
3. Could seen Step for the sake of Step repair factor power with before or after installation capacitor bank.

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