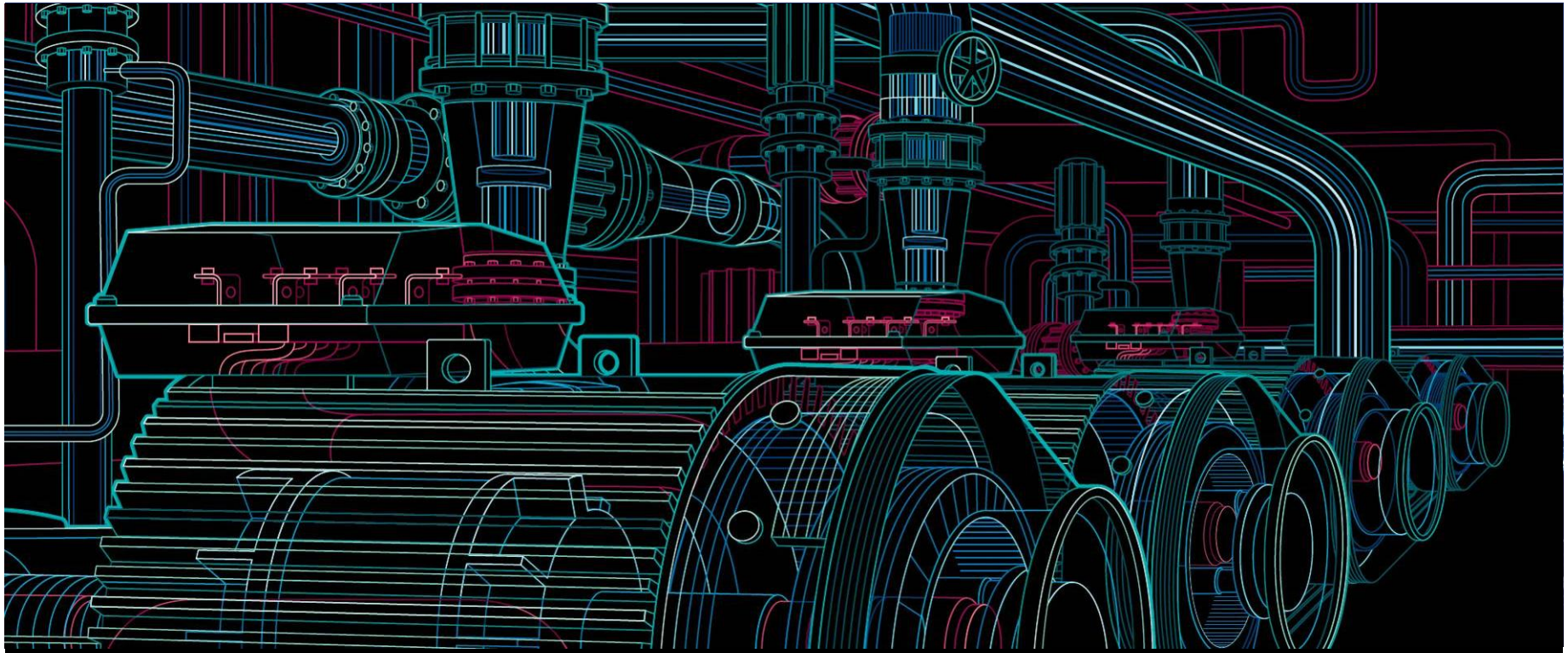


Lee Kok Hong, EPCP/Softstarter

Softstarter
Technical features & functionality

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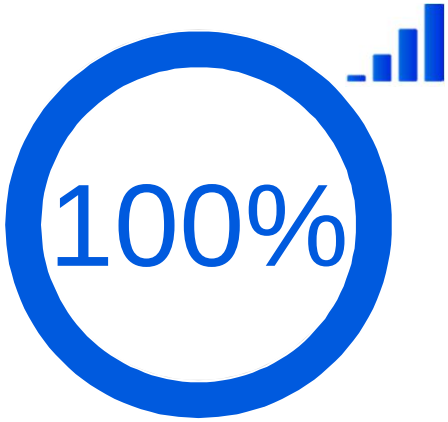
Increase application productivity

Power and productivity
for a better world™

PSTX – Technical features
Increase application productivity

Increase application productivity

- Torque control
- Limp mode
- Jog with slow speed
- Motor heating
- Full voltage start
- Manual pump cleaning
- Stand still break



100% increased lifetime. Reduced maintenance cost.

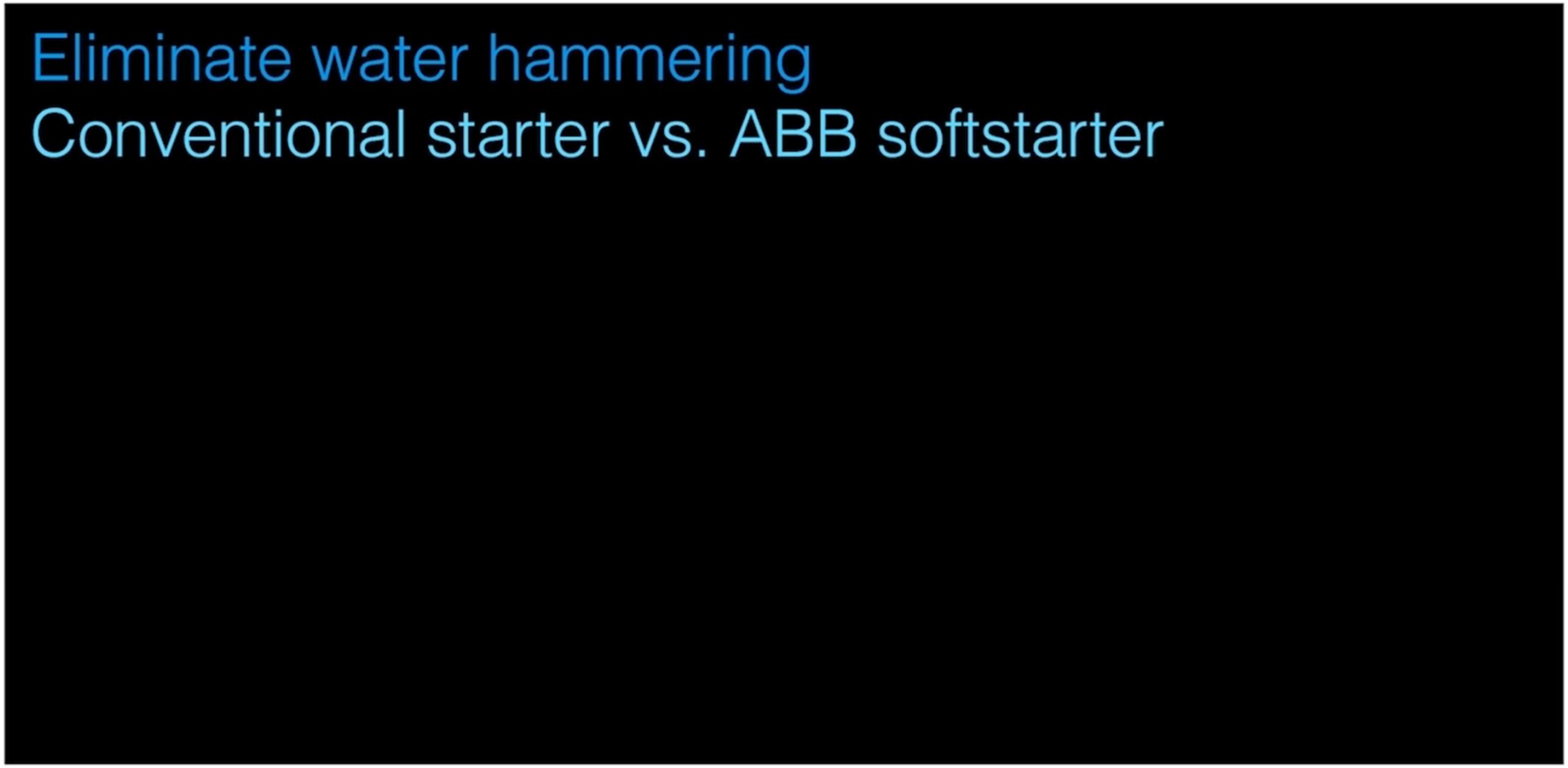
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Torque Control

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PSTX – Technical features
Torque control

Eliminate water hammering
Conventional starter vs. ABB softstarter



Power and productivity for a better world™

PSTX – Technical features
Torque control



Increase application productivity

Prolong the life time of pump systems and minimize downtime by avoiding water hammering

- At stop water hammering could occur if the speed of the pump reduces swiftly, which can cause tremendous mechanical stress on the system
- Torque control reduce the mechanical stress on pipes and valves by eliminate water hammering
- Instead of a voltage ramp, the voltage is regulated in a non-linear way to attain a torque that matches a pre-defined torque curve
- This reference curve is developed by ABB in close collaboration with one of the worlds largest pump manufacturers

PSTX – Technical features
Torque control



Increase application productivity

Water hammering

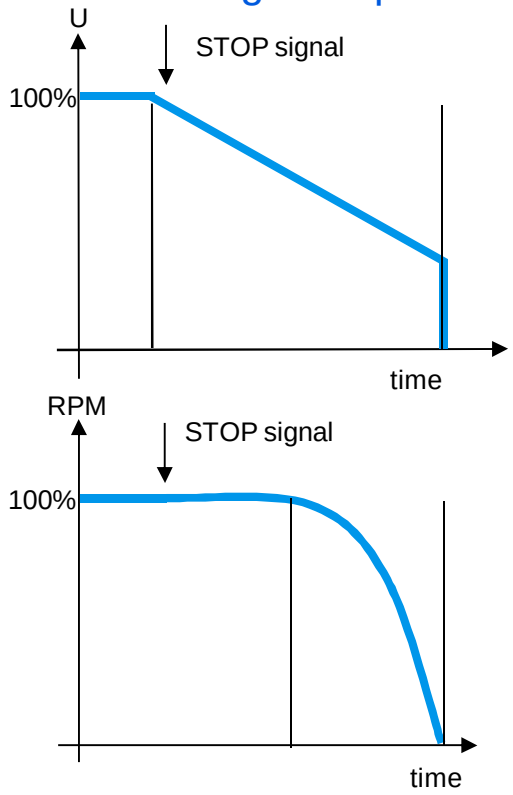
- Pump systems can be very fragile to sudden water surges, also called water hammering
- A harsh start/stop can result in a heavy water surge due to the high momentum and energy in the flowing water
- The water surge can cause damage to valves and pipes and in worst case result in a leakage
- Most common reason is a direct start/stop instead of a start/stop ramp
- Usually, a regular start/stop ramp is not enough to prevent the problem

PSTX – Technical features
Torque control

Increase application productivity

Technical description – for stop

Voltage ramp



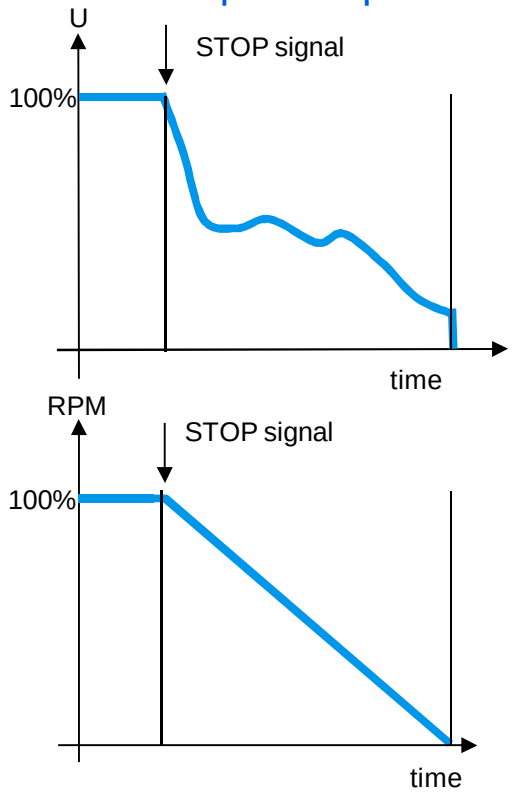
- Voltage reduces lineary
- In pump systems, the speed of the motor doesn't change accordingly to the voltage
- The speed reduction is delayed and the time to stop is very short, due to very high momentum of the moving water
- Very short stopping time gives a water surge, which is harmful for the system

PSTX – Technical features
Torque control

Increase application productivity

Technical description – for stop

Torque ramp



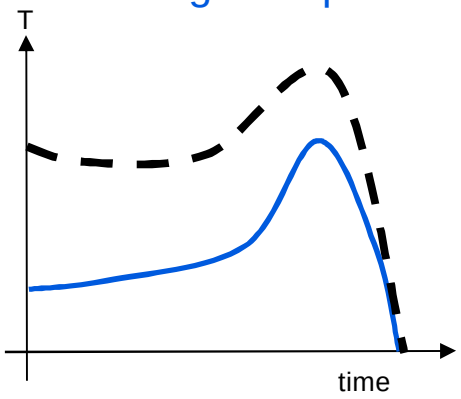
- With Torque control the voltage decrease is non-linear
- Output voltage regulates accordingly to the speed of the motor
- The optimal output voltage at each moment is determined with a feedback loop
- The motor speed reduces lineary and the motor stops smoothly

PSTX – Technical features
Torque control

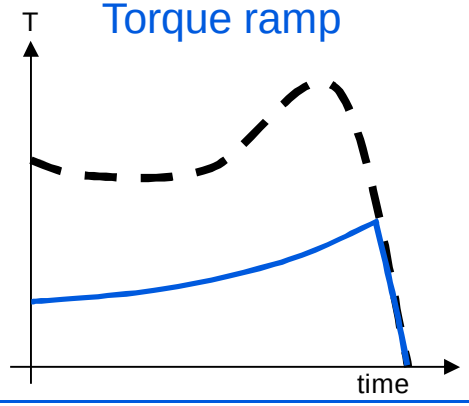
Increase application productivity

Technical description – for start

Voltage ramp



Torque ramp

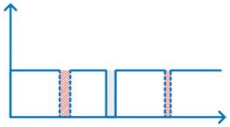


- Torque control also available as a start ramp
- Reduces unnecessary excessive torque
- During torque ramp the torque, is regulated more smoothly
- The feedback system eliminates the excessive torque
- Reduces stress from the system

Limp mode

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PSTX – Technical features
Limp mode

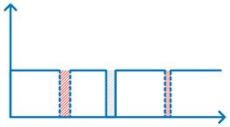


Increase application productivity

Maximize application availablity and productivity with the opportunity of 2-phase control if one thyristor is short circuited

- If one thyristor is shorted the softstarter can restart itself and only use to 2-phase control
- Sophisticated algorithm to eliminate the arising DC-component from 2-phase control
- All protections and most functions are available
- Functions and features in need of 3-phase control are disabled: Jog, Motor heating, Motor break and Stand still break
- Only functional with Inline connection

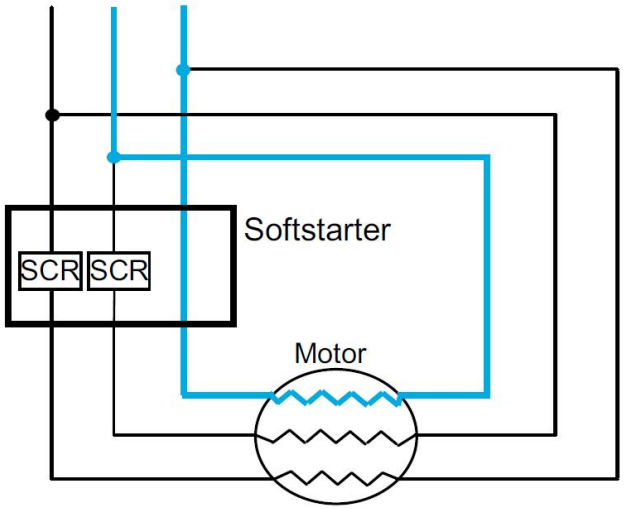
PSTX – Technical features
Limp mode



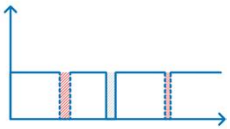
Increase application productivity

Technical description – Why only with inline?

- Limp mode only available when the motor is connected In-line and not Inside delta
- One phase would be shorted in Inside delta
- Current would flow free at all times
- A line contactor would not help



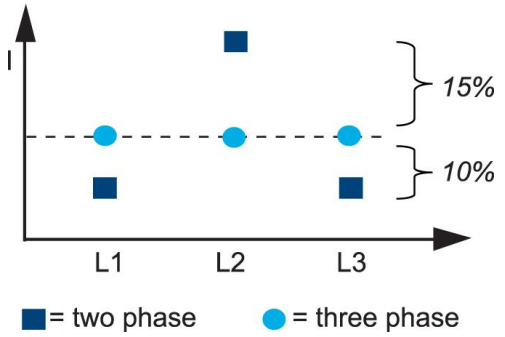
PSTX – Technical features
Limp mode

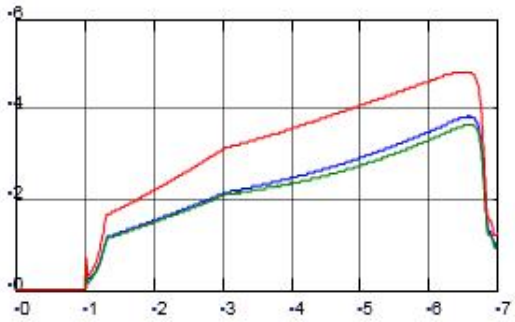


Increase application productivity

Technical description – 2-phase control

- With one phase bypassed a discrepancy between the currents in the three phases will arise
- This is only true during start and stop ramps
- The increased current results in a higher maximum current during start
- A DC component arises from the asymmetry among the phases



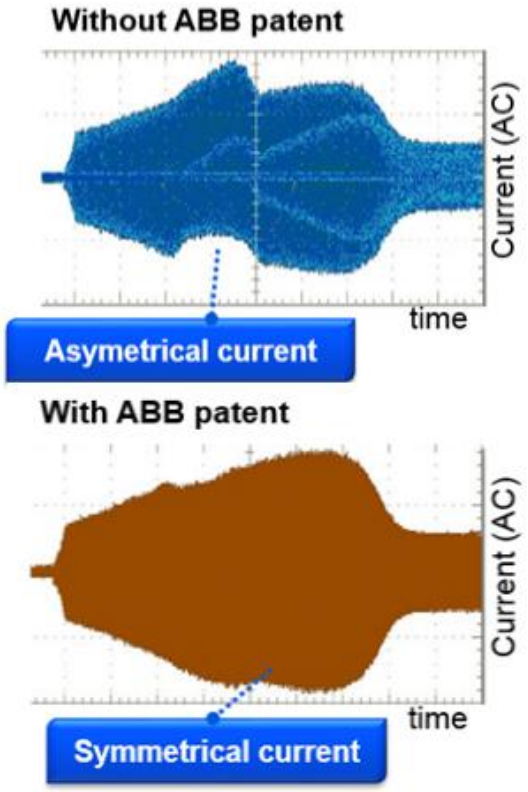


PSTX – Technical features
Limp mode

Increase application productivity

Technical description – 2-phase control

- The arising DC component makes the current during the ramp assymmentrically around the zero
- Worse performance, less torque, heat generation, harsh sound
- ABB's pantented technology will compensate for the problem and provide a close to perfect current ramp
- It all comes down to how the thyristors are triggered…
- … and the zero crossing detection feature ensures highest quality



Motor heating

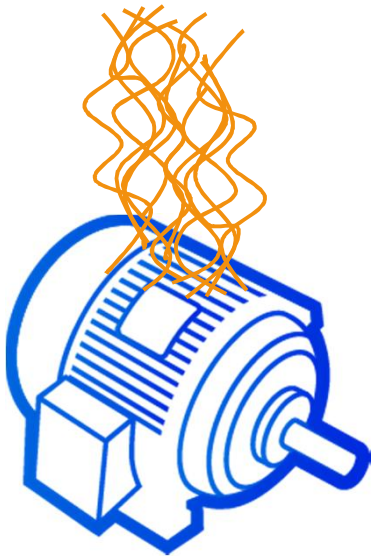
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PSTX – Technical features
Motor heating

Increase application productivity

Prolong life of your motor by reducing moist inside it and ensure that the motor always is ready to start which increases application availability

- Staring a motor which has moist inside, will reduce the life time of the motor. Instead, by carefully heating up the motor the moist can be reduced.
- Motor heating helps prevent the motor from freezing and to reduce moist from condensation
- Suitable in cold and humid environments (also consider condensation)
- The functions' setting is design so that it is easy to replace an outdated softstarter with an external heating system

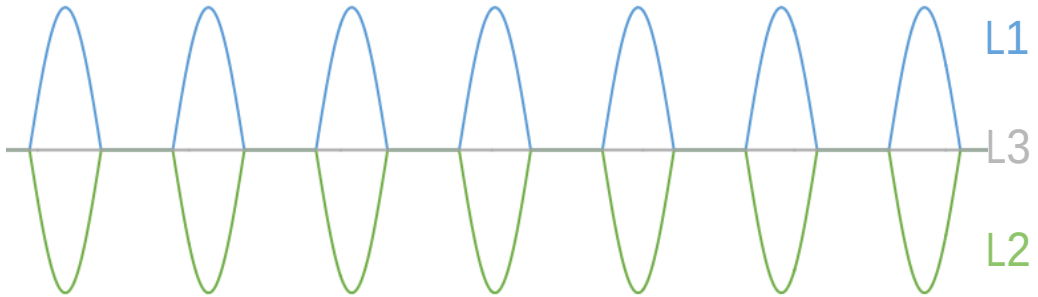


PSTX – Technical features
Motor heating

Increase application productivity

Technical description

- Motor heating is performed by controlling two phases and blocking the third one
- In the two phases two anti-symmetric half sine curves are generated with a particular thyristor triggering sequency
- Due to this, the rotor of the motor will not rotate. Instead all excessive torque will generate heat
- To ensure an even temperature inside the motor, the winding that is heated is changed with a specific time interval

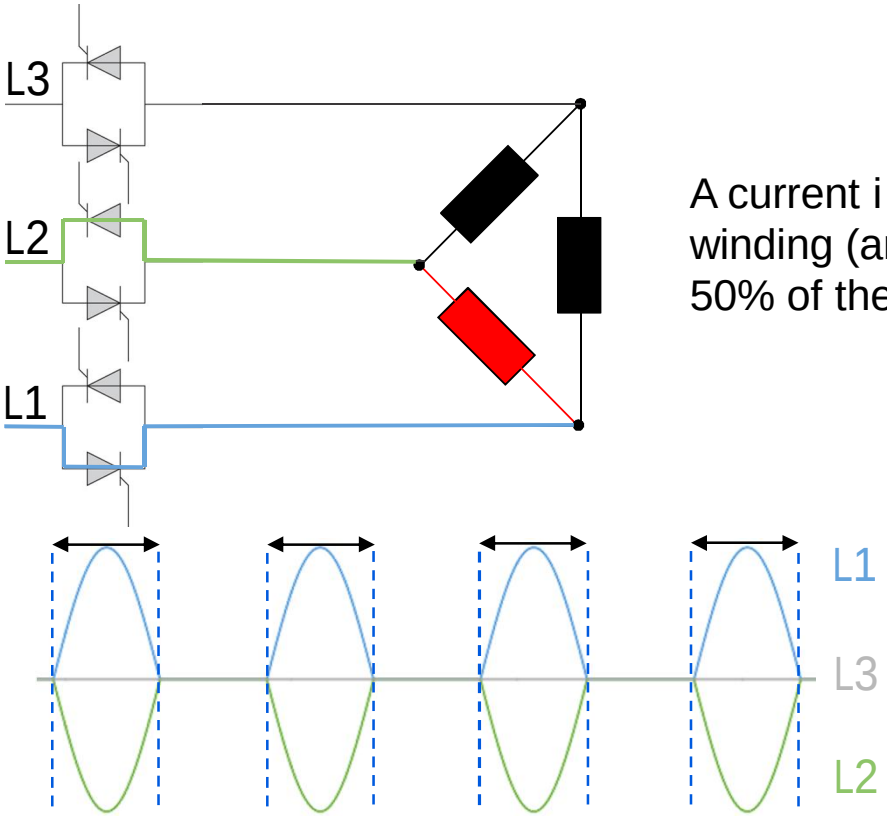


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PSTX – Technical features
Motor heating

Increase application productivity

Technical description

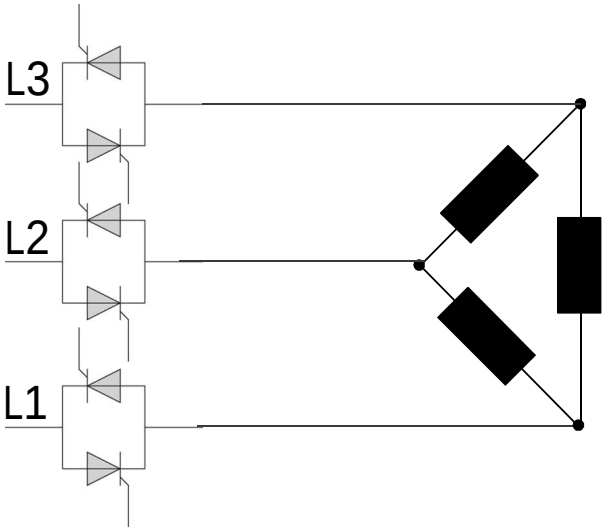


A current i running through the winding (and phases) during 50% of the time

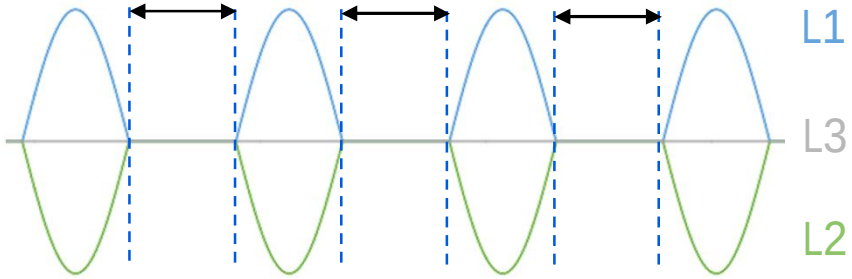
PSTX – Technical features
Motor heating

Increase application productivity

Technical description



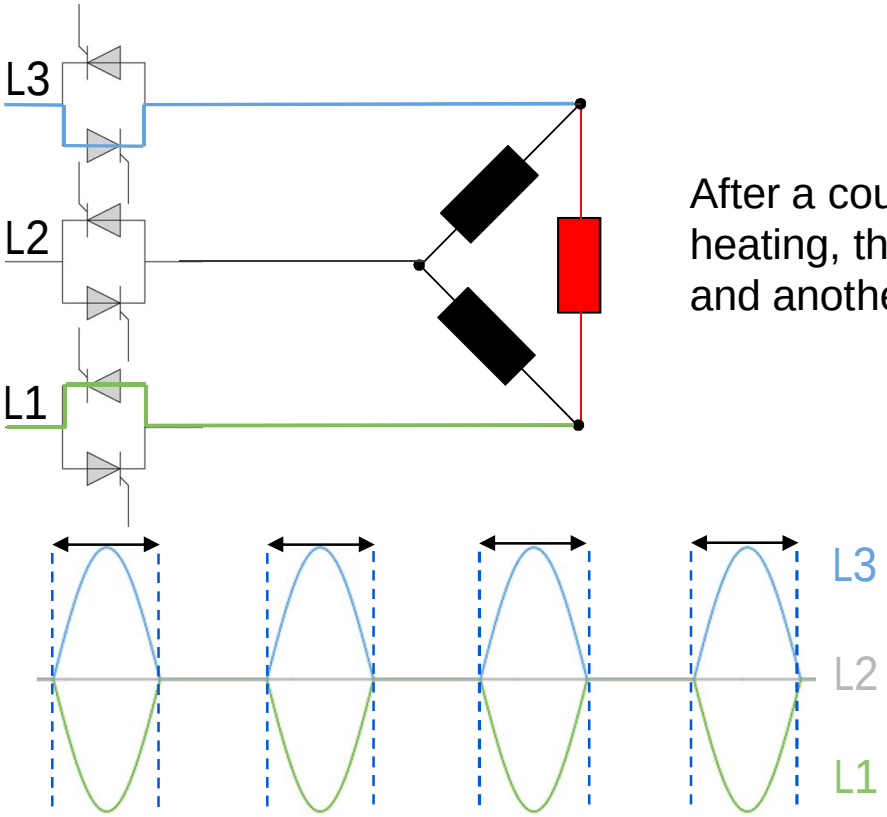
NO current i running through the winding (or phases) during 50% of the time



PSTX – Technical features
Motor heating

Increase application productivity

Technical description



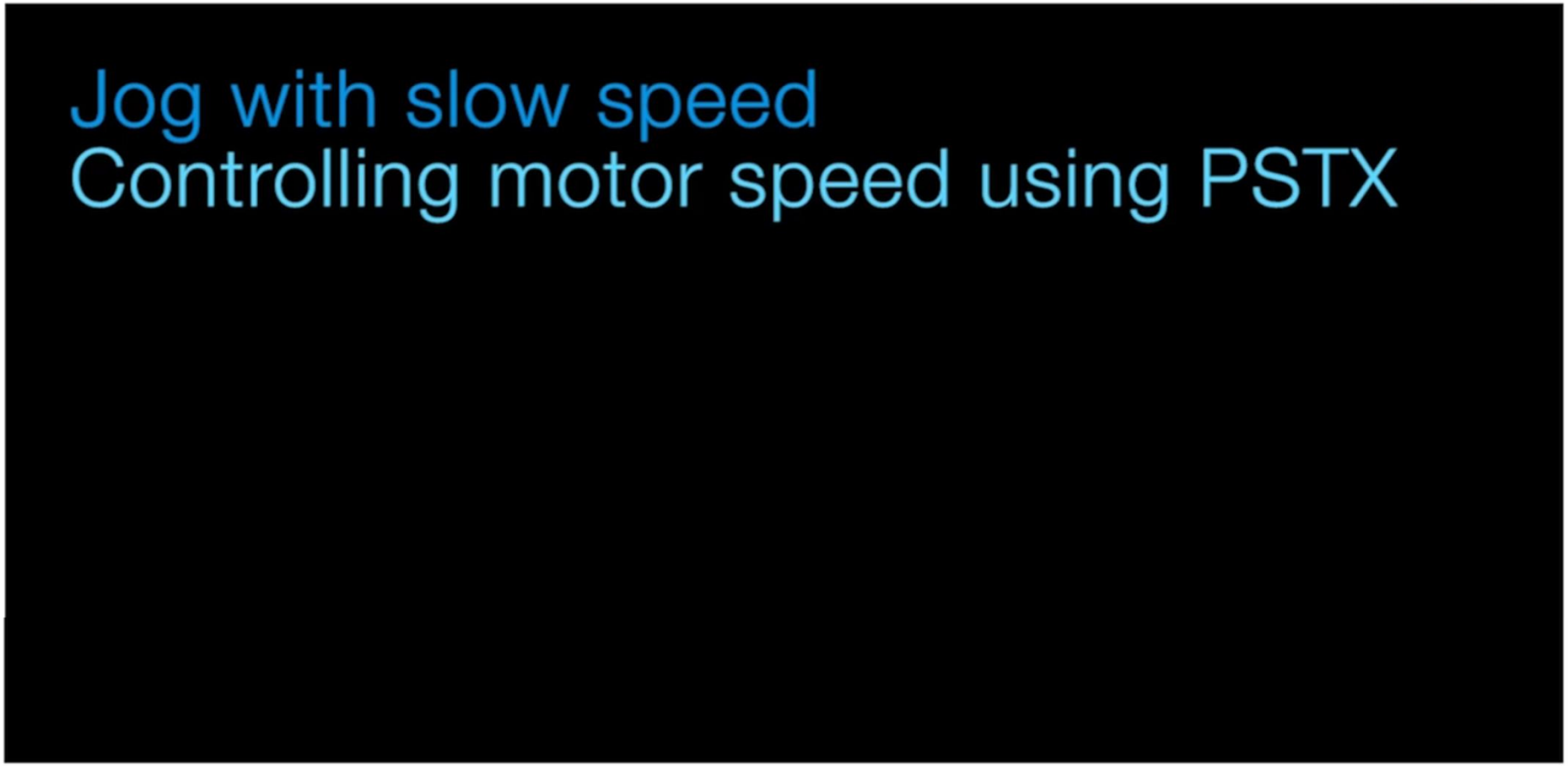
After a couple of seconds of heating, the phases are shifted and another winding is heated

Jog with slow speed

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PSTX – Technical features
Jog with slow speed



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PSTX – Technical features
Jog with slow speed



Increase application productivity

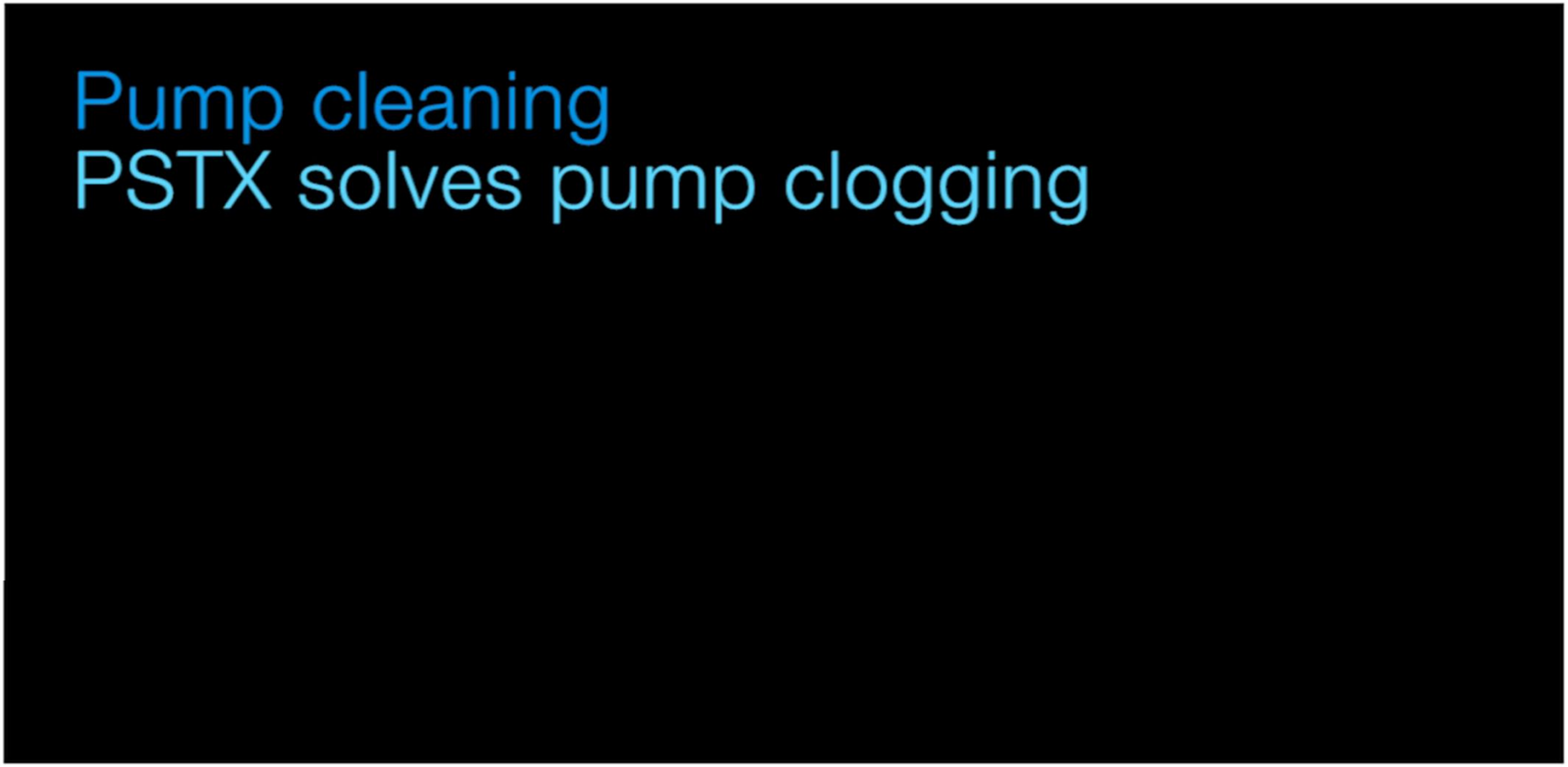
Improved process efficiency, reduced downtime with higher application productivity and lower maintenance cost

- Run the motor in slower speed, both forward and backward
- Speed regulation without the need of a drive
- Typical applications: Positioning conveyor belts after stops, simplifying maintenance inspection, pump cleaning etc.
- Superior function for clogged pipes and jammed pumps
- Three different speeds forward and backward respectively
    - 33%, 14%, 8%, -9%, -20%, -33% of rated motor speed

Pump cleaning

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PSTX – Technical features
Pump cleaning



Power and productivity for a better world™

PSTX – Technical features
Pump cleaning

Increase application productivity

Increased application availablity with minimized down time due to fewer clogging pipes and jamming pumps

- The pump cleaning function comprises kick start and jog with slow speed
- Due to the shape of the blades in a pump, a kick start could help start a jammed pump by slicing through stuck objects in the pump
- Reverse jog gives the opportunity to move the water backward which could help remove stuck objects
- The pump cleaning is conducted manually
- In future software release: ”Automatic pump cleaning” and ”Indication of need of pump cleaning”

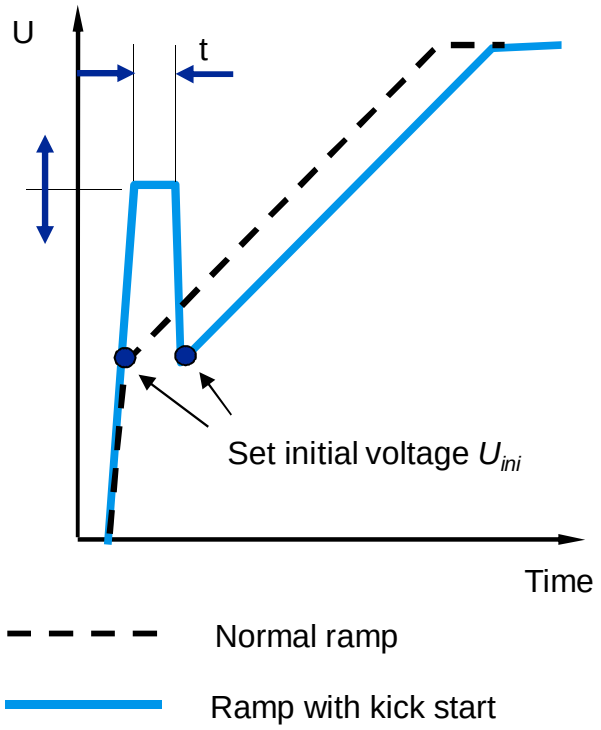
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PSTX – Technical features
Pump cleaning

Increase application productivity

Technical description – Kick start

- Kick start similar to a full voltage start initially combined with a smooth start ramp
- The kick start is performed prior the start ramp and needs to be activated
- For full control, there are two settings to consider; the kick-start level (%) and kick start time (t)



Stand still break

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PSTX – Technical features
Stand still break



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PSTX – Technical features
Stand still break

Increase application productivity

Increase the level of control of the system without the need of extra and costful equipment

- The softstarter can hold the rotor still and making sure that there no back-spin occurs
- No need of extra equipment
- Air flow can resulit in fans running by themself
- In dual fan applications where one fan is still, there is a risk of one fan is running backward due to air flow from the first fan
- Function developed mainly for fans

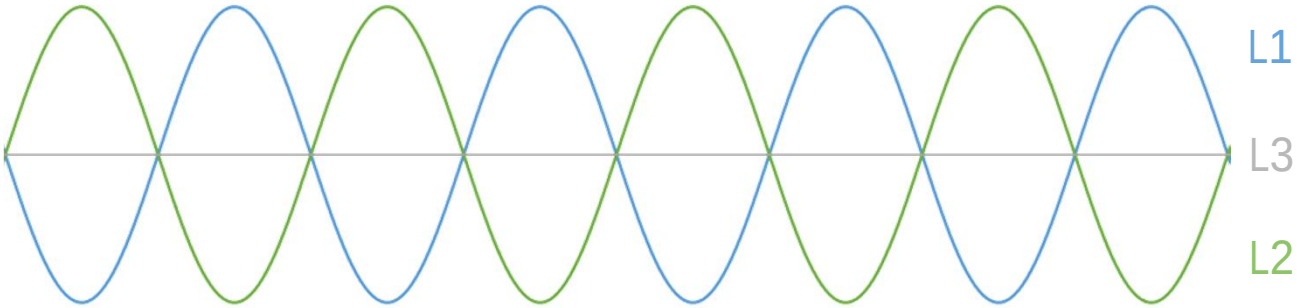


PSTX – Technical features
Stand still break

Increase application productivity

Technical description

- Stand still break, also named ”Anti back-spin”, works in a similar way as motor heating
- DC-pulses for each half period (instead of every period as in motor heat)
- This generates a stationary magnetic field
- The rotor has a propensity to align with the surrounding magnetic field
- If the field is stationary no rotation of the rotor in the motor will occur



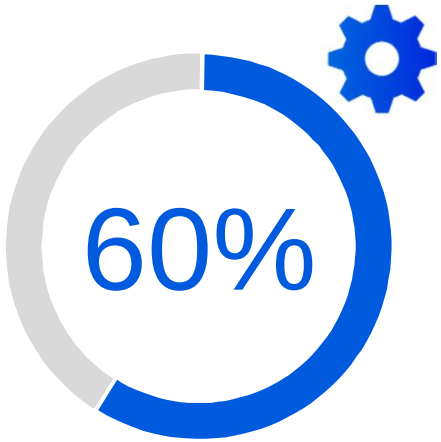
Secure motor reliability

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PSTX – Technical features
Secure motor reliability

Secure motor reliability

- Locked rotor protection
- Underload protection



60% lower starting current. Increasing motor lifetime.

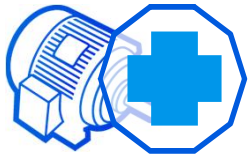
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Locked rotor protection

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PSTX – Technical features
Locked rotor protection

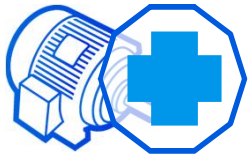


Secure motor reliability

Increase motor life time and reduce service cost with faster protection against overheating

- Pumps in waste water industries often experience jamming and clogging
- A jammed pump results in an increased current which could be harmful for the motor
- The feature is a fast protection which reduces the risk of damage to the motor
- Less damage gives lower cost of service

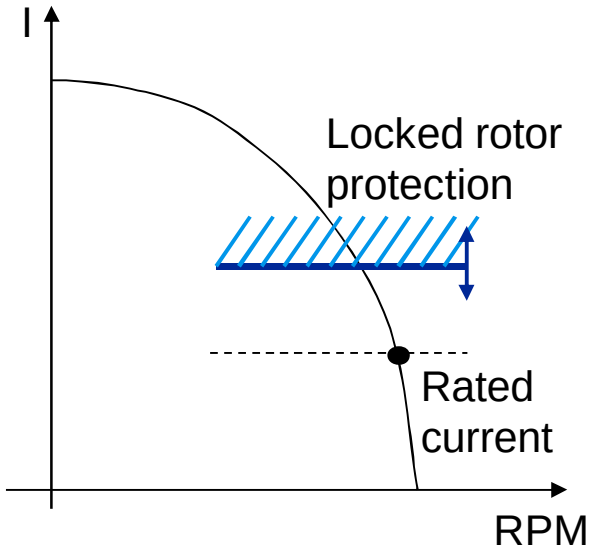
PSTX – Technical features
Locked rotor protection



Secure motor reliability

Technical description

- The protection is similar to the EOL
- An upper limit for the current is used as a tripping level
- It can be used to protect surrounding equipment
- Compared to the EOL, faster protection also means lower motor temperature increase ➔
- ➔Less down time due to less time waiting for the motor to cool down



Current and power factor underload protection

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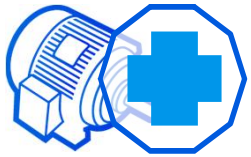
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PSTX – Technical features
Underload protection



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PSTX – Technical features
Underload protection



Secure motor reliability

Prolong system life time and save money with minimized risk of breaking equipment

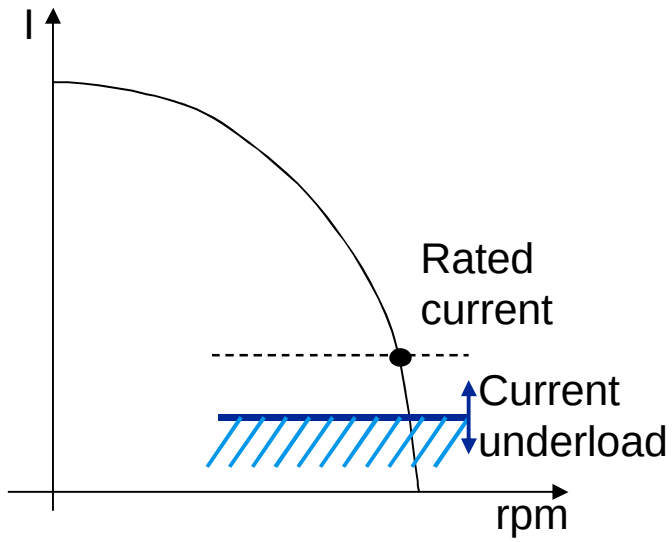
- A situation where a pump is running dry could be harmful to surrounding equipment (bearings, spacers, …)
- The same goes for a snapped conveyor belt
- Two different type of protections for when the load drops:
  - Current underload - based on the current
  - Power factor underload – based on cos φ
- Protections only available in top of ramp
- Suitable both for applications with constant and varying load, just find a suitable vaule for the tripping

PSTX – Technical features
Underload protection - Current

Secure motor reliability

Technical description – Current underload

- Current underload protection – current drops below a predetermined level
- Current measured by the current transformers
- Active after top of ramp



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