

Driving ideas

Softstarters

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AC induction motors are the most common motors in industry. Very often, they are started using a main contactor and a thermal overload relay – the so-called direct-on-line start. However, this approach causes a starting current that can be a multiple of the rated current. This inrush current may cause voltage dips that impact other loads. Also, extreme mechanical stresses can be experienced during start-up that can lead to damage. Softstarters provide an alternative starting method that avoids these inrush currents and mechanical overloading. ABB has successfully introduced a wide range of softstarters to the market.

A softstarter is a device, based on power electronics, that controls the voltage input to a motor starting up and thereby reduces the initial torque and current, which may be multiples of the rated values → 5.

At the heart of a softstarter are thyristors. These bipolar semiconductors – conceived in the 1950s – are now available for very high voltage and current ratings. The thyristors in a softstarter are connected back-to-back on each motor voltage input line and their firing angle adjusted to control startup voltage. Gradually, the firing angle is varied to allow voltage and torque to increase and speed up the motor.

One of the benefits of using a softstarter is that the torque can be set to the exact value required – this torque control feature is an important competitive differentiator.

Another important feature of the softstarter is its soft stop function. This is very useful for stopping pumps in water systems prone to exhibit water hammer when a direct stop using a star-delta starter or direct-on-line starter is employed. The soft stop function can also be used to avoid any material damage

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that might be caused by abruptly stopping a conveyor belt.

ABB softstarters

After much pioneering work by themselves and others during the 1970s, Fairford Electronics in England became one of the first companies to design and produce a three-phase motor controller with automatic energy optimization – with the added functionality of being able to soft start the motor to save energy. By 1982, ASEA had noticed the idea and instigated a collaboration with a small Swedish company, Elfi, to use components from Fairford Electronics along with Elfi know-how to develop an ASEA softstarter.

The project was a success and ASEA's first softstarter – called DEHE – was launched at the Elfack exhibition in 1984. At the time, few were aware of the benefits of a softstarter, so ASEA had the additional task of educating the market. Initial sales were mostly confined to

Swedish mining and paper customers.

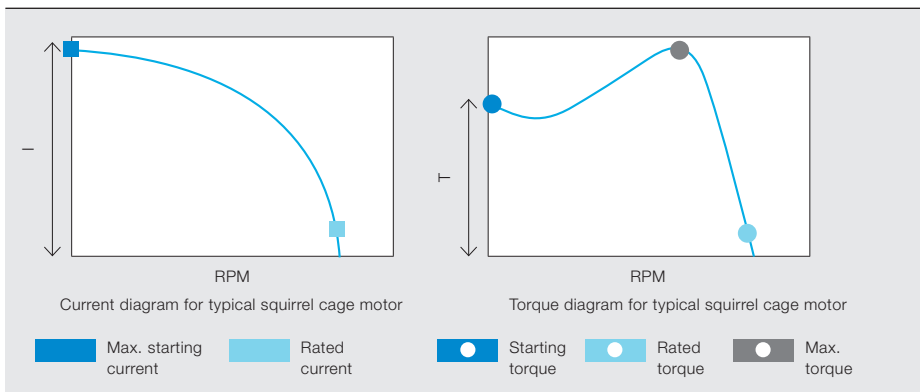
The basic components in a modern softstarter are mostly the same as in the early versions: A contactor, an over-

load relay and the inverse-parallel semiconductor devices (thyristors) → 6. Also, there is a printed circuit board, a heat sink, fans and housing.

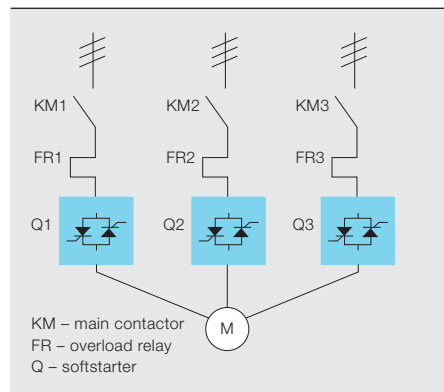
By 1993, a new version – the PSD – with extra functionality was introduced. Being available for a range of voltages, it opened up new markets around the world. The PSD was successful all through the 1990s and although Fairford Electronics was still responsible for the technical aspects, ABB took advantage of its strong market organization and experience to sell the product widely.

The first ABB softstarter, type PSS, appeared in 2000, designed and built in a custom factory in Örjan, just outside Västerås, in Sweden. Two years later, the product was further improved and the product range was divided into low-end (the PSS) and high-end (the PSD) products.

5 Induction motor current and torque – without a softstarter, initial values can be a multiple of rated values.



6 Softstarter – simplified schematic



7 ABB's softstarter range



ASEA's first softstarter – called DEHE – was launched at the Elfack exhibition in 1984.

In 2004, a new version – the PST – was launched, helping ABB become the market leader in softstarters, especially in China. The PST was the first softstarter to have a built-in bypass for normal operation, which saves energy by avoiding thyristor conduction losses. Subsequent development work concentrated on new algorithms to enhance the product's functionality, and the use of modeling and simulation tools to investigate the operation of the softstarter when applied to water pumps. Cost reduction was also a focus area and, in 2010, when the PSE

was released, ABB had established clear all-around leadership in softstarters.

By 2014, the importance of device communication had been recognized and many of today's softstarters are equipped with a port for such communication, which is normally carried out over fiber optic cables → 7. Many different communication protocols are supported – for example, Modbus, PROFIBUS, DeviceNet, Interbus-S, LonWorks, etc. Further, it has become clear that diagnostics, the human-machine interface (HMI) and the integration of softstarters with other devices – such as programmable logic controllers (PLCs) – are also key features. All these considerations were taken into account in the PSTX – ABB's brand-new softstarter.

As with many other industry devices, the need for diagnostics will increase in the future as reliability and availability become more important. New disruptive technologies, like the Internet of Things, Services and People (IoTSP), are clearly leading the trend for connectivity at a

higher level that will allow better preventive maintenance and integration with the factory environment.

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