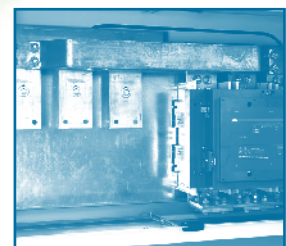
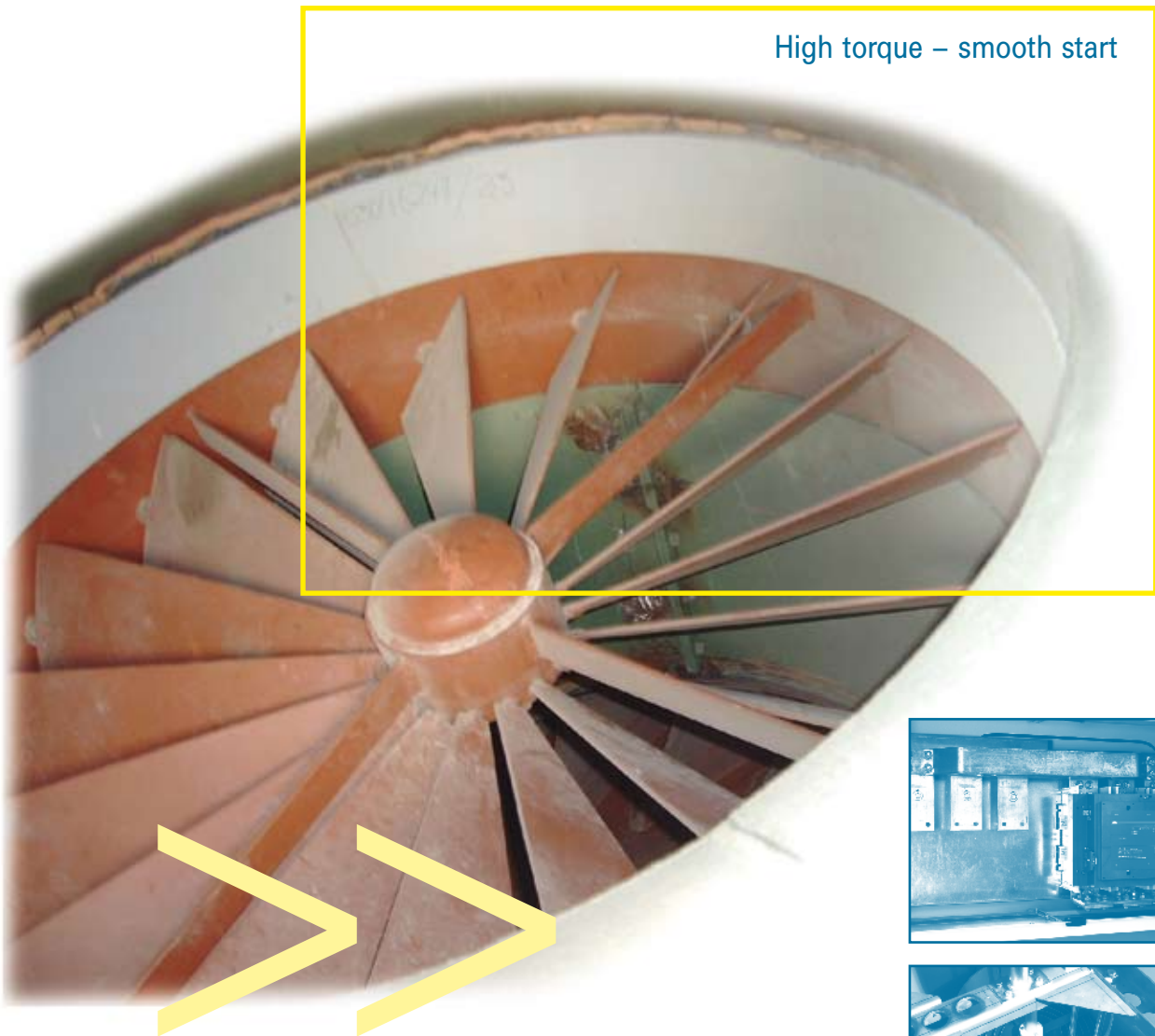


Liquid motor starters

MOTORSTARTERS

High torque – smooth start



General description

LIQUID STARTER FE

for three-phase motors with slip-ring rotor up to 12 MW

GENERAL, APPLICATION

FE starters are filled with an electrolyte, which influences the resistance depending on the concentration.

Additional liquid starters save the heat that forms during the starting process and slowly transfers this by their surface. Therefore, they are particularly suited for high-performance drives that are not frequently started.

This type of starter is always used, when smooth starts are required, by example to save the gear.

Robust equipment guarantees high operational reliability and long service lives.

DESIGNS

- > Single starter for low and medium-voltage machines up to 8000 kW
- > Twin starter for low and medium voltage machines up to 12000 kW
- > Starter with plain steel plate tank
- > Starter with cooling fins for higher starting frequency
- > Starter with additional water heat ex-changer for high starting frequency and speed control

BASIC ACCESSORIES

- > Auxiliary switches required for the customer's control, wired to terminals
- > Temperature monitoring tripping at 85°C
- > Control voltage 230 V – 50/60 Hz
- > Short circuit contactor
- > Servo motor
- > PLC controller
- > Local display for messages
- > Time - or current depending operation
- > Cable inlets, connection directly to short circuit contactor
- > Visual level control
- > Painting RAL 7016

OPTION

- > Control transformer for different control voltage
- > Tank with cooling fins
- > Electrolyte heating
- > Anti-condensation heating
- > Level control with potential free contacts
- > Control of brush lifting device
- > Communication and visualization via industrial bus system

STANDARDS AND REGULATIONS

FE starters comply with

- > DIN VDE 0660 Regulations for low-voltage switchgear
- > DIN 46062 Starters for direct current and alternating current slip-ring motors
- > IEC 60947-4-1 Low voltage switch-gear, contactors and motor starters

According to DIN 50010, T1 the starters are suited for installation in

- > closed locations
- > roofed locations
- > outdoor locations

PROTECTION

Control – and short circuit cabinet IP54
Top cover of the electrolyte tank IP23
Acc. DIN 40050 / IEC 144

AMBIENT TEMPERATURE

-25 ... +45°C, higher temperatures on request

ALTITUDE

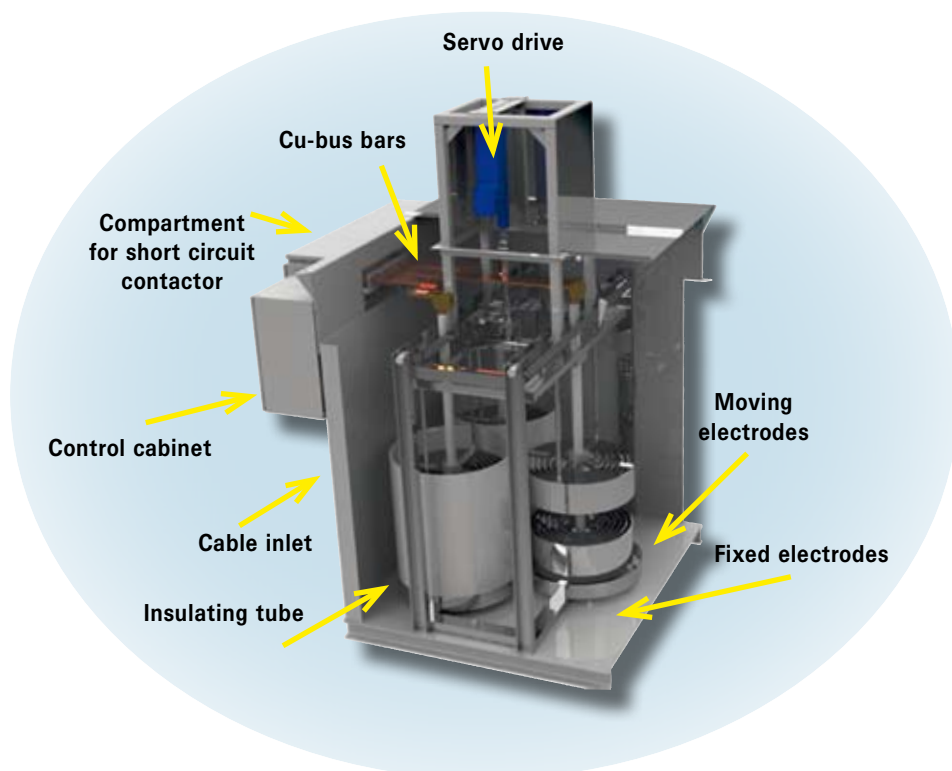
Up to 1000 m above sea level, higher altitudes on request

TO BE PROVIDED BY THE CUSTOMER

- > Plane foundation
- > Main contactor or circuit breaker
- > Feed-in short circuit protection
- > Thermal motor protection

INITIAL FILLING

For the first filling soda (Na_2CO_3) is delivered with the starter



Selection and technical data

Order number FE ①②③④-⑤⑥⑦-Z											
Single starter, with short circuit contactor											
Model	Motor rating [kW] at starting load factor				Rotor current [A] ⑤		Technical starter data				
Order no.. FE①②③④	Half load starting f=0,7	Fan starting f=1,0	Full load-starting f=1,4	Heavy load starting f=2,0	Characte-ristic		max. rotor voltage	max. starter heat storage capacity W _{a max}	Starting time ⑦ t _a ¹⁾	consecutive starts	Starting frequency
	[kW]	[kW]	[kW]	[kW]	1	2	[V]	[kJ]	[s]		[1/h]
0500	2000	1400	1000	700	250	450	1500	94000	30	3	1,40
1000	4000	2800	2000	1400	450	630	2000	190000	30	3	1,30
1500	6000	4200	3000	2100	630	1100	2000	282000	30	3	1,20
2000	8000	5600	4000	2800	630	1100	3000	370000	40	3	1,00
3000	12000	8400	6000	4200	1100	1600	4000	565000	40	3	0,80
5000	20000	14000	10000	7000	1100	1600	4000	942000	60	3	0,80

1) Standard workshop setting if no other specification is made

Accessories, order supplement Z

M 10	Different control voltage with incorporated control transformer; Indicate desired control voltage in full text
M 20	Electronic blocking control protects the drive during starter
M 40	Level control, tripping function: changeover contact wired on terminals
M 45	Monitoring of the numbers or starts
M 50	Electrolyte tank with cooling fins, increases starting frequency by factor 3,8
M 65	anti-condensate heating for the control part
M 80	Controller for brush lifting device
M 90	Communication and visualization
M 80	Controller for brush lifting device

Starter Energy W_a

Energy which is converted during start sequence into heat

$A_a = 0,5 \cdot f \cdot P \cdot t_a$ [kJ]
(for one start)

$W_a = 0,5 \cdot f \cdot P \cdot t_a \cdot Z$ [kJ]
(for z starts)

Number of starts z

Permissible number of starts in succession with starting time t_a and interval time 2 x t_a until reaching operating temperature.

$Z = \frac{W_{a,max}}{W_a}$

Starting frequency h

Number of starts per hour at operating temperature

Starting time t_a

Duration of the start sequence in seconds

Drive with constant load torque

$ta = \frac{i \cdot n^2}{91200 \cdot (f - \frac{M_L}{M_N}) \cdot P}$ [s]

Drive with quadratic increasing load torque and load factor 1

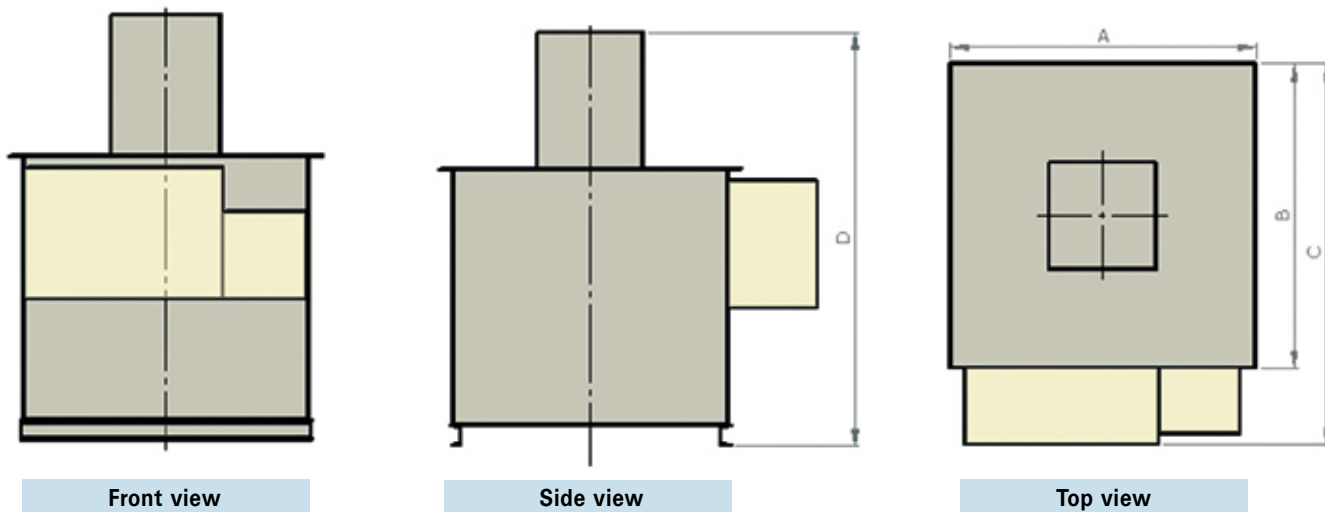
$ta = \frac{i \cdot n^2}{91200 \cdot 0,67 \cdot P}$ [s]

Loadfactor f

Ratio of the mean starting load to the rated load

Half load starting	f = 0,7	M _{max} /M _n ca.1,0
Fan starting	f = 1,0	M _{max} /M _n ca.1,4
Full load starting	f = 1,4	M _{max} /M _n ca.1,7
Heavy starting	f = 2,0	M _{max} /M _n ca.2,5

Dimensions and weights



FE Model	A	B	C	D	weight w/o electrolyte approx. [kg]	electrolyte volume approx. [l]
0500	1060	860	1180	1707	1180	500
1000	1120	1120	1410	1907	1370	1000
1500	1420	1420	1775	1950	1490	1500
2000	1720	1420	1775	2150	1680	2000
3000	1720	1527	1882	2596	1820	3000
5000	--	--	--	--	--	--
6000	--	--	--	--	--	--

Subject to technical changes 2011

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