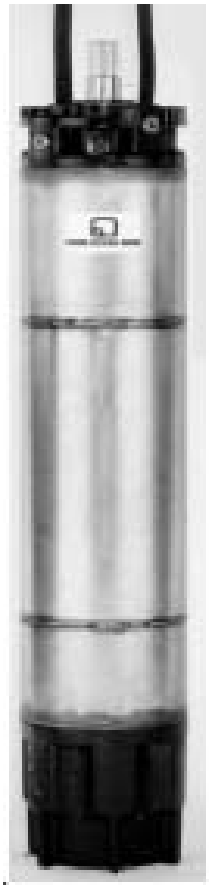
# KSB AMACAN P/K, KRT, AMAREX and UMA/UPA



**Instructions for use of KSB immersible and submersible motor–pumps AMACAN P/K, KRT, AMAREX and UMA/UPA with soft starters**

**Works Nº:** _____

**Type series:** _____

**These operating instructions contain fundamental information and precautionary notes. Please read the manual thoroughly prior to installation of unit, connection to the power supply and commissioning. It is imperative to comply with all other operating instructions referring to components of this unit.**

**This manual shall always be kept close to the unit´s location of operation or directly on the pump set.**

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## 0. General remarks on soft starters

Soft starters reduce torque and starting current of electrical motors during starting by decreasing the supply voltage. A simultaneous frequency variation - and, thus, a speed variation as with frequency converters - does not take place. After starting period motor will run at full supply voltage.
Soft starters are also called electronic starters. Being an alternative to the classical star-delta starting they are more and more displacing the latter one, despite of the fact that - taking into account all costs - a star-delta start is considerably cheaper up to a motor rating of 100 kW.

## 1. Function of soft starters for immersible and submersible motor - pumps

Soft starters are able to **reduce starting current of immersible and submersible motor - pumps to certain limits**.
Reduction of pressure and torque impulses in pumps propagated by manufacturers of soft starters is only possible to a very limited extent as far as immersible and submersible motor - pumps are concerned (refer to para. 5.)

## 2. Selection of soft starters

Soft starters should first of all be selected according to following criteria:

1. Rated motor current $I_N$ (data on nameplate)
2. Maximum starting time of motor (refer to para. 5)
3. Minimum starting current ratio $I_A$ / $I_N$ of motor (refer to para. 5)
4. Starting cycles per hour (see below)

Make sure not to exceed following **maximum switching cycles admissible for immersible and submersible motors:**

**per hour: 10 starts, in regular intervals**
**per year: 5,000 starts**

**We recommend to use soft starters of renowned manufacturers only.** So-called "no name" products may cause considerable loads or even destructions of connec-ted units, both when starting and during continuous operation. In any case the manu-facturer shall be asked for relevant references.
Besides, it is very important **that voltage variations by soft starters are done in all three phases and full wave** (with "half wave", only half of a sinusodial voltage wave will be varied).
A **reduction of motor rating** (as necessary with frequency converters) is **not required** when using soft starters.
Further notes on selection and adjustment of appropriate devices are to be found in paras. 4 and 5.

## 3. Connecting immersible and submersible motor - pumps with soft starters

Units of all type series are connected with soft starter **in the same way as for direct start mode**.

## 4. Protective devices of soft starters and connected motor

Basically, soft starters are equipped with internal monitoring devices. Some manufacturers provide motor-protecting functions such as:

- thermally delayed overcurrent relay
- anti-lock/short-circuit protection
- monitoring of winding temperature
- switching cycle and starting time control

As far as **immersible and submersible motor - pumps** are concerned, it is recommended to **use soft starters with as many motor - protecting functions as possible**. Very often drive unit can be monitored by means of a single, compact soft starter device.
If **flameproof immersible pumps** are applied, soft starters cannot replace required monitoring equipment. **Follow instructions for motor monitoring of corresponding operating manual!**

## 5. Adjusting parameters and options of soft starters

### 5.0 Adjustment in general

Due to voltage - variation soft starters have an impact on starting current, motor torque and hence, on starting time as well. Motor torque curve and starting current are however mainly influenced by motor design.
Consequently, we cannot give any general recommendations in terms of quantity to adjust various parameters. That is why following comments in this instructions regarding only quality.
Starting and stopping times of immersible and submersible motor - pumps are very short because of their low moments of inertia (from 1/10 up to a few seconds).
**Considerable prolongations of the "natural" starting and stopping times will cause additional thermal and mechanical loads on motor.**
**As far as adjusting possibilities for soft starters are concerned, the well-known principle is valid here as well: Less (adjusting) is often more (lifetime of drive)!**

### 5.1 Starting via variable voltage ramps and ramp periods

This is the most common soft start method, for which a starting voltage will be set in percent of the rated motor voltage (depending on product, 0 ... 90 %) as well as a voltage ramp period (depending on product, 0.5 to 60 s), in which voltage is rising from a starting value to the rated voltage. Basically, experience has shown following in principle:

#### 5.1.1 Minimum starting voltage

To exceed static frictions of pump and to avoid excessive starting times (refer to 5.1.2), **we recommend a starting voltage of 50 % of the rated motor voltage**.

#### 5.1.2 Ramp period/starting time

The ramp period is not identical with real starting time of motor.
**A maximum starting time of 4 s** of pump motors in question is to be kept until rated speed ("full" speed) is reached. For this purpose the minimum ramp period, which is possible at soft starter, shall be kept. This is usually =? s.

#### 5.1.3 Starting current reduction

Below a minimum voltage value no further reduction of starting current is possible. There is no significant influence of ramp period on starting current.

#### 5.1.4 Pressure rise-up time

Pressure rise-up time may be extended to some seconds at a maximum by not exceeding maximum starting time of 4 s as said under 5.1.2.

### 5.2 Starting via variable current limitation

This is a soft-start method applied more and more, whereby only a certain limit for ratio starting-/rated current of connected drive is set (e. g. $I_A / I_N = 3.5$).
Provided that minimum starting current ratio is known, this single adjusting parameter will be sufficient to have pump starting at a reduced starting current without delaying starting unnecessarily or endangering drive unit.

#### 5.2.1 Starting time/ramp period

The starting time results from a set value of reduced starting current and accelera-tion
torque of drive unit resulting from it. For safety reasons ramp period should be adjusted to lowest value possible, and starting voltage should amount to 50 % of the rated motor voltage (refer to 5.1.2 and 5.1.1).

#### 5.2.2 Minimum limit of ratio starting-/rated current

If set reduced value of starting current is too low, it won't be possible to start drive unit (soft starter will be switched off due to internal current control or full rated voltage will be applied to drive unit, i. e. direct start of drive after a certain time), or drive will only accelerate very slowly. Both may result in an unnecessary and dangerous motor load.

**Minimum starting current ratio IA/IN depends on motor type. To find out correct value motor design and development department shall be consulted. It will never be less than 2.5.**
Especially with units designed for direct start – such as pipe shaft-mounted pumps AMACAN P – minimum starting current ratio can be considerably higher than $I_A / I_N = 2.5$).
For starting of all immersible pumps, theoretical torque / current curves can be made available by motor design and development department.

### 5.3 Stopping via variable voltage ramps and slow-down period

**In principle, this stopping method is not advisable for immersible and submersible motor - pumps.**
**Especially with submersible motor - pumps, sleeve bearings may be damaged, if respective unit is operated for more than 2 - 3 s below specific minimum speed.**
By this method one cannot achieve a considerable reduction of pressure and torque pulses with immersible and submersible motor - pumps. Therefore a soft stopping only results in an unnecessary load for the motor.

### 5.4 Starting and stopping via pump functions

Some manufacturers of soft starters propagate starting and stopping functions especially for pumps, means multi-stage ramps for starting and stopping. In this respect particular attention is to be paid to comments in 5.1 and 5.3.
**Basically, this special "pump function" must not be taken.**

### 5.5 Kick start/Boost

A "kick start" or "boost" may be applied with some soft starters to exceed a high breakoff torque. As for kick start drive will be supplied with a very short pulse of the rated voltage before starting is effected by means of voltage ramp described in 5.1. This start pulse leads to a starting current peak and to a torque impulse such as with a direct start.
**This function is an unnecessary burden for immersible and submersible motor - pumps and must therefore not be supplied.**

### 5.6 Speed variation - cos f - /economy function

Some types of soft starters have options to vary speed and to optimise cos f during operation (economy).
This function leads to excessive thermal and mechanical motor loads which are not permitted.
**During operation (after starting) of pump soft starter shall always be bridged by means of a by-pass or shall applied by the full rated voltage. Speed regulation of immersible motor or submersible motor - pumps by means of soft starters is not allowed.**

## 6. Vibrations, torque pulses and pulsating torque

Starting of units with electrical motor drive at soft starters results in a highly harmonic voltage supply of drive unit due to reduction of supply voltage. This brings about several negative side effects.

- feedback to electric supply in form of "impurities" in sinusoidal voltage supply, electromagnetic interferences (refer to 8.) as well as supply distortion due to reactive power caused by soft starters control circuit.
- vibrations and pulsating torques on drive unit with 6 - times supply frequency.
- additional heating up of motor (refer also to 5.6).

These effects are normally uncritical for driven pump units because of short starting phase, provided that comments given in these instructions are observed - in particular with regard to keep maximum switching cycles and starting times - and that any additional function of soft starter is avoided.

## 7. Noise

Due to harmonics mentioned under para 6., electromagnetic noise may be produced in drive under circumstances - even during short starting phase.
**Remarkable noise in starting phase is a symptom of incorrect adjusting parameters.**
If a strange noise is also noticed during operation of immersible and submersible motor - pumps, it will be absolutely necessary to check whether soft starter is really bypassed or supplied by the full rated supply voltage (refer to 5.6).

## 8. Electromagnetic compatibility EMC

Motors of immersible and submersible motor - pumps are three-phase asynchronous motors. Strictly speaking, they do not fall under EMC Guideline 89/336/EEC. These motors are in conformity with this standard, in particular with regard to the harmonised European standards EN 50081 and EN 50082 (CE marking). If individual components of an installation get CE marking (as, of course, for soft starter itself), this does not mean that complete installation will automatically bear this marking too.
In fact, even if electromagnetic interferences the complete system " supply - soft starter - cable - pump drive" may normally only occur during short starting procedure, respective protective measures at soft starter should nevertheless be taken to avoid undesired interferences.
In certain cases, this may also include input (line) and output filters in soft starter as well as a cable screen with EMC protective tube - if required in addition. Earthing of screen has to be done according to instructions given by manufacturer of frequency converter. Select a suitable cross section so that discharge currents do not exceed admissible values.

## 9. Reactive current compensation

**A compensation of reactive current between soft starter and drive shall always be prevented.**
In case of reactive current compensation between soft starters and power supply, such as central compensation systems, responsible installation experts shall take measures during engineering phase of complete installation that this compensation cannot cause disturbance at any drive unit

## 10. Operation of flameproof motors with soft starters

Immersible motor pumps with an EExd protection can be operated with soft starters **without any restriction provided that they have a device for direct monitoring of winding temperature.** This is valid for immersible motor pumps by KSB.
The following is recommended by the PTB authority regarding application of soft starters together with flameproof immersible motor pumps:

1. application of soft starters approved by the PTB
2. no application of economy / cos f and speed variation functions