FISCHER Elektromotoren

Linear Motor LIMO

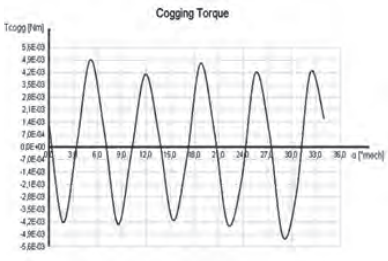
September 2014 - EN

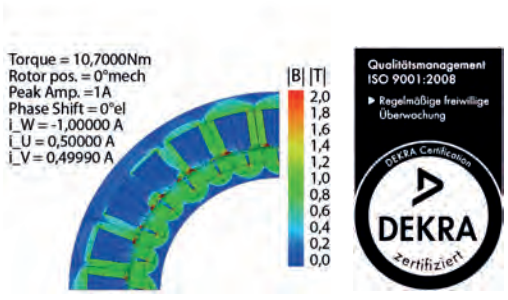
Fischer Elektromotoren GmbH

Schützenstr. 19
74842 Billigheim-Allfeld
Phone: +49 (0) 62 65 / 92 22 - 0
Fax: +49 (0) 62 65 / 92 22 - 22
info@fischer-elektromotoren.de
www.fischer-elektromotoren.de

Contents

Development & construction of linear motors are calculated and issued with special programs. Mechanical and thermal simulations are possible and can be incorporated into further constructions.





Foreword

The specialist for direct drives

With innovative drive solutions for all industries and any application in the automobile, wood and food industries and all other industrial sectors.

Solutions, products and systems from the company Fischer Elektromotoren are used everywhere - worldwide.

Always the right solution

Due to the number of drive variations, we offer our customers the best conditions for the right drive and therefore the most efficient solutions to requirements.

With our own developments, production and assembly, as well as commissioning (or other services) if required, the maximum flexibility at the highest quality is achieved.

The following is available for the production of prototypes for instance:

- Our own tool-making
- State-of-the-art CNC milling and processing machines
- State-of-the-art 3D measurement machine
- Numerous wire eroding machines
- Laser cutting system
- Laser welding centre
- Our own test bay

With our bundled expertise we are able to calculate, construct and manufacture prototypes for our customers within the shortest possible time.

We are certified in accordance with ISO9001:2008, as well as according to the UL insulation system.

The right partner

Our flexible product range and our services make the company Fischer Elektromotoren GmbH your partner for solutions to demanding tasks in the area of "direct" drive technology.

5 Design, Layout, Functions, Electrical connections

Design

The company Fischer Elektromotoren is a specialist for linear and rotating direct drives. **Series products** and **customised** drive solutions are developed and produced. Our own development works with the latest computer-assisted systems such as FEM calculation and 3D CAD programs. This means the motor geometrics and motor parameters can be optimally adapted to your applications. The latest manufacturing and test methods according to the status of technology ensure that Fischer Elektromotoren GmbH can also meet unusual customer requests. We manufacture in individual, small and large series. All motors are measured, tested and data records produced on the test bay.

Layout

By using a linear motor, it is possible to create a straight lined movement. The design of the winding can be customised to the user.

Functions

If a conductor loop is moved in a magnetic field, a voltage is induced in the conductor loop. A coil with a current flowing through produces a time-variable electrical field, which has a reciprocal effect with the constant magnetic field of the secondary part. The resulting force is used to generate the linear movement. A linear motor consists of two components: the primary part with coils and the secondary part with permanent magnets. A differentiation is made between grooved, grooveless and ironless direct drives. The linear motor allows a high force at a defined speed range. The distance between the primary part and the secondary part (air gap) decides on the force level. A steady bearing system guarantees a constant air gap. A measurement system is used to be able to detect the motor position at all times.

Electrical connections

The type of electrical connection option is versatile and can be customised.

- Cable with plug - variable cable lengths
- Open cable outlet with strand end sleeves - variable cable lengths
- Plug on motor housing

A second cable outlet is necessary depending on the complexity of additional components such as the measurement system and temperature sensors.

6 Measurement technology, Water cooling, Winding-related parameters

Measurement technology

Motors from Firma Fischer Elektromotoren GmbH are tested in accordance with the EC guideline 73/23/EEC and the norms EN 50178 and EN 60204. The motors go through these various test procedures before they are delivered.

- High-voltage test
- Partial discharge test
- Insulation test (VDE measurement)
- Pole test
- Resistance measurement for faces and temperature sensors
- Inductivity measurement
- EMF measurement

Furthermore, the motor is measured on the test bench with state-of-the-art measurement technology. The parameter records for commissioning and the peak and nominal values of the motor are established here. All mechanically installed components are measured with the latest measurement technologies such as 3D and a height measurement machine. This allows housings and parts with complex constructions to be measured.

Water cooling

Not only losses of copper cause the motor temperature to increase. More re-magnetising losses and eddy current losses occur at a higher frequency. Water cooling is used in order to be able to channel the produced heat away as well as possible. When using water cooling, the nominal force can almost be doubled in comparison to an air cooled motor. An increase of the peak force is not possible with water cooling. Water cooling is necessary if:

- The drive is only used in the load and brake cycle.
- No rest periods are available
- No temperature should be lost in the machine system.
- There are high outputs.

Winding-related parameters

The nominal speed of the linear motor can be adjusted by the DC-Bus voltage and the winding data. A voltage is induced in the coils as soon as either the primary or the secondary part is moved. This voltage (BEMF) works against the DC-Bus voltage of a field-orientated servo-converter and is proportional to the speed. The BEMF must initially be overcome to be able to store the current necessary for the force in the coils. The result is: the lower the BEMF is, the higher speeds are possible. The working point of the linear motor is determined by the correlation between the winding speed, force and speed.

7 Winding-related parameters, Motor-constant, Thermal motor protect

At low speeds, a constant force can be provided. This means that the force is independent of the speed. The influence of the BEMF rises with increasing speed. This avoids that enough current can be pushed into the winding at a high speed. Hence, with increasing speed the motor force decreases.

Motor-constant

The motor-constant km is used for a better differentiation of linear motors. This constant includes the efficiency of the motor and allows first conclusions of the losses. A high motor-constant stands for a good conversion from electrical energy to mechanical energy. With an increase of the temperature, e.g. by a rise of the current, the winding resistance rises also. Consequently, the power losses increase and the motor-constant decreases.

Thermal motor protection

Direct drives are mainly operated at their thermal limit and the temperature must be constantly monitored. Temperature-related resistances are installed in linear motors to protect against thermal overload. The following temperature sensors are available:

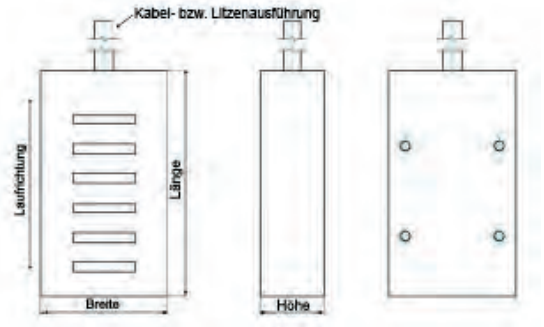
- PTC (thermistor)
- KTY
- Triplet switch (Klixon)

In order to protect the motor against thermal overload, three PTCs can be switched in sequence. Each PTC measures the temperature of one phase. This means that temperature monitoring is even guaranteed when the motor has to maintain its position at a standstill and an asymmetrical current supply occurs. The resistance value of the PTC increases heavily once the nominal temperature is overcome. This means that the overall resistance of row switching also changes rapidly. If a resistance changes, safe shutdown of the motor by the motor protection trigger device (FIMO TA 03) is guaranteed before thermal destruction. The motor protection trigger device also identifies if resistance is too low, signalling a possible defect in the monitoring circuit. The PTC temperature sensor is not suitable for accurate temperature measurement. A KTY temperature sensor is used to measure a temperature sequence exactly. This semiconductor resistance reacts linear to the temperature. This is why a shutdown limit is defined to protect the motor against thermal overload. Because the KTY only monitors the temperature of one phase, the motor can overheat if heating is asymmetrical.

FIMO TA 03

Linear motor - dimensions

Dimensions - technical data



Type classification:

LIMO 022-008-100

- Aktive Stator length (mm)
- Aktive Stator height (mm)
- Aktive Stator width (mm)

Motor height 7,5 mm

Name	Nominal force [N]	Peak force [N]	Velocity [m/s]	Width [mm]	Height [mm]	Length [mm]	Weight [kg]
LIMO 022-008-100	12	35	5,4	34	7,5	100	---

Motor height 17 mm

Name	Nominal force [N]	Peak force [N]	Velocity [m/s]	Width [mm]	Height [mm]	Length [mm]	Weight [kg]
LIMO 035-017-100	50	150	5,6	65	17	125	0,65
LIMO 030-017-150	60	173	4,6	57	17	170	0,55
LIMO 035-017-200	100	300	5	65	17	220	1,35

Motor height 35 mm

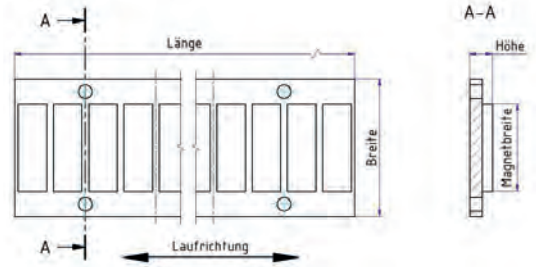
Name	Nominal force [N]	Peak force [N]	Velocity [m/s]	Width [mm]	Height [mm]	Length [mm]	Weight [kg]
LIMO 018-030-100	45	130	5,7	52,5	35	120	0,81
LIMO 035-030-100	90	250	5,8	70	35	125	1,3
LIMO 045-030-100	120	330	4,9	80	35	120	1,62
LIMO 035-030-200	180	510	5,2	70	35	220	2,6
LIMO 045-030-200	240	660	5,6	80	35	220	3,25
LIMO 035-030-300	270	760	4,8	70	35	318	3,9
LIMO 070-030-200	380	1000	4,9	108	35	220	5,3
LIMO 070-030-300	570	1520	4,9	108	35	318	7,9

Motor height 45 mm

Name	Nominal force [N]	Peak force [N]	Velocity [m/s]	Width [mm]	Height [mm]	Length [mm]	Weight [kg]
LIMO 030-040-100	90	270	6	67	45	127,5	1,6
LIMO 030-040-210	180	530	4,7	67	45	232	3,1
LIMO 060-040-100	180	530	5,3	98	45	127,5	2,65
LIMO 030-040-310	270	800	4,9	67	45	331,9	4,7
LIMO 045-040-210	270	800	5,6	85	45	232	3,72
LIMO 060-040-210	360	1060	5	98	45	232	5,3
LIMO 060-040-310	540	1600	5	98	45	336	7,9
LIMO 090-040-210	540	1600	5	128	45	232	6,5
LIMO 090-040-310	810	2400	4,8	128	45	336	9,75
LIMO 120-040-310	1100	3200	4,9	158	45	336	13,5

9 Technical data

Dimensions - technical data



Ordering code for standard-secondary parts

Type classification:
SEK30-04-17,5

- Width of Magnet (mm)
- Number of poles
- Type of secondary part (mm)

Motor	Type	Pole	Width (mm)	Height (mm)	Length (mm)
LIMO-018	SEK30-04-17,5	4	37,5	9	56,2
	SEK30-08-17,5	8	37,5	9	112,4
	SEK30-16-17,5	16	37,5	9	224,8
	SEK30-32-17,5	32	37,5	9	449,6
LIMO-022	SEK08-04-22	4	32	5	27,6
	SEK08-08-22	8	32	5	55,2
	SEK08-16-22	16	32	5	110,4
	SEK08-32-22	32	32	5	220,8
LIMO-030	SEK17-04-30	4	50	9	55,2
	SEK17-08-30	8	50	9	110,4
	SEK17-16-30	16	50	9	220,8
	SEK17-32-30	32	50	9	441,6
LIMO-035	SEK17-04-35	4	55	9	56,2
	SEK17-08-35	8	55	9	112,4
	SEK17-16-35	16	55	9	224,8
	SEK17-32-35	32	55	9	449,6
LIMO-045	SEK30-04-40	4	65	9	56,2
	SEK30-08-40	8	65	9	112,4
	SEK30-16-40	16	65	9	224,8
	SEK30-32-40	32	65	9	449,6
LIMO-045	SEK40-04-45	4	75	13,5	60
	SEK40-08-45	8	75	13,5	120
	SEK40-16-45	16	75	13,5	240
	SEK40-32-45	32	75	13,5	480
LIMO-060	SEK40-04-60	4	90	13,5	60
	SEK40-08-60	8	90	13,5	120
	SEK40-16-60	16	90	13,5	240
LIMO-070	SEK30-04-70	4	90	9	56,2
	SEK30-08-70	8	90	9	112,4
	SEK30-16-70	16	90	9	224,8
	SEK30-32-70	32	90	9	449,6
LIMO-090	SEK40-04-90	4	120	13,5	60
	SEK40-08-90	8	120	13,5	120
	SEK40-16-90	16	120	13,5	240
LIMO-120	SEK40-04-120	4	150	13,5	60
	SEK40-08-120	8	150	13,5	120
	SEK40-16-120	16	150	13,5	240

Specification book for motor design

Please send response to
info@fischer-elektromotoren.de
or fax: 0049-6265-9222-22

Your contact details:	
Company:	
Name:	
Tel. no.:	
Email:	
Project name:	

Specification book for motor design

Tasks of the motor			
Application			
Positioning - accuracy [°]			
Speed [m/sec]			
Required forces			
Nominal force [N]			
Acceleration force [N]			
Connected load			
Intermediate circuit voltage [VDC]			
max. current [Aeff]			
Motor size			
Width x length [mm]			
Weight [kg]			
Construction type			
Housing	○ Air cooled	○ Water cooled	○ None, (installation kit)
Environmental conditions			
Environmental tempe-rature [°C]			
Protection type (only with housing)			
Cable version			
Version	○ Cable	○ Single strands	○ Industrial plug
Winding protection			
Sensors	○ KTY84-130	○ PTC (thermistor)	○ Klixon (switch)
Other/comments			

Note

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Schützenstr. 19
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Phone: +49 (0) 62 65 / 92 22 - 0
Fax: +49 (0) 62 65 / 92 22 - 22
info@fischer-elektromotoren.de
www.fischer-elektromotoren.de

Representation Northern Germany:

Fischer Mess- und Antriebstechnik GmbH
Solterbergstr. 183
32602 Vlotho-Exter
Phone: +49 5228 9892 83
info@fischer-gmbh.info

Representation Southern Germany:

Jürgen Held
Echterdinger Str. 24
70771 Leinfelden
Phone: +49 151 56337756
jh@held-automation.de