

GINO-AKA

Industrial Automation



Liquid Resistance Starters

Product Data Catalogue



1 General Information

When a wound rotor induction motor (WRIM) is started the torque that is generated by the current must be higher than the load starting inertia to induce the rotation of the motor. The required load torque depends on each application and its specifications as the mass of the moving parts, inertia and friction values and materials within the application affecting the operation.

Without a starting resistor, the starting rotor current would reach up to 7 x rated current which would negatively influence the supply grids. Further, it is possible to generate a smoother starting curve which protects electrical as well as mechanical components of the application and the motor and assures a smooth startup of the system. Therefore, liquid resistance starters LRS are commonly used to start up WRIM motors.

For liquid starters, the electrolyte solution of Na_2CO_3 or K_2CO_3 acts as a resistor, with the resistivity, in turn, depending on the soda concentration. By changing the distance between the upper and lower electrodes, the resistance is reduced smoothly. In addition, the fluid acts as an energy storage medium for the dissipated heat during start-up procedures. Following the start-up, the energy is then slowly dissipated to the atmosphere over the tank surface (heat exchanger for faster cooling can be supplied optionally).

This system is predominantly used where the process does not require speed control and the application requires a very high starting torque. With the AK type starter series, GINO-AKA provides a cost-effective, reliable solution for the cement and industrial sector. For the minerals market, particularly for Ball and SAG Mills, GINO-AKA developed the MAK type starters with additional features for the specific demands.

The robust design guarantees high operational reliability and long service life. Advantages of the GINO-AKA liquid starters type AK and MAK at a glance:

- Smooth, stepless start-up of slip ring motors
- Adjustable starting times
- Triangular alignment of electrodes for balanced current density
- Protection class: IP 55
- Global commissioning and service structure
- Bushings above water level
- Scalable for dual pinion drives

Typical applications of the GINO-AKA starters:

- Ball Mills
- Cement Mills
- SAG Mills
- Crushers
- Shredders



2 Design Overview

Cabinets in separate sections for controls and feed

Tank for electrolyte solution and electrode system

Drain valve



Spindle drive with emergency hand wheel

Fully removable electrode drive module for easy replacement and maintenance

Electrode sled with mechanical protection against jamming

Electrodes arranged in triangular position



3 System Information

Standard Equipment	<ul style="list-style-type: none"> • Electrode material: Stainless steel 1.4016 or cast alloy (TDR120:1) • Crouzet SMART PLC controller with ethernet • ABB short circuit contactor • Agitator • Visual level control • Temperature protection: Warning at 70°C, tripping at 75°C • Separate cabinets for LV control and HV feed • Cabinet heating with thermostat and hygostat • Drainage valve • Auxiliary terminals for the customer's control • Painting RAL 7000 • Tank material: Steel 1.0037 (optional: 1.4301, unpainted)
Protection class	Starter: IP 55; Switch board: IP55 (acc. to DIN 60529:2019-06)
Ambient temperature	0 °C to +40 °C, deviating temperature range upon request
Installation height	Up to 1000 m above sea level, higher altitudes upon request
Electrolyte fill	<ul style="list-style-type: none"> • Electrolyte powder (Na₂CO₃ or K₂CO₃) supplied in 25 kg bags • Each starter is delivered with quantity for first commissioning
Site requirements	Water quality: Fresh water
Applied standards and regulations	<ul style="list-style-type: none"> • 2014/ 35/ EU (low voltage regulations) • IEC 60947-4-1 • UL/CSA/GOST certification (optional)

4 Technical Data

Model Size	Approx. Motor Power				Max. Rotor Current [A]	Max. Rotor Voltage [V]	Max. Starter Energy at 40°C [MJ]
	Half Load	Fan	Full Load	Heavy Load			
	f=0,7 [kW]	f=1,0 [kW]	f=1,4 [kW]	f=2,0 [kW]			
AK10	2300	1600	1100	800	950	3000	190
AK15	3400	2400	1700	1200	950	3000	285
(M)AK25	5700	4000	2800	2000	2200	3600	470
(M)AK45	10200	7100	5100	3500	2200	3600	850
(M)AK60	13500	9500	6800	4700	2200	3600	1130

5 Available Extras

Local control (panel display)

The local control extra gives an intuitive interface for the control of the LRS through a HMI panel.

Brush lifting device control

Brush lifting device of slip ring motors can be integrated in the starter control system on request.

Electronic blocking control

The electronic blocking control detects jamming of a motor or the application and automatically trips the starting procedure to protect the equipment.

Rotor voltage measuring

The rotor voltage is measured and transferred to the customers control system for real time monitoring.

Customized short circuit contactor

For high current or high voltage applications that exceed the standard specifications we use special contactors from our technology partner TELARC.

Rotor current measuring

The rotor current is measured by Hal Effect CTs and transmitted to the customer control system.

Electronic level monitoring

The continuous electronic sensor monitors the electrode level between 0% and 100% of the tank volume.

Continuous temperature monitoring

The electrolyte temperature is monitored by a PT 100 and transmitted to the customer control system.

Conductivity measuring

The conductivity is continuously monitored to signal electrolyte deterioration.

Heat exchanger

GINO AKA calculates and designs a fitting cooling circuit (Electrolyte/Water or Electrolyte/Air cooling).

Circulation pump

An additional circulation pump keeps the electrolyte concentration homogeneous and speeds up the cooling process of the LRS.

Electrolyte heater

In cold environments a suitably dimensioned electrolyte heater prevents the LRS from freezing.

SER compatible

GINO-AKA LRS can be used with slip energy recovery drives and are equipped with a suitable isolating contactor as well as SER backup software.

Sunroof protection

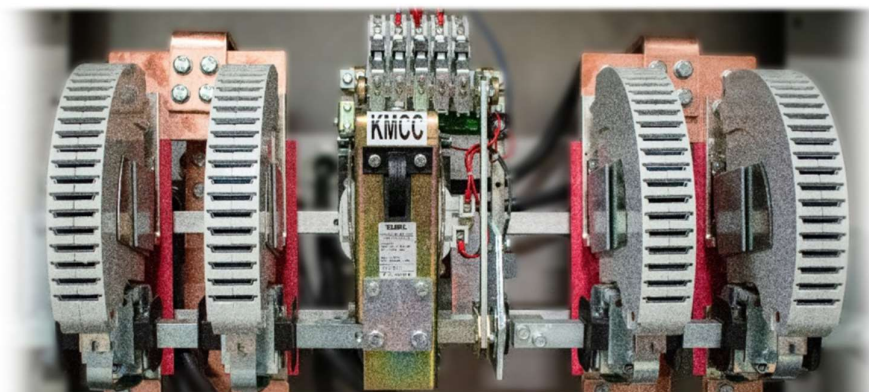
For outdoor installations this feature protects the LRS from direct sun radiation and falling objects.

Embedded AKAMAS motor monitoring device

The AKAMAS device is a tool developed by GINO-AKA to monitor the starting performance of starters.

Customized paint finish

Specific paint finish and thickness on request.



6 AKEP and MAK starters

GINO-AKA provides two unique starting solutions depending on the specific requirements of the customer and the application. For cement mills and standard applications, the AKEP series offers solid performance for a great value. For larger machines, typically used in mining applications, such as Ball and SAG Mills we offer the MAK series with additional features to reach higher performance levels.

Starter Type	AKEP	MAK
Tank volume	1000 to 6000l	2500 to 12000l
Turndown ratio	80:1	120:1
Maintenance	Low	Low
Enclosure and tank material	Mild steel 1.0037	Stainless steel 1.4301
Electrode material	Stainless steel 1.4301	Cast alloy
Short circuit contactor	Air insulated contactor (ABB)	Bar contactor (TELARC)
Dual Pinion application	✓	✓
Heat exchanger	✗	✓
Active electrode cooling	✗	✓
SER drive ready	✗	✓
Active slip regulation	✗	✓

7 Required Technical Data

Power (P, kW)

The largest driving factor for the size of the LRS is the motor power.

Rotor voltage (U_2 , V)

As specified on the motor data sheet. (This data is needed for the layout of the switchgear and bus bars)

Number of consecutive starts (z)

The value z determines the number of consecutive starts from cold condition. These are usually between 2 and 5 and describe the possible number of starts with starting time t_a and interval time $2 \times t_a$ until reaching the maximum temperature (75°C).

Starting time (t_a , s)

The starting time is the value for the duration of the start sequence in seconds and must be specified by the customer. If not GINO-AKA will use empirically determined standard times according to motor size and drive application.

Rotor current (I_2 , A)

As specified on the Motor data sheet. (This data is needed for the layout of the switchgear and bus bars)

Starter load factor (f)

The starter load factor depends on the application and must be provided by the customer.

Starting frequency per hour (h)

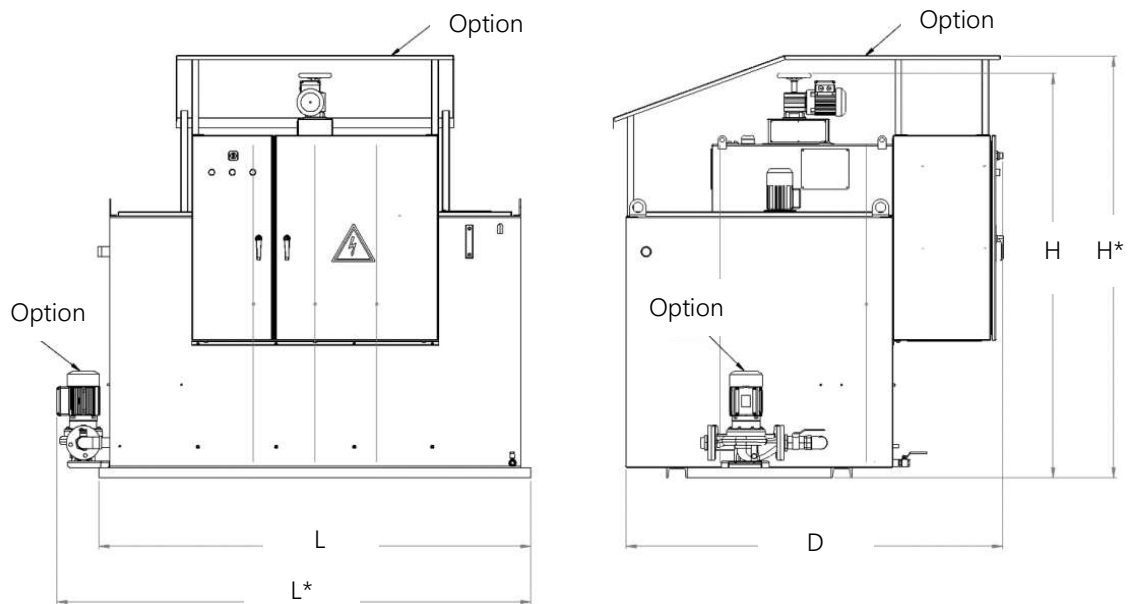
After having z starting operations and reaching the operating temperature the value h shows how many starts per hour are possible. This value must be determined by the customer as it will affect the surface needed for heat dissipation.

Environmental data

For exact calculations and in extreme circumstances we must take environmental data (extreme temperature, extreme height) into account. Please ask customer of details on the environmental circumstances of the installation site.

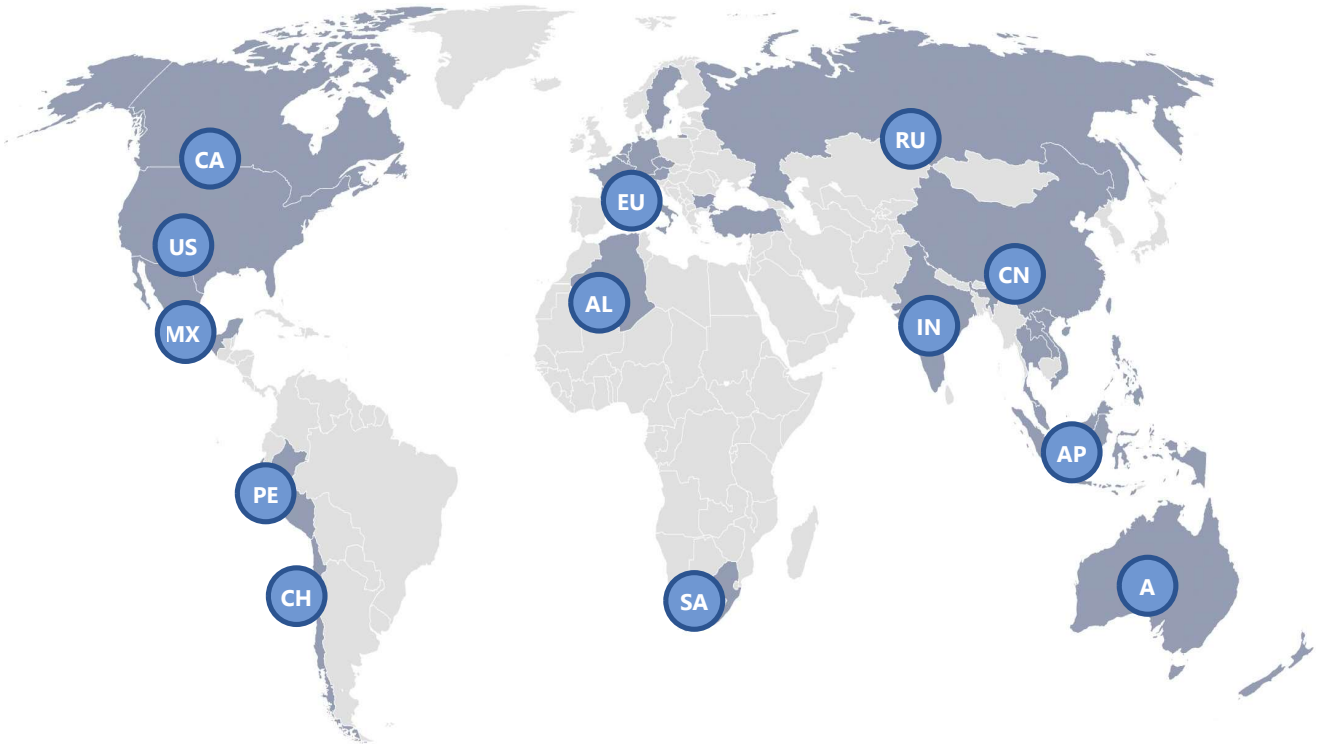
8 General arrangement

Dimension sheet AKEP & MAK



Model Size	Electrolyte Volume [l]	Weight without Electrolyte [kg]	Length L [mm]	Width D [mm]	Height H [mm]	Length L* [mm] (optional)	Height H* [mm] (optional)
Single Drive							
AK10	1000	650	1250	975	1950	N/A	2085
AK15	1500	700	1650	1400	1950	N/A	2085
(M)AK25	2500	950	2100	1700	1950	2300	2085
(M)AK45	4500	1100	2850	2000	1950	3250	2085
(M)AK60	6000	1250	3700	2222	1990	4295	2125
Dual Drive							
AK15 DUAL	1500	700	1650	1400	1950	N/A	2085
(M)AK25 DUAL	2500	950	2100	1700	1950	2300	2085
(M)AK45 DUAL	4500	1500	2850 3095*	2000	1950	3000	2125
(M)AK60 DUAL	6000	1750	3700	2222	1990	2664	2125
2x(M)AK60 DUAL	12000	2500	3700 3945*	4300	1990	N/A	2125

GINO-AKA SAS Representatives



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