

Motor starting with soft starters – reduced stresses (part 2)

Soft starting

In the previous journal, we analyzed the various technical parameters which are available for user to implement perfect starting and protection of induction motors.

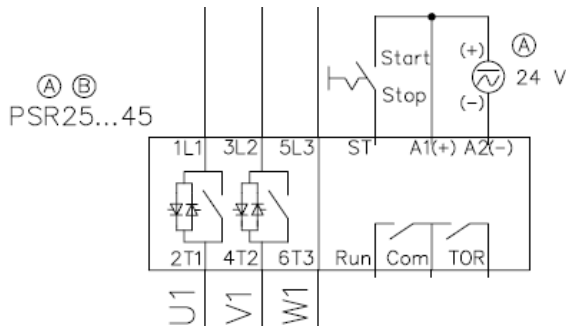
In this journal we will analyze further understanding on implementation of controls in soft starters. There are normally two method implemented.

- 2-Phase control
- 3-Phase control

We will discuss in detail of these two method to understand merits and de-merits both type of construction.

2- Phase control

The below diagram provides typical power block construction of 2-phase Controlled soft starters. Soft starters normally have 6 thyristors which are connected back to back to provide controlled output voltage to the motor. As an optimized solution is also in practice where only 4 thyristors



are used as indicated in this figure. You can clearly observe only thyristor blocks are connected in R&Y phase and B-phase cable is just passing through the soft starter without any power devices. The functionality is very similar, however there are some constraints or exceptions.

There are many manufacturers who offer 2-phase controlled soft starters. As a user one of the important aspect to be considered whether the soft starters have inherent feature of eliminating DC components. Normally 2-phase controlled soft starters creates DC component which acts as braking which leads to reduced torque and high noise during starting.

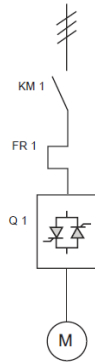
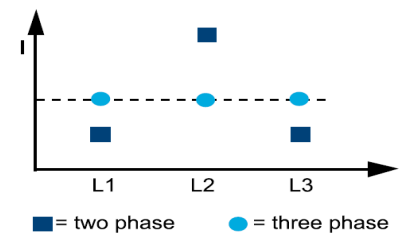


ABB soft starters are implemented with special algorithms which eliminates these DC components. **In case of use of these types of soft starters, as users it is very important to check whether DC components are eliminated or not.**

Delta connected option is not possible in 2-phase controlled soft starters.

3- Phase control

In 3-phase controlled soft starters, all three phases will have 2 thyristors/phase. Here 3 phase current will be fully balanced when compared to 2-phase controlled devices. The imbalance in 2-phase controlled can be seen for short period only during starting and stopping of motors.



The following are typical considerations where one can decide whether to select a 2-phase control or 3-phase controlled soft starters to be used.

2 phase control	3 phase control
In all different segments	Absolutely lowest starting current is required
When torque control is required	Inside delta connection is required
Normal start or heavy duty start	The unbalanced currents during start and stop is a problem
When a compact and cost effective solution is required	

Starting of several motors

When an optimization of the project is to be done, multiple motor starting either sequentially or in parallel is a one of the good option. However certain preconditions to be met in selecting the soft starters to switch motors in parallel.

- Soft starter selected should be capable of handling rated current of all motor together.
- Soft starter selected should be capable of handling starting current of all motors together.
- Ensure separate over load relays are used for each motor.

For example if rated of two motors are 50A each and starting current given by the manufacturer is 5 times rated current. Then soft starter's selection should be such that it should be capable of withstanding 500A ($50 \times 2 \times 5$). This has to be checked by plotting soft starter curve.

When motor are required to be started sequentially, following parameters are to be checked.

- Starting current requirement
- Starting time requirement
- Separate over load relays

For example with same motors above of 3 nos to be started with 3 different starting time of 5, 7 and 10 seconds. Then the total starting current is 750 ($50 \times 3 \times 5$) and total starting time is 22 seconds. Selection curve to be checked for the parameters.

The above calculation is only for motor with same rated power. However if the rated power is of motors are different to each other, different calculation to done.

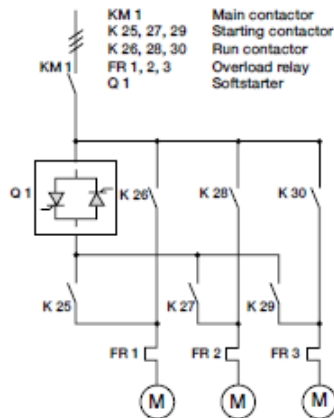
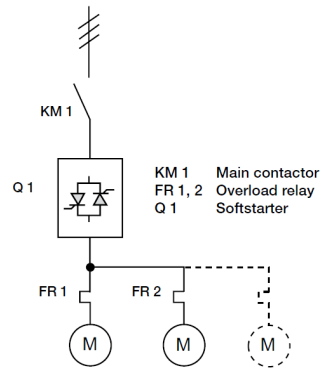


ABB offers comprehensive solution of soft starter for motor starting applications.



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