



## MOTOR START-UP CHALLENGE

The simultaneous startup of multiple motors can cause voltage drops destabilizing electrical networks and significantly deteriorate line conditions. The ability to regulate the high current with local compensation dramatically reduces the draw from electrical networks.

Most common solutions include:

### 1. DIRECT ON LINE CONNECTION (DOL)

High torque, low current, low voltage drop

The current of 3 phase inductive motor at startup is approximately 7 times higher than its steady operation state.

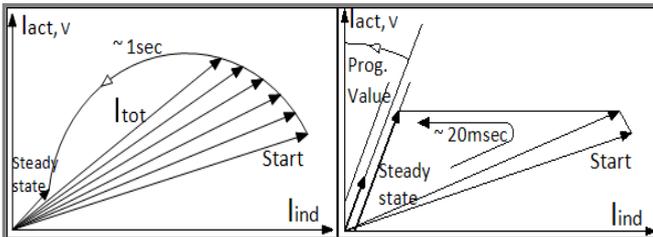


Figure 1: motor startup vector diagram with and without compensation. This concept of compensation (within less than 20 ms) is resulting in the substantial reduction of the

The reactive current shifts the vector of the voltage drop in the opposite direction reducing the voltage substantially.

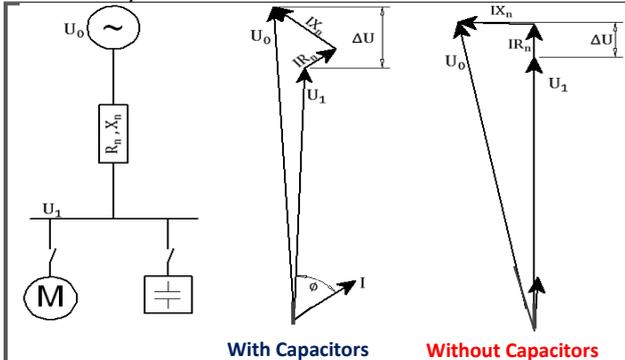


Figure 2: the effect of the voltage drop is determined by its amplitude and mostly the consumed current phase shift.

### 2. CONNECTION USING SOFT STARTER

Controlled torque, low current, low voltage drop

Soft starter devices provide step-less motor control, allowing both the start-up torque and current to be adjusted in small increments. However, in order to provide the necessary high torque, the soft starter must consume a large amount of current, which in some cases can reach levels of 3-4 times more than nominal.

During a soft-startup period two main problems might be addressed:

- Most of the consumed current being reactive might cause voltage drop below permitted values.
- In weak networks, high voltage drops can limit the initial torque causing the motor to fail to start.

## The Solution: ELSPEC Equalizer

The Elspec Equalizer, Real Time Power Factor Controller, provides full compensation in 2/3 of a cycle. This system offers the perfect solution for startup current reduction and stabilizes voltage— while at the same time, increasing the initial torque. The Equalizer is a new concept in cost effective motor startup SVC solutions.

### 1. DIRECT ON LINE CONNECTION (DOL)

High torque, low current, low voltage drop

- Allows protection against voltage drop on the main service while maintaining full torque.
- The Equalizer is able to fix/eliminate the voltage drop level.

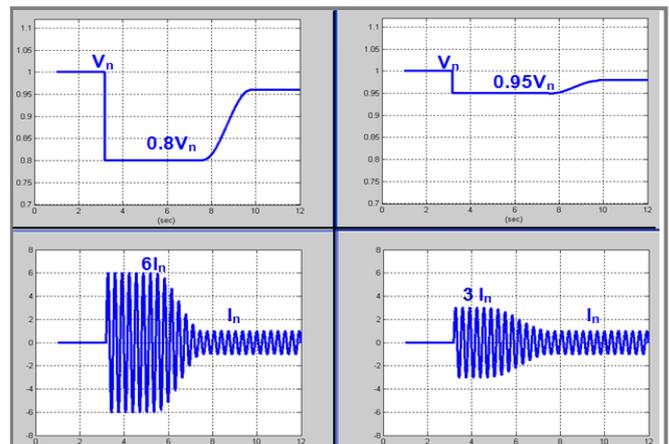


Figure 3: The effect of the consumption of the current and voltage drop with and without the Equalizer. (the voltage drop is in direct proportion to the consumption of the reactive current.

### 2. CONNECTION USING SOFT STARTER

Controlled torque, low current, low voltage drop

In weak networks, the initial torque provided by a soft starter is limited, causing motors to enter "kick-start" mode. The Elspec Equalizer provides reactive current eliminating voltage drops and enabling the soft start to accomplish its task successfully.



As a centralized compensation solution, Equalizer design provides the reactive current requirements for several motors, saving on additional devices on a multi-motor site. The Equalizer accommodates both low and medium voltage installations. Due to the short time reactive energy requirements, the size of the step up transformer is minimized making the Elspec Equalizer an extremely **cost effective** solution.