liquid rotor starters for slipring motors 550 to 20,000 kW EPM

The EPM starter is specifically designed for controlled starting and speed control of large slipring motors in arduous applications such as

- Ventilation
- Crushing
- Milling
- Conveyors
- Pumps ...

In a variety of industries such as mines, quarries, cement plants, water treatment and associated industries.

They can also be used for applications such as car fragmentisers, plastic mixers and sugar cane knives.

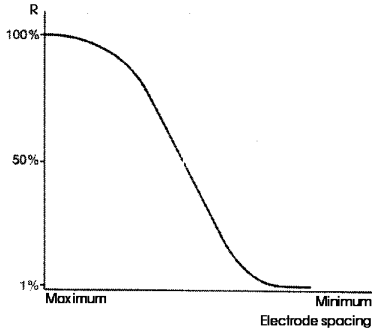
- Smooth progressive acceleration
- Wide range of applications
- Rugged and reliable
- Customised for each application
- Reduced maintenance

operating principle

The EPM rotor starter is normally used to control the starting of a slipring motor, and the starting current is generally limited to a maximum of 250% FLC.
Optimal starting torque for each application is normally selected by the choice of the initial value of resistance.
The principle of the EPM starter is that the resistance automatically varies during the starting period.
This type of starter is designed to provide the optimum starting characteristic, which results in smooth progressive acceleration to full load speed. It can also be used for speed variation and torque control. Plug braking can also be implemented with this system.

The variation in the resistance is achieved by displacement of the electrodes in the electrolyte.

At the end of the acceleration, the electrodes are shorted out.



description

EPM starter

An EPM unit comprises :
- the electrolytic resistance contained within a tank complete with electrodes of a size rated for the specific kW rating.
- the MV enclosure housing the Shorting contactor.
- an LV enclosure which contains the control system.

Tank .....
The tank is manufactured with heavy duty sheet steel 30/10 to 50/10 mm gauge, and is normally supplied complete with lifting eye bolts
Tank capacity and dimensions are determined by the motor rating. (See characteristics).
The tank is filled through a filling flap and emptied through valves situated at the base of the unit, which are normally locked in the 'closed' position.
Protection: IP54.

Agitator .....
The agitator is thermostatically controlled to ensure maximum thermal capacity.

Electrolyte .....
Various concentrations of sodium carbonate are normally employed.
Electrolyte level is monitored by a float switch and the temperature is controlled by thermostats.

Electrode assemblies .....
A set consists of three fixed and moving electrodes; polypropylene containers shroud the fixed electrodes to provide adequate isolation between phases.
The cast alloy electrodes consist of concentric cylinders which merge with each other in the minimum resistance position.
The fixed electrodes, located inside the insulating containers, are fed from an insulated copper bar.
Since this bar does not pass through the tank wall, there is no danger of electrolyte leakage.
The moving electrodes travel vertically inside the insulating container, guided by a nylon rod. The assembly is supported by two brass rods fixed to a transversal carrier which is common to all three electrodes and constitutes the neutral point.
Current density is extremely low (typically 1 amp/cm2) resulting in extremely long electrode life.

Electrode control system .....
• Displacement of the electrodes is effected by a motor driven worm screw assembly. This is normally controlled by either a geared motor or a servomotor depending on the application.
An inverter may also be used for certain applications.
A hand wheel is also provided for emergency operation.
Starting times are adjustable from 10 to 150 seconds.

• Control and interlocking
Limit switches are incorporated to control the geared motor, and to energise the Shorting contactor which shorts out the residual resistance at the end of the run up time. The geared motor is fitted with an overload relay, which is used to provide protection in case of the drive mechanism jamming.
An electrical interlock prevents a restart before the electrodes return to the initial maximum resistance position.
If a power failure occurs during starting, the electrodes return automatically to the start position when the supply is restored, so that a new start is possible.

Control panels .....
The control gear is housed in two separate enclosures. The shorting contactor complete with the rotor terminations are housed in the MV enclosure.
A separate housing is provided for the LV controls.
The MV enclosure is normally included with the starter, but for higher ratings, it may be supplied in a separate control panel.

EPM DUO starter

For starting machines of large powers, or to reduce mechanical stress, it may sometimes be preferable to use two motors totalling the rated power rather than a single one.
A dual EPM starter is then used, to ensure identical acceleration of both motors.
The EPM DUO comprises two resistances whose ohmic values are equalised between the two tanks. The electrode drive assemblies are mechanically coupled, so as to ensure complete synchronisation of the movement of the two electrode assemblies, which are driven by a common geared motor.
The two resistances are finally shorted out by a single four or six pole shorting contactor, at the end of the run-up period.

Heat exchanger starter

The starter is normally equipped with a heat exchanger for these applications.
This can either be of the water cooled type, (adequate supplies of cooling water must be available on site), or an air blast cooler can be used.

specifications

A range of models are used for the control of various motor ratings for single and dual EPM drives.
The adjoining table provides a guide to rating the various models of EPM starters. Many factors, such as the run up time, starts per hour, starting torque, operating temperature and a range of other factors effect the selection of the starter.
EPM starters equipped with heat exchangers may be used with motors whose powers exceed those shown on the table. These are determined by the size of the heat exchanger.

Maximum rotor voltage between sliprings: 3 500 V.
Standard starting times : 20, 30, 40, 60, 80 and 130 seconds. These are preset during manufacture.
The electrolyte level is monitored by a magnetic float switch.
The temperature of the electrolyte is controlled by thermostats.
The electrolyte is cooled by natural convection and forced circulation.
Because the current density is low (in the order of 1 A/cm2), the electrode life is extremely long.

Max motor rating (1)

Starter type	TS/FLT = 0.7	TS/FLT = 1	TS/FLT = 1.4	TS/FLT = 2
EPM1	1 600 kW	1 100 kW	790 kW	550 kW
EPM 2	2 600 kW	1 800 kW	1 300 kW	900 kW
EPM 3/1	5 200 kW	3 700 kW	2 600 kW	1 850 kW
EPM 3/2	6 400 kW	4 500 kW	3 200 kW	2 250 kW
EPM 4/1	7 800 kW	5 500 kW	3 900 kW	2 750 kW
EPM 4/2	13 000 kW	9 100 kW	6 500 kW	4 550 kW
EPM 1 DUO	2 X 1 600 kW	2 X 1 100 kW	2 X 790 kW	2 X 550 kW
EPM 2 DUO	2 X 2 600 kW	2 X 1 800 kW	2 X 1 300 kW	2 X 900 kW
EPM 3/1 DUO	2 X 5 200 kW	2 X 3 700 kW	2 X 2 600 kW	2 X 1 850 kW
EPM 3/2 DUO	2 X 6 400 kW	2 X 4 500 kW	2 X 3 200 kW	2 X 2 250 kW
EPM 4/1 DUO	2 X 7 800 kW	2 X 5 500 kW	2 X 3 900 kW	2 X 2 750 kW
EPM 4/2 DUO	-	2 X 9 100 kW	2 X 6 500 kW	2 X 4 550 kW

(1) Maximum rating for 1 start/hour or three consecutive starts from cold.
TS: starting torque - FLT: full load torque.

Maintenance.....
Check electrolyte level and top up with drinking water once a year. The electrode worm screw should also be greased at this time

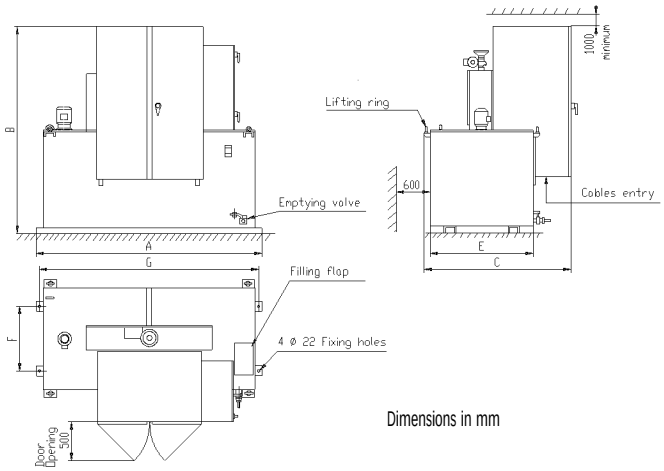
options

Antifreeze heater .....
This comprises an immersion heater with thermostat and control gear.

Inverter .....
The electrode drive motor can have a variation in acceleration between 10 and 150 seconds.

dimensions - weight

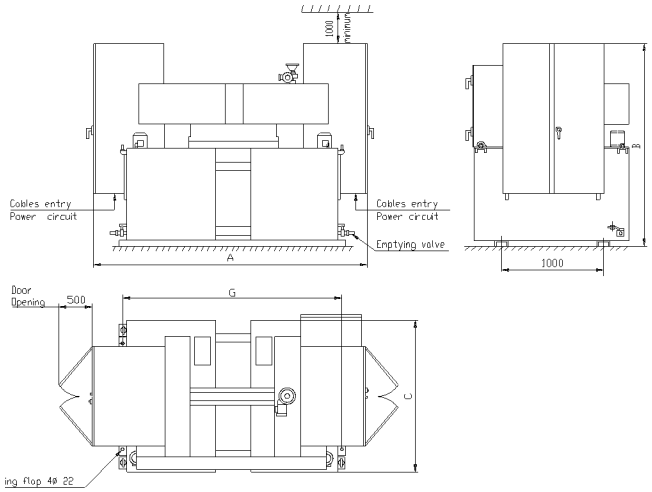
EPM 1 to 4



Dimensions in mm

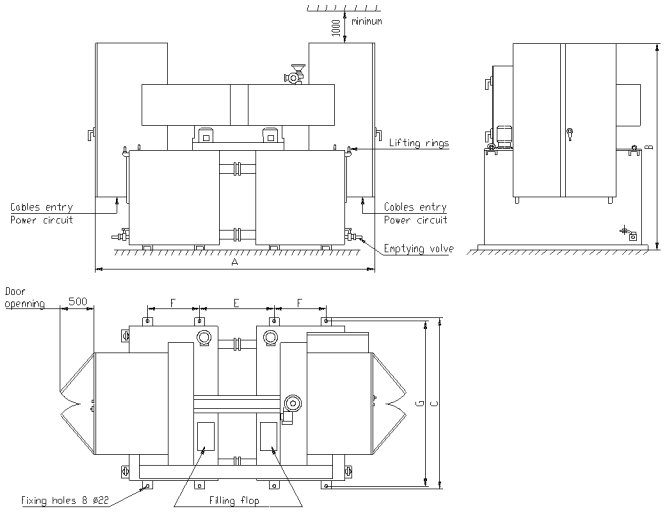
Model	A mm	B mm	C mm	E mm	F mm	G mm	Weight without electrolyte (kg)	Tank capacity (litres)
EPM 1	1 700	2 000	1 230	856	600	1 620	720	1 000
EPM 2	2 120	2 000	1 360	950	600	2 060	850	1 500
EPM 3	2 510	2 290	1 660	1 190	600	2 440	1 230	3 000
EPM 4	2 950	2 500	1 860	1 410	800	2 850	1 550	5 000

EPM 1 and 2 DUO



Dimensions in mm

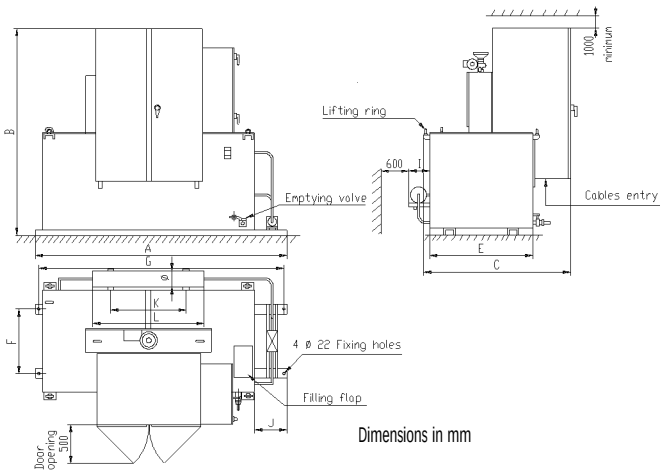
EPM 3 and 4 DUO



Dimensions in mm

Model	A mm	B mm	C mm	E mm	F mm	G mm	Weight without electrolyte (kg)	Tank capacity (litres)
EPM 1 DUO	2 760	2 000	1 520	-	-	2 140	1 500	1 000 X 2
EPM 2 DUO	2 945	2 000	2 030	-	-	2 325	1 800	1 500 X 2
EPM 3 DUO	3 580	2 290	2 560	990	600	2 460	2 450	3 000 X 2
EPM 4 DUO	4 020	2 500	2 950	1 015	800	2 850	2 800	45 000 X 2

EPM 1 to 4 with exchanger



Dimensions in mm

Model	A mm	B mm	C max. mm	D mm	E mm	F mm	Weight without electrolyte (kg)	Tank capacity (litres)
EPM 1 E	2 000	2 000	1 640	856	600	1 920	870	1 000
EPM 2 E	2 410	2 000	1 735	950	600	2 350	1 000	1 500
EPM 3 E	2 840	2 290	2 025	1 190	600	2 770	1 480	3 000
EPM 4 E	3 270	2 500	2 245	1 410	800	3 180	1 800	5 000

ordering instructions

The following information is necessary so that we may provide an EPM starter customised to your application.

General operating conditions .....
ambient temperature
maximum and minimum temperatures
relative humidity
height above sea level
location

For the motor(s) .....
- power
- speed (rpm)
- stator voltage
- rotor voltage
- rotor current
- starting torque

For the driven machine .....
- type
- coupling method
- speed (rpm)
- moment of inertia
- number of consecutive starts
- setting up and installation requirements

For the starter control gear .....
- protection IP 54 or 55
- supply voltage for geared motor etc.
- control voltage

For starter with heat exchanger .....
- temperature of cooling water
- percentage slip for permanent slip
- speed variation and duty cycle

Options .....
- speed control for electrode drive
- special paint
- cable entries
- antifreeze control
- anticondensation heaters

AOIP maintenance

The EPM starter is robust and easy to operate and is designed to provide a long and trouble free life, even in the most arduous of environments.
AOIP provides a complete dossier for each project, which includes complete data for identifying the electrolyte, the geared motor, the control gear, the shorting contactor and all other ancillary equipment which will allow you to easily identify a component.

AOIP will respond quickly to meet your requirements
In practice, each starter is fitted with a rating plate which is unique to each EPM starter. It is only necessary to provide us with the serial number for your EPM starter and AOIP can quickly respond to all your queries. All our documentation is archived for 40 years and our technicians are always available to provide worldwide assistance.

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