SAER – SOFTSTARTER & Sub. Motors

- The softstarter makes use of the fact that when the motor voltage is low during start, the starting current and starting torque is also low.
- During the first part of the start the voltage to the motor is low. Gradually, the voltage and the torque increase so that the machinery starts to accelerate.
- Another feature of the softstarter is the softstop function, which is very useful when stopping pumps where the problem is water hammering in the pipe system at direct stop as for star-delta starter and direct-on-line starter.

Increased temperature during ramp times

- By using a softstarter the voltage is reduced during the start sequence with the result that the motor torque is reduced. During the start sequence the softstarter increases the voltage so that the motor will be strong enough to accelerate the pump to the nominal speed without any torque or current peaks.
- A normal starting current with a softstarter when starting a fully loaded centrifugal pump is approx. 4 times rated motor current.

Eg: motor type MSX302-220 kW – 460V / 60 Hz – 2 poles - Delta

- Rated current: 343 A
- Cosϕ = 0,89
- Starting current – DOL= 2.298 A
- Starting current – operated via softstarter @ 65% of rated voltage (300 V) = 1245 A (3,7 times the rated current)
- By considering a starting ramp of 20 s, the average absorbed current is several times the rated current for a considerable long time!
- Since the temperature increase due to Joule effect, in a very short time the winding temperature reaches very high values.
- Furthermore, due to low rpm, the cooling flow around the motor is negligible.

→ The first problem caused by setting to long ramp times is the increased temperature of the winding.

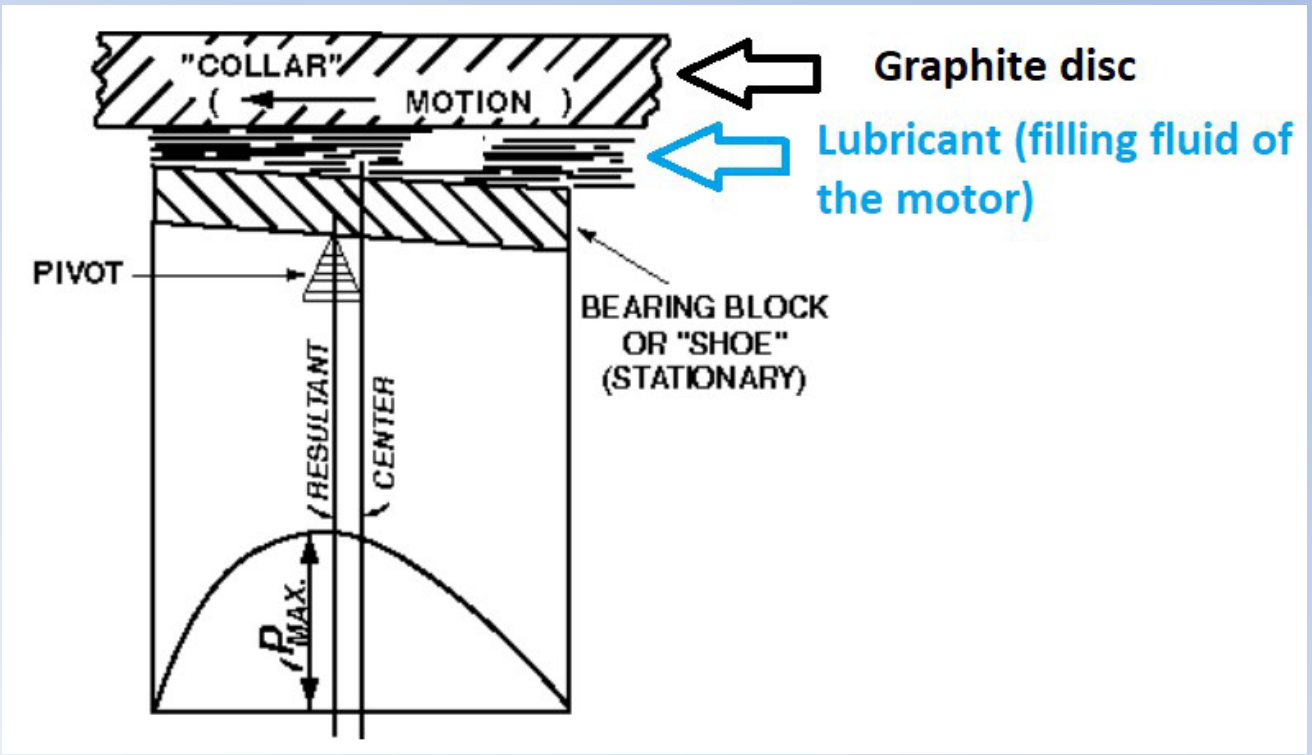
For PE+PA submersible motors, the max allowable temperature of the winding is 90°C. For a standard «surface» motor with Class F insulation, the max allowable temperature of the winding is 155°C

→ The reccomendations given for standard IEC or NEMA surface motors are not valid for water filled rewindable submersible motors.

Wear of the «sliding» components

- Inside the motor there are «sliding» components: journal bearings, mechanical seal and, mainly, thrust bearing.
- The thrust bearing assembly is made by a graphite disc over a cage with sevaral «shoes» made of steel.
- While working, the thrust bearing has a «water meatus» between the graphite disc and the shoes cage.

Axial thrust bearing working



- When the motor is still, the Graphite disc (collar) relay on the shoes
- When starting the motor, during the starting time, the friction between the disc and the shoes is high because is static (static friction coeff.) and there's no water meatus.
- If the starting torque is too low it doesn't overcome the load torque (due to the static friction) and this damages the sliding components.
- Once the graphite disc is damaged, the thrust bearing is unable to create the water meatus and so it is unable to work properly. At each starting the damage increases.
- To avoid these problems, most advanced soft starters allow to set an initial torque «boost». This features is used to set a value of torque (or voltage) for a very short time (some msec.) needed to win the static friction of the sliding components. After this short time the starting ramp continues. This feature has different name according to the softstarter brand: «torque boost» ; «voltage boost»; «kick start» etc…

SAER RECOMMENDATIONS

- Acceleration and deceleration ramp time: max 4 s
- Minimum voltage: 65% of rated voltage for motors with rated power> 37 kW, 55% for motors with rated power ≤ 37 kW.
- Use soft starters with torque boost feature and generally, with specific features for centrifugal pumps
- Must have a bypass to exclude the IGBT once pump is started
- Check the soft starter resizing according to the starting condition of the pump (open or closed valve….)