

# TECNOTION<sup>®</sup>

## THE LINEAR MOTOR COMPANY

*Ironless vacuum linear motor series*

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PROVISIONAL

# QUALITY AND SERVICE DELIVERED WORLDWIDE

## [ TECNOTION ]

Tecnotion is *the* global authority on linear motor technology. We are the world's only unbundled manufacturer of linear motors. A former part of Philips, we specialize solely in the development and production of linear motors. Because of this, our expertise, customer service and product quality are unmatched.

We have a global presence, with production plants in The Netherlands and China and local representation around the world. This ensures short delivery times and high quality support, wherever you are located.

When you do business with Tecnotion, you have a team of highly skilled sales and application engineers at your disposal. They help you from your initial prototype all the way to the application of our products and beyond.

Whatever your needs are, you can count on Tecnotion as a solid, reliable partner.

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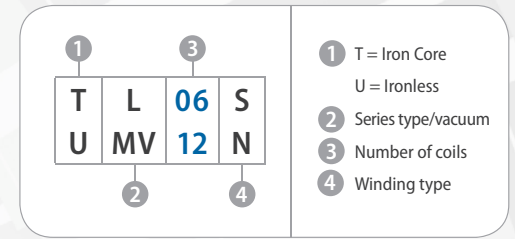
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## Vacuum technology

Tecnotion is *the* specialist for vacuum linear motors. Twenty years of experience is used in designing and building vacuum coils and magnets. Tecnotion can supply any vacuum linear motor that can match even the strictest vacuum requirements but can also provide vacuum products for smaller budgets.

A growing amount of high tech applications require vacuum solutions to minimize the chance of unwanted chemical reactions or pollution of the process or surrounding equipment. Vacuum applications may be: Positioning stages & gantries, inspection, scribing, encapsulation, lithography, deposition processes, sputtering & E-beam. Motion is one of the main challenges

within a vacuum environment. Serviceability, reliability, versatility and outgassing are critical factors in a vacuum application and failure of one of them could mean long downtimes. Total cost of ownership should be considered over the initial investment.

Maintenance costs of motion systems in vacuum are potentially high. Linear vacuum rated motors have no moving parts and are frictionless making the motors maintenance free. Additionally Tecnotion's linear motors can be placed into vacuum as a whole and therefore do not require a feed trough saving costs.

High outgassing of the motion system can influence the production

process. Tecnotion's vacuum rated ironless linear motor is a dedicated and specially designed coil unit and magnet yoke for use in high vacuum, down to  $10^{-8}$ , and the lowest achievable outgassing for a series product.

### Tecnotion currently offers 3 types of vacuum linear motors

1. Vacuum rated Ironless linear motors for very high and low vacuum requirements.
2. Linear Motor Transport system using ironless motors.
3. Customized linear actuator designed to customer requirements and, if required, the highest specifications available on the market.



### UMV Series

Fp 400N Fc 80N

The UMV coils are the smallest coils in the vacuum rated linear motor series. This serie is ideal for postioning, e.g. in gantries, or high dynamic, light weight applications which require extreme accuracy.

### ULV Series

Fp 720N Fc 150N

The ULV coils are high end coil in the vacuum rated linear motor series. The ULV series is commonly used for applications demanding peak force or low heat output. In longer strokes ULV coils can be combined to save magnet material but still achieve high performance.

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## Ironless vacuum motor series

### Features

#### Capabilities

- Coil unit and yoke are completely vacuum compatible
- Minimum pressure down to  $10^{-8}$  mBar
- Typical total outgassing of  $10^{-5}$  mBar/l/s
- Typical CxHx outgassing of  $10^{-8}$  mBar/l/s

#### Design

The ironless vacuum rated motors have a unique metal housing and are sealed to prevent outgassing into the vacuum and make the coil high-vacuum resistant. Despite this housing the coil is still light weight which allows for high dynamics.

#### Connection and sensors

Coil units are equipped with a temperature measurement and cut-off sensor to enable monitoring and overheat protection of the coil unit at all times. The sensors and three phases of the coil unit are connected to vacuum compatible cables. These are the only necessary connection to the outside world.

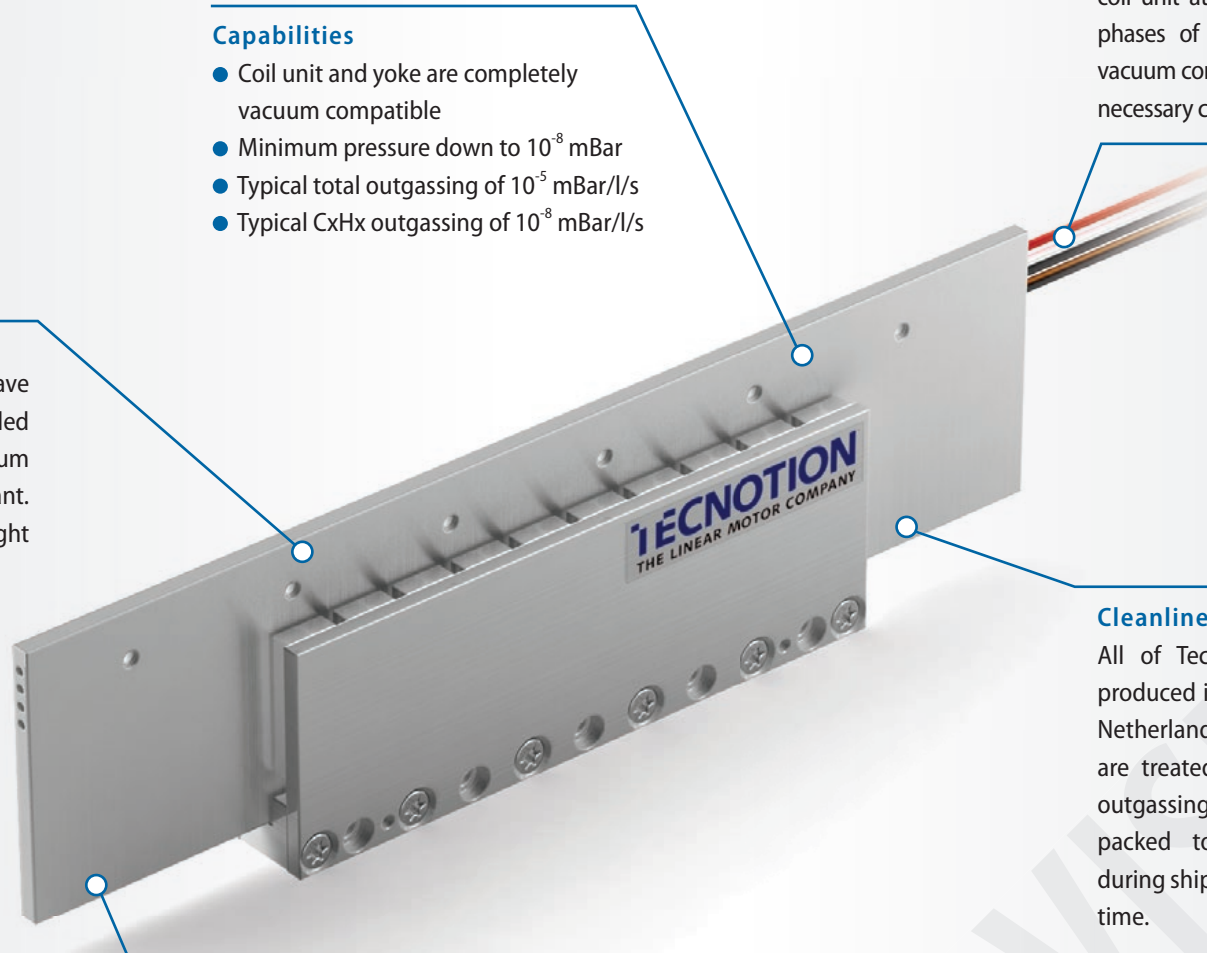
#### Cleanliness

All of Tecnotion's vacuum products are produced inside our own cleanroom in The Netherlands. Before shipping the products are treated and cleaned to reduce initial outgassing after which they are cleanroom packed to prevent any contamination during shipping and installation at the same time.

#### Thermal

Thermal management is one of the main challenges in vacuum. Therefore the coil units have been designed to achieve a low thermal resistance ( $R_{th}$ ) to enable the coil unit to quickly conduct heat away from the coil.

Equal to the standard linear motors, the vacuum linear motors have a high efficiency. This means a lower coil temperature and therefore a higher continuous force.



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**WHY CHOOSE FOR IRONLESS VACUUM RATED?**

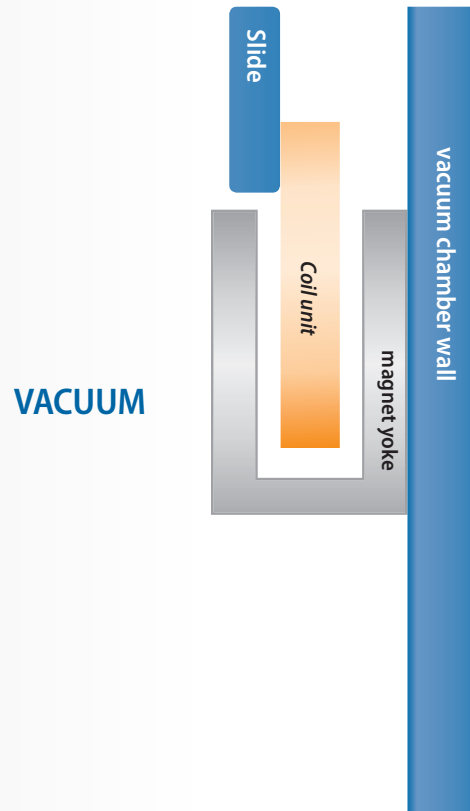
- Defined low outgassing
- No particulation
- Low thermal resistance
- High cleanliness
- No large cable feed-through required
- Can be positioned anywhere in the vacuum chamber

**APPLICATIONS**

- Positioning stage & gantry
- Inspection
- Scriber
- Encapsulation
- Lithography
- Deposition processes
- E-beam
- Sputtering

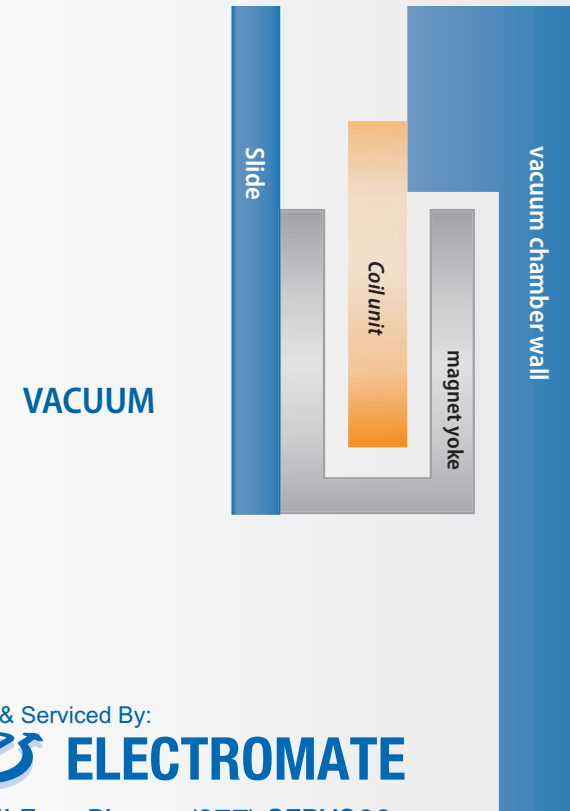
**Moving coil application**

The moving coil application is ideal for dynamic applications or low masses. Multiple coils can be placed on one magnet track to move individually or work together



**Stationary coil application**

A stationary coil application can be used in less dynamic applications or high masses. The stationary coil, mounted on a solid coil mount enhances passive cooling through conduction significantly.



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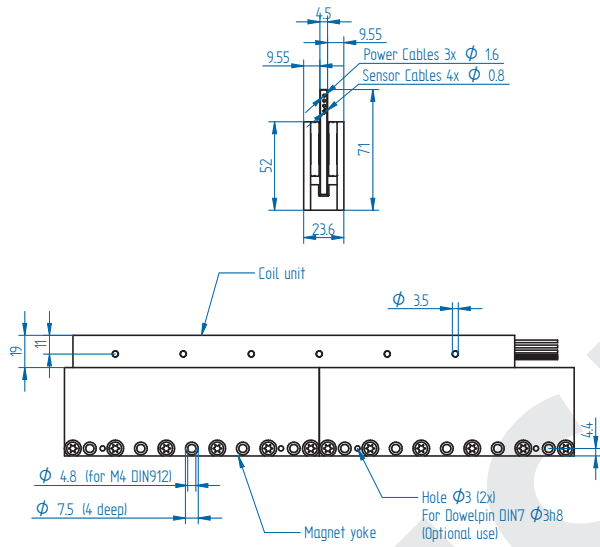
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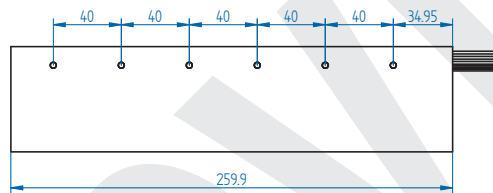
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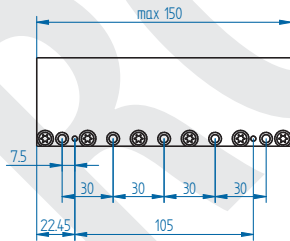
# UMV



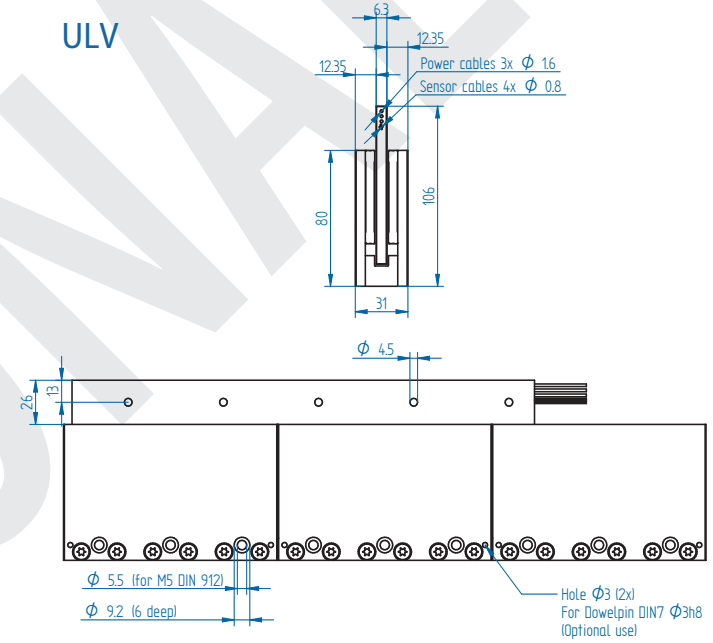
## COIL UNIT



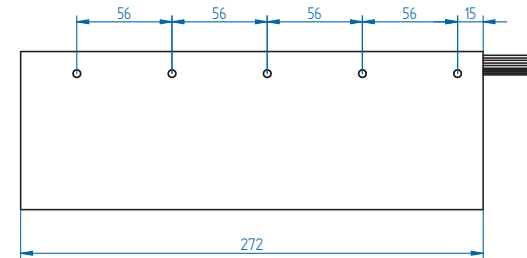
## MAGNET YOKE



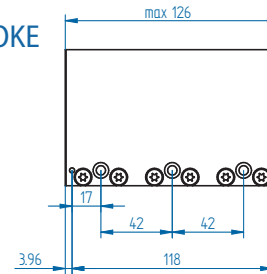
# ULV



## COIL UNIT



## MAGNET YOKE



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UMV

ULV

	Parameter	Remarks	Symbol	Unit	UMV12		ULV9	
					N	S	N	S
Performance	Winding type				N	S	N	S
	Motortype, max voltage ph-ph				3-phase synchronous Ironless, 300V <sub>dc</sub>			
	Peak Force @ 20°C/s	magnet @ 25°C	F <sub>p</sub>	N	400		720	
	Continuous Force passive cooled*	coils @ 110°C	F <sub>c</sub>	N	20		45	
	Continuous Force active cooled**	coils @ 110°C	F <sub>c</sub>		80		150	
	Maximum Speed***	@ 300 V	v <sub>max</sub>	m/s	10	16	5	12
	Motor Force Constant	coils @ 20°C	K	N/A <sub>rms</sub>	36.3	19.9	68	27.5
	Motor Constant	coils @ 25°C	S	N <sup>2</sup> /W	95		290	
Electrical	Peak Current	magnet @ 25°C	I <sub>p</sub>	A <sub>rms</sub>	11.0	20.0	10.6	26
	Max. Cont. Current passive cooled*	coils @ 110°C	I <sub>c</sub>	A <sub>rms</sub>	2,2	4,0	2,2	5,5
	Max.Cont. Current active cooled**	coils @ 110°C	I <sub>c</sub>	A <sub>rms</sub>	0,55	1,0	0,66	1,63
	Back EMF Phase-Phase Peak		B <sub>emf</sub>	V <sub>dc</sub> / m/s	30	16	55.5	25.5
	Resistance per Phase	coils @ 25°C ex. cable	R <sub>f</sub>	Ω	4.6	1.4	5.3	0.85
	Induction per Phase	l < 0.6 lp	L <sub>f</sub>	mH	1.5	0.4	4.2	0.7
Thermal	Electrical Time Constant	coils @ 25°C	τ <sub>e</sub>	ms	0.3		0.8	
	Maximum Continuous Power Loss	all coils	P <sub>c</sub>	W	91		105	
	Thermal Resistance	coils to mount. sfc.	R <sub>th</sub>	°C/W	0.6		1.0	
	Thermal Time Constant*	to max. coil temp.	τ <sub>th</sub>					
Mechanical	Temperature Cut-off / Sensor				PTC 1kΩ / NTC			
	Coil Unit Weight	ex. cables	W	kg	0.330		0.720	
	Coil Unit Length	ex. cables	L	mm	260		272	
	Motor Attraction Force		F <sub>a</sub>	N	0		0	
	Magnet Pitch NN		τ	mm	30		42	
	Cable Mass		m	kg/m	0.060		0.060	
	Cable Type (Power)	length 1 m	d	mm (AWG)	3x 1,6mm (20)			
	Cable Type (Sensor)	length 1 m	d	mm (AWG)	4x 0,8mm (26)			



UMV12 in 150mm magnet yoke shown

UMV Magnet yoke dimensions	
Le (mm)	150
M4 bolts	5
Mass (kg/m)	6.7
Magnet yokes can be butted together.	

ULV Magnet yoke dimensions	
Le (mm)	126
M5 bolts	6
Mass (kg/m)	13.6
Magnet yokes can be butted together.	

All specifications ± 10%

\* Depends on environmental conditions in the application. Continuous force noted has been determined with a thermal resistance of 0,05 K/W and a mounting surface of 20°C when the motor is driven at max. continuous current

\*\* Depends on environmental conditions in the application. Continuous force noted has been determined with a thermal resistance of 9 K/W for the UMV12 and 10 K/W for ULV9 with a temperature difference between coil and vac. chamber wall of 60°C

\*\*\*Actual values depend on bus voltage.

### Outgassing

Information and specifications concerning outgassing of the UMV and ULV series are available on request. Since these values depend on materials and environmental conditions, please contact us directly so we can advise you about your specific vacuum application. The knowledge and experience we have gained from designing and implementing custom vacuum motors for large OEMs enable us to provide a fitting solution for any application.

### Suited for pressures of 10<sup>-8</sup> mbar and lower, due to:

- Custom stainless steel coil unit housing
- Special high vacuum cables
- Low outgassing yoke design
- Cleanroom manufacturing process