EKA LIQUID STARTERS

designed to make you forget where it is

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

Annex:

Operation principle

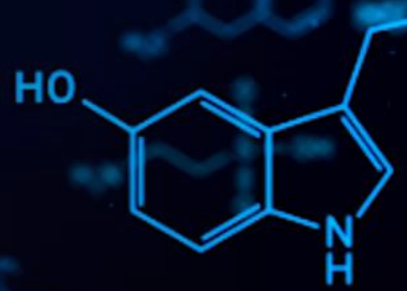
Main parts

Models and sizing

Technical terms

Tailor-made solutions

Required info for selection



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Operation principle

EKA-starters designed for long term operation. All EKA-starters control both start graph and start time by serial connection to slipring motor rotor circuit. During first stage, the distance between moving electrodes and fixed electrodes is high, resistance has maximum value and in the end is minimum value(R: f/(1/s)), R: resistance, s: distance between electrodes. When electrodes reach minimum position, moving eletrodes mesh with fixed electrodes, by-pass contacts close, start process is ended.

We install logic relay for all series which has own program that assures simple and user-friend communication with technicians.

All of used equipments are available in the market and it is brand free design, assures easy spare part access.

Except EKA-micro, all electrode control system has VFD which make trend control eaisier
Electrode’s position is checked by maximum switch and minimum switch, signals comes to logic relay..

We use ultra high Electric strength material for insulation pool, mounted on top steel cover, makes simple disassemble, by our own design we provide electrolit circulation through fixed/moving electrodes which means effective heat transfer from electrodes.

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Main parts

Electrolit tank

The tank made of steel tank inside triple layer epoxy coat and outside electrostatic powder paint. Only by removing top cover bolts you are able to remove all insulation pool, all electrodes, all mechanical actuator system and all equipments like electrolit heater, electrolit level sensor and electrodes level sensors all together. All covers and flap are sealed for higher IP and prevent water loss.

Moving and fixed electrodes

Starter has three fixed unique shape electrodes and three moving made of steel plate. Own designs brings you high surface area electrodes which provides them much longer life time(low current density)

Power panel

Equipped with well known brands, Schneider/Telemecanique for low voltage and Homa is for big currents/ high voltage levels. Design provides you, high insulation level, easy cable access, high mechanical protection level IP65

Control panel

Our stardard brand for circuit and logic relay is Schneider/Telemecanique, logic is programmed by our team and has screen to inform the process and failures as well

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Models

	MODEL	VOLUME	f:0,80	f:1,00	f:1,20	f:1,40
Uni drive	EKAmicro	400lt	1.120kW	900kW	750kW	650kW
	EKAmini	600lt	2.250kW	1.800kW	1.500kW	1.300kW
	EKAmidi	1200lt	4.200kW	3.350kW	2.800kW	2.400kW
	EKAmaxi	2000lt	6.750kW	5.400kW	4.500kW	3.850kW
	EKAmega	3000lt	10.500kW	8.400kW	7.000kW	6.000kW
	EKAgiga	4500lt	15.000kW	12.000kW	10.000kW	8.600kW
Dual drive	EKAmicrotwin	700lt	2x1.120kW	2x900kW	2x750kW	2x650kW
	EKAminitwin	1100lt	2x2.250kW	2x1.800kW	2x1.500kW	2x1.300kW
	EKAmiditwin	2200lt	2x4.200kW	2x3.350kW	2x2.800kW	2x2.400kW
	EKAmaxitwin	3500lt	2x6.750kW	2x5.400kW	2x4.500kW	2x3.850kW
	EKAmegatwin	5000lt	2x9.000kW	2x7.200kW	2x6.000kW	2x5.150kW

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Models

Angular moving system starters:

EKAmicro, 400lt, controlled motor power may vary from 650kW to 1.120kW depends on starting severity

Applications: Crushers, Classifiers, Conveyors, Rolling mills, Small size horizontal or vertical mills, SAG mills, Small size fans, pumps and compressors

Features

- The newest design
- Price/performance rating is amazing low
- The most simplicity you ever seen
- Designed by aiming the simple design beside sustainable operation
- No maintenance for lifetime, you may forget where it is in your factory
- Extra compact starter which allows smaller power motor starts, very agressive competitive of oil cooled resistors
- Logic relay, Electrolit level probe, Temperature controller and Electrolit heaters are standard equipments
- Adjustable starting time and starting trend
- Easiest troubleshooting, just read failure on smart relay screen
- All control and power cables have cable glands, IP65 protection is standard

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Models

Vertical moving system starters:

EKAmini, 600lt, controlled motor power may vary from 1.300kW to 2.250kW depends on starting severity
The most compact member of user friend liquid starter's family
Applications: Crushers, Classifiers, Conveyors, Rolling mills, medium size horizontal and vertical mills, SAG mills, Wood grinders, Medium size fans, pumps and compressors

EKAmidi, 1200lt, controlled motor power may vary from 2.400kW to 4.200kW depends on starting severity
Suitable for most common average powers
Applications: Big size Crushers, big size Rolling mills, medium size horizontal and big size vertical mills, SAG mills, big size fans, pumps and compressors

EKAmaxi,2000lt, controlled motor power may vary from 3.850kW to 6.750kW depends on starting severity
Applications: Big size Crushers, big size Rolling mills, medium size horizontal and big size vertical mills, big size fans, pumps and compressors

EKAmega,3000lt, controlled motor power may vary from 6.000kW to 10.500kW depends on starting severity
Applications: Big size horizontal mills, vertical mills, fans, pumps and compressors

EKAgiga, 4500lt, controlled motor power may vary from 8.600kW to 15.000kW depends on starting severity
Applications: The biggest size horizontal mills, vertical mills, fans, pumps and compressors

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Common features:

Vertical movement of electrodes, provide easy maintenance even during operation

Thanks to well designed electrode’s shapes, assure high area
Considering the tank size, the highest electrode areas which results very low current density thereby provide long lifetime of electrodes and capable to run higher currents in compact size of tank

Simple electrical circuit

Circulation pump, Electrolit heaters are controlled by logic relay

Electrolit minimum limit probe, PT100 and PT100 relay

Electrolit temperature is seen on PT100 relay which is installed on control panel door

Internal Variable frequency converter allows adjusting starting time and trend, which make it using on several application independent on how high starting torque you need(only limit is your motor starting torque capacity)

By screen of logic relay, easiest failure recognising

Control circuit and power circuit are separate, both separated from tank

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Common features:

All control and power cables have cable glands, IP65 protection is standard

Free space for cable termination kits, easy power cable connection

High quality insulation equipments around electrodes withstand till 85C, provide frequent starts
(-30C to 60C ambient temperature and altitue till 4000m is optional)

Ready, Run, Electrolit level, Trip and Start(dry and 24Vdc) are standard IOs

Provision for Electrolit heat exchanger

25kg/50kg/75kg Sodium carbonate is included according to size

Optionals:

Automatic brush lifting system control
Rmax, Rmin, By pass Close, Brushes raised, Brushes Down, Electrolit temperature analogue output, Electrolit conductivity analogue output are optional IOs
Brush lift motor power, Motor space heater, Brushes light are optional power outputs
Electrolit heat exchanger system
Locked rotor control system(frequency relay)
Different control and power circuit brand label

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Dual starters

In industry we have also dual motor installed mills commonly use, we also have specific designs for such application. Beside one electrical control, we also have one mechanical control for both electrode system in the same tank which is our distinguishing feature that has advantages of
The same conductivity assures the same starting torque on both motor
One source of movements assures the same distance between electrodes which means the same speed/torque on both motor

EKAmicrotwin,700lt, range 2x650kW to 2x1.120kW depends on starting severity
EKAminitwin,1100lt, range 2x1.300kW to 2x2.250kW depends on starting severity
EKAmiditwin,2000lt, range 2x2.400kW to 2x4.200kW depends on starting severity
EKAmaxitwin,3000lt, range 2x3.850kW to 2x6.750kW depends on starting severity
EKAmegatwin,5000lt, range 2x5.150kW to 2x9.000kW depends on starting severity

Applications: Dual conveyors, dual horizantal mills , dual sag mills

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Power(Ps, kW)

Nominal design power of slipring motor, can be calculated by
Ps = √3 x U x I x CosQ x Eff
U:stator voltage(kV), I:stator current(A), CosQ:power factor of motor, Eff:efficiency(0,95eg)

Rotor Power(Pr, kW)

Rotor power of slipring motor, can be calculated by
Pr = √3 x Ur x Ir x √3
Ur:rotor voltage(kV), Ir: rotor current(A)
The major factor for sizing liquid starter.

Starter load factor(f)

Depends on design of machine(starting torque curve); can be calculated by Average starting currect / Nominal current

Semi load	f : 0,7
Rated load	f : 1,0
Full load	f : 1,4
Heavy load	f : 1,8

Number of consecutive start(z)

Define size of tank, means how many start we do need from cold condition till reaching design maximum temperature(80°C) (2 x tb interval)

Starting time(ta, s)

Time required to accelerate the machine from zero speed to rated speed
ta = (J_G x Mload) / (9,55 x Mst)
J_G:total inertia(kgm^2)
Mload:starting load torque(Nm)
Mst:motor starting torque(Nm)

Starting energy(W, kJ)

50% of starting energy consumed for motor acceleration and converted into heat
W = 0,5 x Pr x f x tb x c x z (kJ)
tb:from Rmax to Rmin set time
c:the constant(equal to 0,9)

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Starting frequency per hour(h)

Indicates how many starts per hour needed for process, most case slipring motor manufacturers limits their motor start frequency to 3 per hour in cold condition

Electrolit resistance(R, ohm)

Calculated by $R = k \times r \times l / s$

k : coefficient of electrodes shape

r : conductivity of solution(effected by temperature)

l : distance between fixed and traveling electrodes

s : surface area of electrodes

Starting resistance(Rmax and Rmin, ohm)

Electrodes on top position, Rmax per phase formula:

$Rmax = Ur / (Ir \times \sqrt{3} \times f)$

Rmin = Rmax / ratio of starting resistance

Power loss at slip control mode (Pvariable, kW)

Depends on load curve we have several formulas:

Constant torque(power loss& slip resistance, kW,ohm)

$Pvariable = Pr \times n_{slip} / n_{nom}$

$Rslip = (Ur / Ir \times \sqrt{3}) \times n_{slip} / n_{nom}$

Parabolic torque(power loss and slip resistance)

$Pvariable = (Pr \times n_{slip} / n_{nom}) \times (n_{operation} / n_{nom})^2$

$Rslip = (Ur / Ir \times \sqrt{3}) \times n_{slip} / (n_{nom} \times (n_{operation} / n_{nom})^2$

$n_{slip} = n_{nominal} - n_{operation}$

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Tailor-made solutions

EKA-STARTER company is well to make special design which could be

New design for replacement of existing liquid starter, that warranty you the same position and location of your existing rotor cable ends and the same mounting dimensions

New design for replacement of your oil cooled starter which might have issues or old designed

One new replacement liquid starter for your whole factory in case of any existing starter’s breakdown, assuring flexible resistance adjustment, flexible starting time set, considering the highest rotor current of existing motors

In case of dual drive mills, one motor differs than other, we are able to make specific design to assure both motor equal load share during start even motor starting torques and currents are different

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Required information to select correct model:

Motor Power(kW) =

Rotor Voltage(kV) =

Rotor Current(A) =

Rated speed(rpm) =

Line Frequency(Hz) =

Aplication(load curve if available)=

Starter load factor(f) =

Number of consecutive start(z)=

Starting frequency per hour(h) =

Ambient temp/Altitue(ºC/m) =

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