LIQUID STARTER
FOR SLIP RING MOTORS
FROM 250kW to 10.000kW

AKEP Solutions for Cement Plant
SMOOTH START WITH HIGH TORQUE

For applications in which the load presents a high starting torque and/or a low starting current, the wound motor (slip ring motor) provides unique starting characteristics.

The issues

Wound Motors offer the possibility to adapt motor starting characteristics to the driven load by adjusting the secondary motor resistor. AKEP Liquid starters with their continuous resistance variation were designed to progressively start a wide range of large slip ring motors (stepless) compared to multistep resistor systems specifically designed for one application. Liquid resistance can be easily adapted for a specific need as motor replacement.

AKA solution

AKA developed a robust and reliable range of liquid starters suitable for heavy duty applications such as mines, cement plants, shredders or conveyors. Since 1990 AKA focused in improving its starter performance so it can meet very specific requirements for special applications. Thanks to R&D effort, AKA achieved unprecedented starting resistance ratios, up to 150.

Starting is smooth, without any mechanical shocks and starting current can be limited to very low values.

Key benefits

- Robust, simple and reliable
- Stepless thanks to a continuous variation of the resistance
- Easy to adapt to different motor
- Cost effective: One shorting contactor compared to multi stage metallic resistors with multiple contactors for traditional starters
- Low maintenance costs (minimizes shocks, and energy usage)

AKEP advanced features

- Best performances up to 150 ratio
- Optimum control over starting current, torque & motor load acceleration
- AKAMAS: device which measures the torque & speed in real time (option)
- Modular construction
- Expertise in liquid starter applications: AKA will adapt and configure AKEP to special requirements and applications
MODULAR CONSTRUCTION FROM 250kW TO 10.000kW

Tank

Four tanks to cover the range made out of steel or Stainless steel 304 (option).
Tank can be custom designed for specific applications.
Tank wall thickness: 3mm
Volume: 750L, 1500L, 2500L, 4500L
Tank Protection: IP42

Panel

Three types of panels to suit the shorting contactor:
1, 2 and 3 doors panel. Panel protection: IP56

Electrodes

Two material for electrodes are available:
- Stainless steel for standard applications.
- Cast alloy for heavy duty applications
  Resistance Ratio: 150 (option)

Electrode drive mechanism

It is the heart of the liquid starter. It consists of a geared motor, a screw and nut moving a set of mobile electrodes.
The drive mechanism is a mechanical assembly independent of the tank that can be taken off for maintenance.

AKA Automatismes
ZAC du bois Chaland
15 rue des Pyrénées, 91090 LISSES
+33(0)1 69 76 16 65
+33(0)1 64 97 84 27
**SLIP RING MOTOR STARTING**

**Principles**

The secondary liquid resistor is connected to the slip rings of the motor. Resistor is constituted by the electrodes and the electrolyte in the tank. The electrodes' drive mechanism moves the electrodes modifying the value of the resistance. During start up the resistance value is reduced from R_{max} to R_{min}.

- R_{max} when electrodes are in "Ready to start", up position.
- R_{min} when electrodes are lowered and reach down position, "End of start"

**Resistance ratio**

It defines the liquid starter : R_{max}/R_{min}

- Standard Ratio: For basic application as cement plants with driven loads as Ball Mills, Raw Mills, Crushers, Fans ...
- Ratio 150: For high performance applications as mining operations and driven loads as : mining Ball mills, Sag mills, Conveyors, Shredders

The two technology differs mainly by the design and technology of the electrodes.

The announced ratio's are measured on site in real operations.
Conveyor Belts

Are characterized by a specific starting process like:
- Pretension of the belt at 5% FLT
- Automatic adjustment of startup unloaded or loaded: 50% to 150% FLT depending on belt material, at optimal starting time.
- Constant torque startup: at a preset value at 120% FLT
- Creep speed at 15% of belt speed (85% slippage)
  It may require a heat exchanger.

Slip recovery system

AKA Liquid Resistance Starters is designed to work with Slip Energy Recovery systems.

Heat exchangers

This option is available for any application that requires frequent starts that generates substantial heat in the tank.

**Specific Applications**

**Dual Starters**

For large applications it is quite usual to find two or three motors driving a common load. The conditions for proper operation are the following:
- Common resistor
- Resistance variation strictly identical: electrodes position synchronized by chain.
- Common short circuit contactor
- AKAMAS monitoring measure in real time rotor currents of both motors and activate pre-alarm if the differential current value is greater than that preset.

Dual drives are designed either with 2 tanks or with 1 single tank containing 2 sets of electrodes.

**Shredder drives**

A dynamic torque adjustment is necessary to prevent HV motor stall. The optional AKAMAS is then commonly used to control the AKEP liquid starter, adjusting the rotor resistance based on the torque and slippage it calculates.

**AKAMAS**

**Torque and Speed real time measurement**

AKA developed this powerful digital system able to measure with great precision rotor currents whatever the frequency (50Hz or 60Hz to 0.1Hz during startup) as well as motor speed. It computes motor slippage and frequency too. The AKAMAS is an unparalleled device which shows exactly what is happening in the motor during start up. It interfaces with the AKEP. The starting torque or current can thereby be adjusted to safely meet the requirements.

**Starting simulation tool**

A simulation tool running on PC is available to validate and evaluate the performance of the system before its implementation.
### AKEP RANGE

#### Single drive

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<tr>
<td>Starting Torque= 120%</td>
<td>40°C</td>
<td>2.000W</td>
<td>3.000kW</td>
<td>5.000kW</td>
<td>10.000kW</td>
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<tr>
<td>Starting Torque= 120%</td>
<td>40°C</td>
<td>1.500kW</td>
<td>2.700kW</td>
<td>4.500kW</td>
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<tr>
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<td>2.000kW</td>
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<td>6.200kW</td>
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<tr>
<td>Volume</td>
<td></td>
<td>1000 L</td>
<td>1500 L</td>
<td>2500 L</td>
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#### Dual drive

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<tr>
<td>Volume</td>
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<td>2500 L</td>
<td>4500 L</td>
<td>9000 L</td>
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*3 starts from cold and 2 starts from hot*
### AKEP DIMENSIONS

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<th>L</th>
<th>L*</th>
<th>H</th>
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<td>2 861 mm</td>
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L* Dimension with pump system

H* Dimension with “sun roof” option
Since its creation in 1988 AKA continuously innovated in order to strengthen its position as a significant European manufacturer of power electronics and motor control. By focusing on Research and Development, AKA has built up know-how in the control of electric motors. The developed products are competitive on national and international markets and exports account for more than 85 % of turnover.

More than 800 AKEP are in operation worldwide in Cement and Mine plants

THEY TRUST US

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ZAC du bois Chaland
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+33(0)1 60 76 15 55
+33(0)1 64 97 84 27