



Case Study - How your Motor Protection should be designed when running in parallel with Capacitor Bank

Hello Friends / Sirs,

Protection is a vast field and its designing, and implementation is a subject of involved Technicality and Engineering Experience to larger extent. For Switchgears, Protective Relays are designed to provide protection for electrical equipment and hence Engineering toward Designing of Protection Scheme and Protection Relaying must be done keeping all the aspects in mind.

During all these years in Engineering Services, we have mastered the art of Design and Selection of Protection Scheme. We have also helped many of our valued customers to Rectify the issues related to wrongly Designed and Implemented Protection Schemes and Philosophies.

Presenting you one of such case which we, **System Protection** have Identified and Rectified for wrong Design of Protection Scheme which in turn reduces Selectivity and increases down time or remain Inoperative in case of some genuine fault conditions.

In one of the Process Plant where switchboard was designed by some consultant who showed ignorance owing to lesser experience and knowledge in Design & Engineering of Protection Schemes. This has costs frequent failure of 6.6 kV HT Motors without any warnings and abnormality reflected.

Till date we, **System Protection** were contacted and called upon to identify and rectify the root cause, 3 Motors have been burnt due to Overheating / Overloading in just 9 -10 months.

Usually, we never suspect the Engineering of Protection Schemes, hence started analyzing the data viz. Motor Ratings, CT Sizing, Transformer Ratings, Relay Settings, Load patterns, connected loads etc.

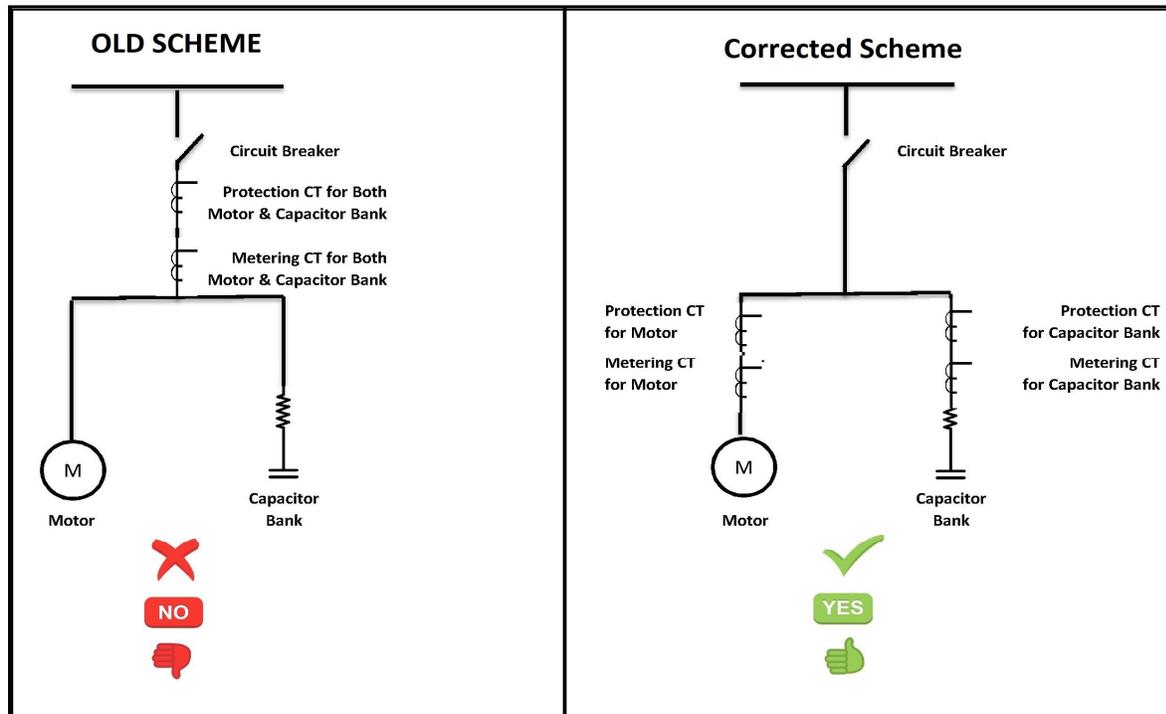
Examining further when no check points left, we finally checked the Protection Scheme and SLD that lead us to an instant conclusion that it was wrong Protection Scheme for Motors causing frequent failure and loss of revenue with significant repairing cost and down time.

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Below is the **SLD Representation of existing / old scheme and corrected Protection Scheme for HT Motors with Capacitor Bank.**



It was common CT and Relays for Both Motors and Capacitor banks which was causing the frequent failure of motors. Here under are the reasons why Common Protection should not be used for HT Motor with Capacitor Banks.

1. Protective relay will not sense the fault properly:

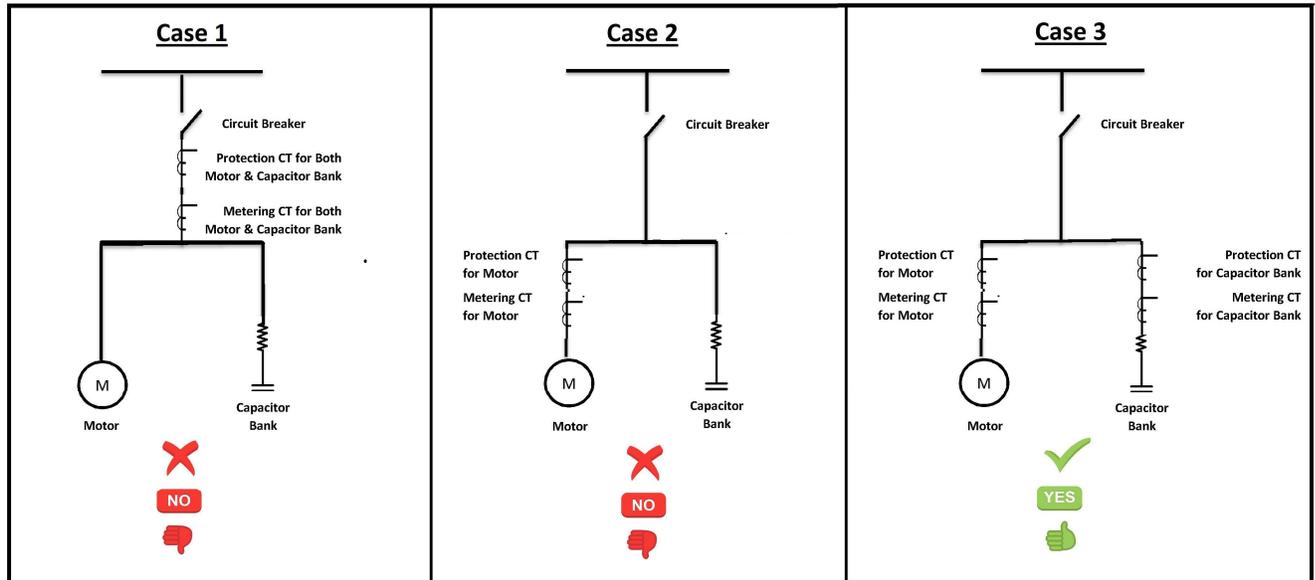
- In a common installed Protection Scheme for Parallel connected Motors and Capacitors, current sensed by CT will be less than what is being consumed by Motor.
- Suppose 3600 kW, 6.6 kV, 384 Amp FLC (0.82 P.F) Slip Ring Induction Motor is running at full load without capacitor bank than Motor will be taking 384 Amp normally.
- But when connected in parallel with capacitor bank of 1350 KVAR, loading remains the same i.e. 3600 kW but as power factor is improved to 0.95, net current reduces to 335-340 Ampere.
- Normally Motor Protection Relay settings shall be done as per 384 Amp as FLC + permissive overload for a time being. Whereas in existing protection scheme Relay will take 340 Amp only. So, to reach Threshold of 384 Amp, motor has to run at approx 4250 kW which is in actual 115% of rated capacity. Now if motor keep running at 115% normally, it will be overheated and shall surely results into breakdown.

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- Also, whenever Relay trips due to fault, it takes longer time for Engineers to identify the fault / location since common protection for Motor and Capacitor Bank has been used, and hence increases the down time of breakdown as Engineers have to check Motors, Associated rotor equipments (If any) in the field and Capacitor Bank in the Substations.



System Protection provided them complete Engineering support with Selection of CT, Relay, Design, Supply and Installation of new CT and Relays, Complete scheme Implementation and testing.

Due to above described factors, we advise the Plant authorities to modify protection scheme, by implementing separate protection for motors and capacitor bank. We also advise to manipulate the Motor Protection Relay settings by reducing it to 88% approximately till the modification in protection scheme is made.

Stitch in Time, Saves Nine!

Don't let your Plant suffer the same as in described case study, do check your Protection Scheme and if you have the same then feel free to Call / Write to us.

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If you are looking for a dedicated agency that understands the direct link between your assets and your revenue, call/write to us, we will be happy to assist you.

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(Servicing & Testing of Circuit Breaker, Relay, CT, PT, Transformer, Other Switchyard Equipment's, Relay Co-ordination Studies, Cable, etc.)

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