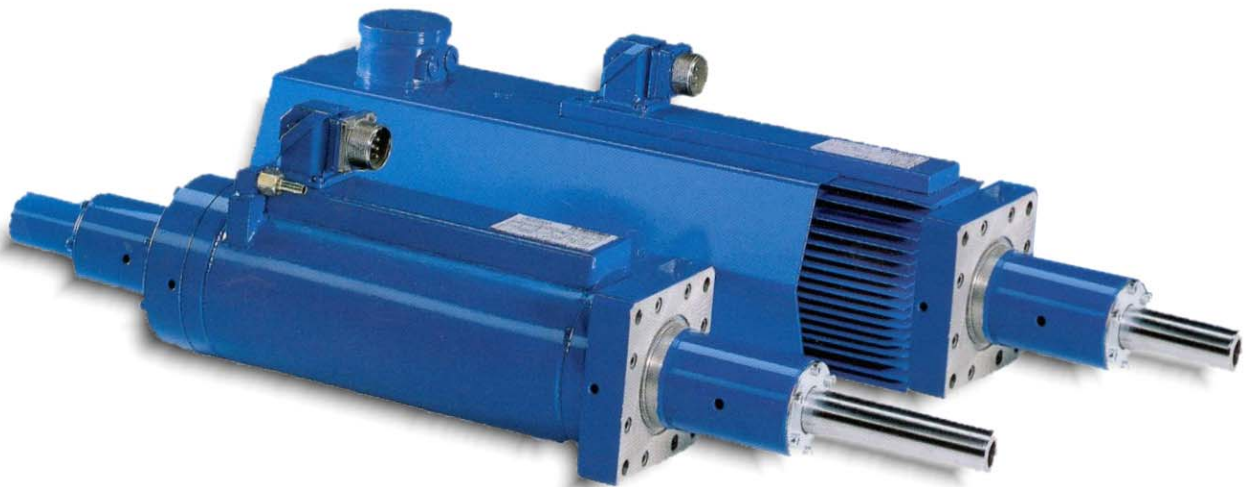


*Linear direct drives*  
*Three-phase synchronous linear motors*

Series LIN-S ... L with external cooling  
Series LIN-S.. F with liquid cooling  
enclosure IP 54 .. 65



## General description

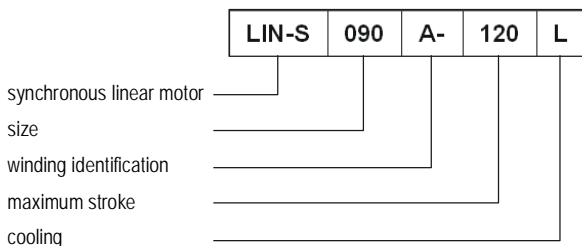
OSWALD's linear drives of the series LIN-S 070 through LIN-S 132 are direct synchronous linear motors with permanent magnet shafts. They are of cylindrical shape and are traditionally called *polysolenoid motors*. Direct drives of this kind do not require any mechanical drive gears such as gear wheels or helical worm gears, elements that are subject to wear. Furthermore, there is no mechanical clearance at reversal of the direction of movement. The motors are particularly suited for short linear travel up to 220 mm. Their design is simple, compact and sturdy. They produce a high force density and consequently large accelerations. In contrast to linear motors of flat design (single-sided and double-sided linear motors) cylindrical motors by OSWALD do not develop lateral forces. They find versatile applications for all linear motions in which not only their own mass but also big external loads must be moved with large acceleration or strong counter forces. Because of their simple construction they are inexpensive and reliable. Together with appropriate converters and control circuitry they open up new fields of application in servo engineering and for power drives.

Linear motors are based on the same working principle as rotating synchronous motors. Therefore they operate with the same power converters and control elements. An extremely high precision of speed and position can be realized by using high-quality control systems and position transducers. The motions executed by these linear motors may be programmed for any pattern via suitable interfaces. These patterns usually consist of repetitive variable positioning steps. Besides stepping motions, all kinds of sequential patterns of motions may be realized.

The stator of these linear motors consists of three-phase windings in the shape of stacked solenoids, hence the name *polysolenoid*. The shaft is the analogy to the rotor with permanent magnets of synchronous motors. The shaft is guided by sturdy linear bearings. Because bending and torsion moments cannot arise in the cylindrical design of the motors, rotation of the shaft needs to be prevented only as far as required by the position sensors.

OSWALD linear motors of this series are offered both as air cooled and liquid cooled versions. They can be designed according to the standards IEC and VDE for short operation, continuous operation or intermittent operation. The standard design conforms to insulation class F. The internal structure permits intensive heat transfer thus allowing high power densities. The data sheets below offer a choice of motor types. Optional higher power levels and special customer designs of linear motors can be offered.

## Type designation (example):



## Customer specifications

Operational forces:	continuous (S1), short. (S2) operations
Dynamics:	mass of the load maximum excursion maximum acceleration max speed frequency of motion cycle
Converter:	intermediate voltage rated current maximum current
Cooling:	external air cooling liquid coolant ambient conditions
Constructional details:	structure, flange dimensions, radial forces, torsion forces

## Force specifications

The specified forces accelerate the motor and are exerted on the load. They can be estimated with the simple formula:

**force equals mass times acceleration plus load-force**

$$F = m \cdot a + F_2$$

## Temperature control

The stator windings are equipped with temperature sensors in the form of thermal switches, or resistors with positive or negative temperature coefficients according to customer specifications. The maximum temperature of the stator windings is 155°C conforming to insulation class F.

## Position sensing, mounting the transducer

The position measuring system (linear scale and transducer) can be mounted on side A or side B or on moving machine parts near the load. The transducer must be attached absolutely rigidly because otherwise vibrations may impair the dynamic operation. As an option we offer to integrate a rigidly mounted measurement system on side B of liquid-cooled motors with travel excursions up to 120 mm.

## Linear bearings, shaft design

The standard construction provides life-long lubrication of the linear bearings. The shafts are preferentially manufactured as hollow shafts with smooth ends. In the interest of a long life of the bearings they never feature provisions against rotation.

The load is attached to the motor shaft by means of clamps. When installing and operating the motor, care must be exercised to prevent moments to act on the motor shaft. Even small lateral forces reduce the operating life time of the bearings.

## Realization - technical data

OSWALD - Linear Motors will be optimally adapted to every application. The dynamical specifications like force, acceleration, speed and the motion pattern vs. time, listed in the order data above, determine the power and the design of the windings. Therefore, the following tables do not contain standard values for these data.

## Technical data - motors series LIN-S ... L with external air cooling

Ventilators are mounted axially,

Enclosure IP 54 .. 65 according to standards DIN 40050 and EN60034-5. max ambient temperature 40 °C.

type	$a_{max}$ (m/s <sup>2</sup> ) maximum acceleration	$F_N$ (N) nominal force	$F_{max}$ (N) peak force	$I_N$ (A) rated current	$I_{max}$ (A) peak current	$m_L$ (kg) mass of shaft	$m_M$ (kg) mass of stator
LIN-S070A-070L	250	550	1600			6	24
LIN-S070A-120L	260	450	1400	3,5	10,5	5	23
LIN-S070A-220L	150	250	700			4	21
LIN-S090A-060L	350	1200	3650			10	39
LIN-S090A-120L	300	950	2800	9	26	9	38
LIN-S090A-210L	250	550	1600			6	35
LIN-S132A-070L	360	3650	11000			30	130
LIN-S132A-120L	345	3250	9850	19	57,5	28	128
LIN-S132A-220L	300	2450	7350			24	124

Nominal force: refers to S1 operation.

Peak force: maximum force developed by the motor without demagnetizing.

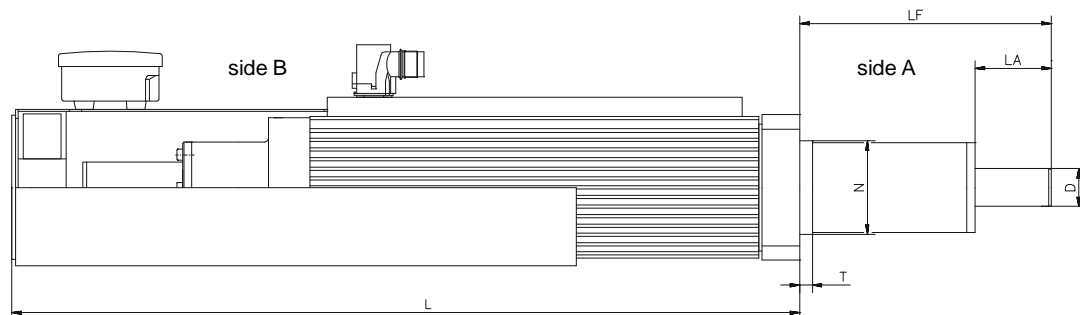
Speeds depend on the load; max. speed is 3 m/s at 400 V.

Other specification, e.g. for other types of operation (S3) or for different ambient conditions will be furnished upon request.

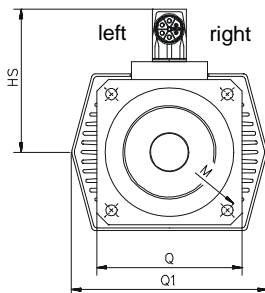
These data may be changed.

## Principal dimensions - motors series LIN-S ...L with external air cooling

Enclosure IP54 ..65, configurations B5, V1, V3, with axially mounted external ventilator



The end of the shaft is shown at the inner position  
The cooling air flows from side B towards side A.



type	stroke	Q	Q1	M	HS	L	LA	LF	Dh6	Nh6	T
LIN-S070A-070L	70					624					
LIN-S070A-120L	120	115	155	130 (M10)	113	674	60	152,5	30	74	10
LIN-S070A-220L	220					784					
LIN-S090A-060L	60					621					
LIN-S090A-120L	120	132	192	152 (M12)	160	681	86	199	40	72	10
LIN-S090A-210L	210					771					
LIN-S132A-070L	70					845					
LIN-S132A-120L	120	240	230	265 (M16)	198	895	90	198	50	110	10
LIN-S132A-220L	220					995					

Dimensions in mm; they may be changed

Other configurations than B5, shown above, are optional.

## Technical data - liquid cooled motors series LIN-S ...F

with water-cooled stators, requiring anticorrosion protection. Entrance temperature of water  $\leq 20\text{ }^{\circ}\text{C}$ .  
Enclosure IP 54 .. 65 according to standards DIN 40050 and EN 60034-5

type	$a_{\max}$ (m/s <sup>2</sup> ) maximum acceleration	$F_N$ (N) nominal force	$F_{\max}$ (N) peak force	$I_N$ (A) rated current	$I_{\max}$ (A) peak current	$m_L$ (kg) mass of shaft	$m_M$ (kg) mass of stator
LIN-S070A-070F	285	800	1800			6	24
LIN-S070A-120F	280	700	1500	12	27	5	23
LIN-S070A-220F	180	350	800			4	21
LIN-S090A-060F	365	1800	3750			10	39
LIN-S090A-120F	310	1450	2900	13,5	27	9	38
LIN-S090A-210F	260	800	1650			6	35
LIN-S132A-070F	400	6100	12300			30	130
LIN-S132A-120F	380	5400	10900	32	64	28	128
LIN-S132A-220F	335	4100	8200			24	124

Nominal force: refers to S1 operation.

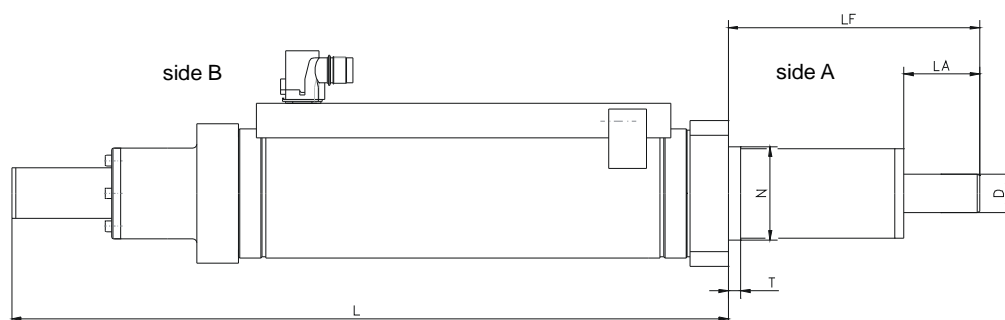
Peak force: maximum force developed by the motor without demagnetizing.

Speeds depend on the load; max. speed is 3 m/s at 400 V.

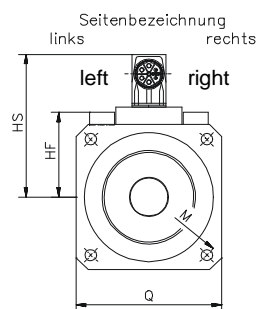
Other specification, e.g. for other types of operation (S3) or for different ambient conditions, will be furnished upon request. These data may be changed.

## Principal dimensions - liquid cooled motors series LIN-S ...F

Enclosure IP54 ..65, configurations B5, V1, V3, with liquid coolant



The end of the shaft is shown at the inner position  
The cooling air flows from side B towards side A.



type	stroke	Q	M	HS	HF	L	LA	LF	Dh6	Nh6	T
LIN-S070A-070F	70					567					
LIN-S070A-120F	120	115	130 (M10)	113	68	617	60	152.5	30	74	10
LIN-S070A-220F	220					727					
LIN-S090A-060F	60					534					
LIN-S090A-120F	120	132	152 (M12)	155	90	594	86	199	40	72	10
LIN-S090A-210F	210					684					
LIN-S132A-070F	70					755					
LIN-S132A-120F	120	240	265 (M16)	198	135	805	90	198	50	110	10
LIN-S132A-220F	220					905					

Dimensions in mm; they may be changed.

A second free shaft end on side B of the same diameter as on side A is optional. Also available are configurations other than B5 (shown above).

Instead of water other liquid coolants with anticorrosion agents, e. g. oil, may be used; power derating may be required.