Operating instructions
Linear conveyor "HFA-L-5xx"

fimotec – fischer
Montagetechnik

HFA-L-540
HFA-L-560
HFA-L-580
HFA-L-599

FB no.: ________________
Com.: ________________
Date: ________________

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Status 10 / 2022

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1. Safety information

1.1 General

These instructions contain the required information for the intended use of the products described herein. They are directed toward technically qualified personnel.

Qualified personnel are people who have been authorized by persons responsible for the safety of the system to execute the required activities and are able to recognize potential dangers and avoid them based on their training, experience and instruction, as well as their knowledge of relevant standards, regulations, accident prevention regulations and operating conditions (definition of skilled personnel according to IEC 364).

Warnings
The following warnings both serve for the personal safety of the operating personnel as well as the safety of the described products and the devices connected to them.

ATTENTION!
Nonobservance can lead to personal injury or material damage to the device.

WARNING!
Dangerous voltage.
Nonobservance can lead to death or serious bodily injury.

NOTE:
Here, tips for use and important information about how to work with the device are given.

DANGER:
For persons with active and passive body aids due to magnetic fields.

Disconnect the power supply before installation or dismantling.
Observe the valid accident prevention and safety regulations for your specific application.
Before commissioning, check whether the nominal voltage of the device agrees with the local mains voltage.
Emergency Stop mechanisms must remain active in all operating modes. Unlocking the Emergency Stop mechanism must not result in uncontrolled reactivation.
Existing protective equipment must not be removed.

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1. Safety information

1.2 Danger of the machine

Mechanics:
For a device left in its original condition, no danger is to be expected here.

Electrical engineering:
For a device left in its original condition with electrical equipment in perfect working order and intended use, no danger is to be expected here.
If the linear conveyor comes into contact with moisture, there is a danger of electric shock.
➔ Make sure the protective ground is in perfect condition:

1.3 Noise emissions

The noise level of the HFA-L depends on the goods to be transported and the design of the linear conveyor rail. The noise level according to the "Machinery" EC directive can therefore only be determined on site under real conditions.

If the noise level exceeds the permissible level, suitable noise protection measures must be taken.

1.4 Intended use

The linear conveyor may only be used in a dry environment as it is not protected against splash water. Use in an Ex zone or wet area is prohibited.
The HFA-L is to be used for driving linear conveyor rails. These are used for the transport and correct positioning of bulk parts as well as the metered feeding of bulk material.
Any other use of the HFA-L deviating from this is considered improper.

ATTENTION!
If not used properly, damage can occur to the device.

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2. Transport and storage

2.1 Transport

The internal transport of the linear conveyor HFA-L is preferably done with a trolley or similar transport device. A crane should be used for lifting.
For the tare weights of the different types, please refer to the technical data (chapter 4).

ATTENTION!
The HFA-L must not be lifted or transported by the transducer!

2.2 Storage

If stored over a relatively long time period, the linear conveyor must be kept dry and protected from aggressive media.
Strong temperature fluctuations must be avoided.

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3. Set-up and commissioning

3.1 Setup

The linear conveyor must be placed on a sufficiently stable base. This must not transmit any vibrations of the HFA-L.
The HFA-L is equipped with rubber-metal buffers at the factory. These have internal threads on the underside with which the linear conveyor can be screwed to the base.
For the drilling data of the different types, please refer to the technical data (chapter 4).

NOTE:
The linear conveyor and any attachments must not touch other equipment during operation.

3.2 Commissioning

Attach the part-specific linear conveyor rail to the HFA-L. The screw connection is made appropriately via the intermediate plate available as an accessory. The intermediate plate or also the linear rail can be screwed directly to the transducer of the HFA-L with the enclosed sliding blocks. If the linear conveyor is part of a fully assembled system, this work step is omitted.

NOTE:
- Make sure that the linear conveyor rail is firmly screwed to the basic unit.
- Check that the unit is free standing.
- Make sure that the connection cable of the linear conveyor is in perfect condition.
- Compare the available supply voltage and frequency with the data of the HFA-L.

The connection to the electrical mains is made exclusively via suitable control units. Please refer to the technical data (chapter 4) for the connection values.

The electric connection to the mains of the power supply company may only be carried out by a skilled professional.

After connecting to the electrical mains, check the delivery behaviour of the unit.

- Completely set up HFA-L are already set to optimal values by the manufacturer. The settings of the associated control units can be taken from the test protocols supplied.

- HFA-L without linear conveyor rails are adjusted ex works to a certain assembly weight (linear conveyor rail, conveyed material, possibly intermediate plate). Please refer to the technical data (chapter 4) for these assembly weights.
  If the assembly weight deviates from the specified values, this will result in a reduced delivery rate. The necessary retuning of the units is described in chapter 7.

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4. Technical data

Note:
An alternating voltage of 50Hz generates an oscillation frequency of 100Hz at the vibration drive.

Device type		HFA-L-			
		540	560	580	599
Dimensions					
Length	[mm]	442.5	619.5	819.5	1019.5
Height	[mm]	110	110	110	110
Transducer width (design B)	[mm]	89.6	89.6	89.6	89.6
Transducer width (design S)	[mm]	55.6	55.6	55.6	55.6
Total width (design B)	[mm]	90	90	90	90
Total width (design S)	[mm]	85	85	85	85
Net weight	[kg]	7.1	8.8	11.2	11.8
Mounting dimensions					
Thread		M4 (4x)	M4 (4x)	M4 (4x)	M4 (4x)
Drilling dimension	[mm]	200 x 60	300 x 60	450 x 60	500 x 60
Number of spring packages		2	2	3	4
Spring dimensions					
Length x width	[mm]	70 x 40	70 x 40	70 x 40	70 x 40
Thickness	[mm]	2.0 / 3.0	2.0 / 3.0	2.0 / 3.0	2.0 / 3.0
Max. assembly weight	[kg]	approx. 5.5	approx. 7.0	approx. 8.0	approx. 9.0
Max. rail length	[mm]	700	900	1100	1300
Nominal voltage	[V]	220	220	220	220
Nominal frequency	[Hz]	50	50	50	50
Nominal vibration frequency	[1/min]	6000	6000	6000	6000
Nominal current consumption	[A]	0.5	0.5	0.5	0.5
Power consumption	[VA]	110	110	110	110
Max. air gap	[mm]	1.2	1.2	1.2	1.2

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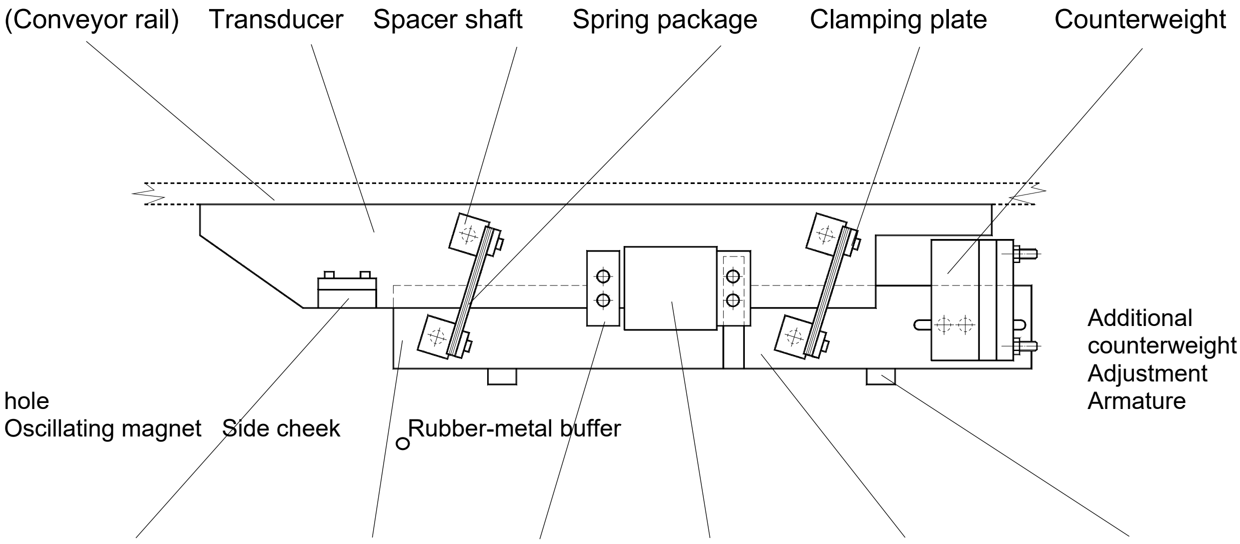
5. Machine description

5.1 Setup

The linear conveyor HFA-L consists of the following components:
- Base plates
- Transducer
- Oscillating magnet with armature
- Spring packages
- Counterweight

The HFA-L is available as type S (narrow) and type B (wide).

5.2 Side view



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5. Machine description

5.3 Functional principle

The linear conveyor HFA-L is a two-mass oscillating system, whereby the oscillating mass (transducer, linear conveyor rail and material to be conveyed) is connected to the counter mass (base plates with attachments and counter weights) via the spring packages. This spring-mass system has a certain natural frequency with which the system oscillates for a certain time after a single impact - depending on the existing damping.
If alternating current flows through the oscillating magnet, it exerts a sinusoidal force on the oscillating mass connected to the armature. This imposes an oscillation behaviour on the system whose frequency deviates from the natural frequency. This frequency is called the vibration frequency.

Due to the vertical and horizontal movements of the linear conveyor rail connected to the transducer, the conveyed material performs small throwing movements. The adjustment of the spring packages determines the throwing direction. This lies at right angles to the plane of the spring packages.

The closer the natural frequency and the vibration frequency are to each other, the greater the vibration deflections and thus the throwing movements of the conveyed material. The largest oscillation deflections occur at the resonance point, where natural frequency and vibration frequency coincide. However, resonance operation does not make sense for linear conveyors because, on the one hand, every change in damping (for example, due to different conveyed material) causes changes in the vibration deflections. On the other hand, in resonance mode it would be necessary to set a large air gap between the oscillating magnet and the armature to prevent striking. In this case, however, a constant driving force by the oscillating magnet would no longer be given, since the magnetic pulling force decreases approximately inversely proportional to the square of the air gap. Therefore, in practice, a distinction is made between two modes of operation:

a) Supercritical operation:
   Here the vibration frequency is above the natural frequency.
   In this mode of operation - as in resonance operation - the vibration deflections and thus the conveying speed depend on the nature of the material being conveyed. In addition, the electric current absorbed can rise sharply, since the oscillating movements and the exciting force are approximately in phase opposition, so that the case can arise where the largest air gap coincides with the maximum current.

b) Sub-critical operation:
   Here the vibration frequency is below the natural frequency.
   In this operating mode, the vibration deflections and thus the conveying speed are largely independent of the nature of the material being conveyed. Furthermore, since the oscillating movements and the exciting force are approximately in phase, the smallest air gap meets the current minimum here.

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6. Maintenance

The linear conveyors HFA-L are generally maintenance-free. However, thorough cleaning is recommended after contact with liquids or in case of heavy soiling.

WARNING!
Before starting maintenance work, the HFA-L must be disconnected from the electrical mains.

- First disconnect the linear conveyor's mains plug from the control unit.

- Clean the inside of the linear conveyor after dismantling the transducer (if necessary) (see chapter 7.3).

- Remove dirt in the air gap between the oscillating magnet and the armature.

- Check the air gap and adjust it if necessary (see chapter 7.4 and chapter 4).

- If necessary, reattach the transducer.

- Reconnect the unit to the electrical mains.

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7. Alignment

WARNING!
Before starting adjustment work, the HFA-L must be disconnected from the electrical mains.

If the desired conveying speed is not achieved, re-adjustment is necessary.
This re-adjustment is done by changing the spring configuration (conveying speed) and adjusting the spring or centre of gravity angle (conveying behaviour).

* First make a rough adjustment of the conveying speed.
* After that, the conveying behaviour must be adjusted.
* Finally, the conveying speed is finally adjusted.

7.1 Conveying speed

To change the conveyor speed, it is necessary to determine whether the linear feeder is below or above the oscillation frequency of 100Hz (50Hz AC voltage) in the tuning range.
For this, one or two plates are removed from the counterweight. If this causes a change in the conveying speed, springs are installed or removed according to the following table.

NOTE:
The setting of the control unit must not be changed.

Changing the conveying speed after reduction of the counterweight	Conveying speed should become faster	Conveying speed should become slower	Natural frequency
slower	remove springs	install springs	> 100 Hz
faster	install springs	remove springs	< 100 Hz

Note:
An alternating voltage of 50Hz generates an oscillation frequency of 100Hz at the vibration drive.

NOTE:
When adjusting the HFA, make sure that the number of springs per spring package is distributed as evenly as possible (maximum 2 springs difference).

Since the spring force increases with the square of the spring thickness, the spring constant of the various leaf springs must be taken into account when adjusting the conveying speed:
Therefore, coarse tuning should be done with thick springs, but fine tuning should always be done with thin springs.

NOTE:
The natural frequency of the HFA-L must not coincide with the mains frequency, otherwise resonance will occur.

7. Alignment

7.2 Conveying behaviour

To achieve even transport of the conveyed material on the conveyor rail, it is necessary that the positioning angle of the spring packages is identical to the angle of the centre of gravity. The centre of gravity angle is determined by the position of the centres of gravity of the oscillating and counter mass. If the spring and centre of gravity angles match, the force direction of the springs is applied exactly to the centre of gravity of the oscillating mass, the vertical amplitude is the same on the inlet and outlet side of the rail.

If the spring angle is greater than the centre of gravity angle, the force direction of the springs is initiated in front of the centre of gravity of the oscillating mass. The vertical amplitude is greater on the inlet side than on the outlet side. The material to be conveyed jumps in the inlet area of the rail and is not transported at all or only poorly in the outlet area. To equalise the spring and centre of gravity angles:

* The counterweight can be reduced or shifted in the conveying direction.
* The additional counterweight can be reduced.
* The spring packages can be positioned at a steeper angle.

If the spring angle is smaller than the centre of gravity angle, the force direction of the springs is initiated behind the centre of gravity of the oscillating mass. The vertical amplitude is greater on the outlet side than on the inlet side. The material to be conveyed jumps in the outlet area of the rail and is not transported at all or only poorly in the inlet area. To equalise the spring and centre of gravity angles:

* The counterweight can be increased or shifted against the direction of conveyance.
* The additional counterweight can be increased.
* The spring packages can be positioned flatter.

NOTE:
The spring angle can be adjusted in a range between 10° and 30° (to the vertical). If the centre of gravity angle is outside this range, a uniform conveying speed can be influenced by the design of the linear conveyor rail (see chapter 8) in addition to the changes to the counterweights or additional counterweights.

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7. Alignment

7.3 Installing and removing the leaf springs

To change the leaf springs of the HFA-L, proceed as follows:

1. Disconnect the mains plug of the HFA-L from the control unit.

2. Remove the upper fastening screws (4 or 6 pcs.) of the spring holders.

3. Pull the transducer assembly upwards.

4. The respective spring package can be removed after loosening the two lateral fastening screws of the lower spring holder.

NOTE:
For the rearmost spring package, unscrew the protective conductor attached to the upper spring holder.

5. Clamp the shorter shaft with spacers (5 mm each) together with the long shaft in a vice (this will maintain the optimum centre distance). Use protective jaws to avoid damaging the spring holders.

6. Remove the spring fastening screws and the clamping plates and carry out the spring replacement. Make sure that intermediate plates are always installed between the individual springs!

7. Before tightening the spring fastening screws (do not forget the clamping plates!) make sure that the shorter (upper) spring holder is aligned centrally with the longer one and that both spring holders are parallel to each other. The tightening torque of the spring fastening screws is 7.5 Nm.

8. Reinstall the spring package with the desired positioning angle. The correct position of the transducer in relation to the counterweight is achieved by inserting two M5 screws with a minimum length of 70 mm into the adjustment holes on the sides of the transducer and base plates.
   The tightening torque of the fastening screws of the spring holders is 7,5 Nm.
   Reattach the protective conductor to the rear spring package.

9. Remove the two staking screws.

10. Reconnect the HFA-L to the control unit.

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7. Alignment

7.4 Adjusting the magnetic gap

The magnetic gap of the HFA-L can be adjusted without dismantling any components. Proceed as follows:

1. Disconnect the mains plug of the HFA-L from the control unit.

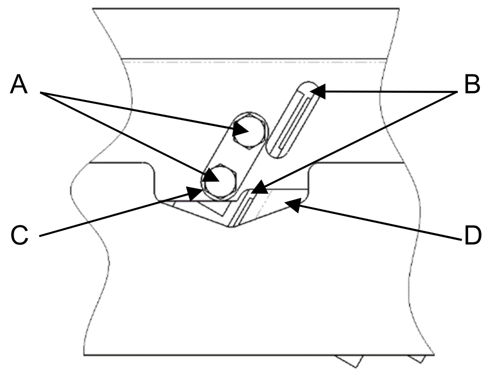
2. Loosen the two armature fixing screws (A). These are attached to the outside of the left side (in the direction of conveyance) of the transducer.

3. Next to the two holes for the armature adjustment there are two openings (B) in the transducer profile. Insert two feeler gauges t = 1.2 mm at the top and bottom here.

4. Push the two fixing plates (C) in the direction of the magnet (D) against the conveying direction and tighten the armature fixing screws (A) (7,5 Nm).

5. Remove the feeler gauge and reconnect the HFA-L to the electrical mains.

NOTE:
Care must be taken to ensure that the gap is set between magnet and armature in parallel.



7.5 Adjusting the spring positioning angle

Proceed as follows:

1. Disconnect the mains plug of the HFA-L from the control unit.

2. Secure the position of the transducer to the counterweight by inserting two M5 screws with a minimum length of 70 mm into the adjustment holes on the side of the transducer and side cheeks.

3. Loosen all the fastening screws on the sides of the spring holders.

4. Adjust the positioning angle of the spring packages by moving the lower spring holders in the arched slotted holes attached to the side cheeks (to the front: positioning angle flatter; to the rear: positioning angle steeper).

5. Tighten the fastening screws of the spring holders again (tightening torque: 15 Nm).

6. Remove the two M5 staking screws.

7 Reconnect the HFA-L to the control unit.

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7. Alignment

7.6 Operation on a frequency control unit

To avoid damage to the oscillating magnet, when operating the HFA-L on a frequency control unit, make sure that its output frequency is not set lower than -10% of the nominal frequency of the oscillating magnet:

At nominal frequency 50 Hz: Output frequency not below 45 Hz.

For the nominal frequencies of the oscillating magnets, please refer to the technical data (chapter 4).

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8. Rules of the design of the linear conveyor rail

The conveyor rail should be made as light as possible. Make sure that the recommended assembly weight (see chapter 4) is not exceeded.

The length of the conveyor rail should not exceed the specified dimension (see chapter 4).

The projection of the conveyor rail beyond the linear conveyor's transducer should be a maximum of 100 mm (infeed side) and a maximum of 200 mm (outfeed side).

To avoid uncontrolled swinging at the rail ends, ensure sufficient torsional stiffness for long conveyor rails.

An intermediate plate made of 5 - 8 mm thick aluminium mounted between the linear conveyor rail and the transducer increases the lateral torsional stiffness of the conveyor rail.

If the conveyor rail consists of several short sections, these must be assembled on the transducer and screwed tight. On the infeed side, flat chamfers facilitate the transition of the conveyed material from one rail section to the other.

The clearance between the upper edge of the conveyed material and the lower edge of the rail cover must be adjusted depending on the conveying speed. The greater the conveying speed, the greater the play. In principle, the largest possible clearance should be selected at which the conveyed material can still be transported without getting caught or jammed.

The cover of the conveyor rail must be screwed on tightly. Loose or hinged covers should be avoided (vibration reduction, increased running noise).

Tips for attaching the linear conveyor rail:

* Screw the conveyor rail firmly to the linear conveyor.
* Ensure that the conveyor rail rests evenly and level on the transducer.
* By changing the transducer profiles, a wide (design B) or narrow (design S) support of the linear conveyor rail is achieved.
* A central arrangement of the conveyor rail on the linear conveyor is to be aimed for.
* To achieve a higher conveying speed, the linear conveyor can be installed with a slight downward slope in the conveying direction.

NOTE:
If the slope is too steep, increased wear of the rubber-metal buffers is to be expected.

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9. Malfunctions

WARNING!
The cable plug may only be opened by a qualified electrician.
Before working on the linear conveyor, it must be disconnected from the electrical mains.

Malfunction	Potential failure cause	Troubleshooting
The HFA-L does not start when switched on	Mains plug of the control unit not plugged in	Plug in the mains plug
	Connecting cable between HFA-L and control unit not plugged in	Plug in connection cable
	Fuse in control unit defective	Replace fuse
	Power cable of the control unit defective	Replace power cable
	Connection line between HFA-L and control unit defective	Replace connection cable
	Oscillating magnet defective	Replace magnet
HFA-L vibrates only weakly	Control unit set too weak	Set the amplitude of the control unit to 80%.
	Electrical connection values not suitable	Check connection values
After a longer period of operation, the capacity of the HFA-L is reduced.	Air gap between magnet and armature misaligned	Set air gap correctly
	Fastening screws of the conveyor rail loose	Tighten screws
	Fastening screws of the spring packages loose	Tighten screws
	Leaf springs broken	Replace leaf springs
	Spring gaps soiled	Blow out gaps
Strong noise development	Foreign body in the air gap between magnet and armature	Remove foreign body, then check air gap
	Oscillating magnet strikes armature	Correct air gap
	Leaf spring fastening screws loose	Tighten screws

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9. Malfunctions

Malfunction	Potential failure cause	Troubleshooting
Conveying speed on the outlet side greater than on the inlet side, parts jump on the outlet side	Spring angle smaller than centre of gravity angle ➔Vertical amplitude of the conveyor rail in the outlet area greater than in the inlet area	* Set the positioning angle of the spring packages flatter. * Move the counterweight against the conveying direction. * Increase counterweight. * Increase additional counterweight.
Conveying speed on the inlet side greater than on the outlet side, parts jump on the inlet side	Spring angle greater than centre of gravity angle ➔Vertical amplitude of the conveyor rail in the inlet area greater than in the outlet area	* Set the positioning angle of the spring packages steeper. * Move the counterweight in the conveying direction. * Reduce counterweight. * Reduce additional counterweight.
Unsteady conveying behaviour (parts jumping) at constant conveying speed	Spring and centre of gravity angles are too large ➔Vertical amplitude of the conveyor rail is too large over the entire length	* Move the counterweight in the opposite direction to the conveying direction. * Increase counterweight. * Increase additional counterweight. * Set the positioning angle of the spring packages according to the new centre of gravity angle.
- Low conveying speed with uniform conveying behaviour - Irregular conveying behaviour of large-surface or oily parts despite uniform height amplitude	Spring and centre of gravity angles are too small ➔Vertical amplitude of the conveyor rail is too small over the entire length, no throwing movement can take place ➔For oily parts, the adhesion force is greater than the throwing force	* Move the counterweight in the conveying direction. * Reduce counterweight. * Reduce additional counterweight. * Adjust the positioning angle of the spring packages according to the new centre of gravity angle.
Conveying speed and behaviour cannot be adjusted with the measures listed above	* Rail stiffness not sufficient. * Butt joints or separating points of the conveyor rail work towards each other. * Asymmetrical components on the conveyor rail lead to uneven running behaviour.	* Attach stiffeners. * Screw together butt joints or separating points. * Counter asymmetrical components with weights or replace them with lighter components.

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10. Accessories

10.1 Accessories, mechanical

Since the mounting holes of the linear conveyor rails cannot always be set to match the grooves in the linear conveyor's transducer profiles, it is useful to fit **intermediate plates ZP** . These allow the conveyor rail to be mounted not only in the centre but also offset to the side.

In addition to being screwed directly to a base plate, the linear conveyors HFA-L can also be mounted on a **stand** (e.g. ST-100-50-B or -S). Matching **AP mounting plates** are available as an adapter between the HFA-L and the stand.

10.2 Accessories, electronic

The linear conveyors are connected to the mains exclusively via suitable **control or regulating devices**. Various types are available from our delivery programme.

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11. Spare and wear parts

If required, the following individual parts are available for the unit types described in these operating instructions:

* Oscillating magnet
* Magnetic armature
* Leaf springs 2.0 or 3.0 mm thick
* Intermediate plates (between the individual leaf springs)
* Clamping plate (between leaf spring and fastening screws)
* Spring holder, bottom
* Spring holder, top
* Rubber-metal buffer
* Line plug STAS 20

To ensure fast and error-free processing of your order, please always state the unit type (see type plate) and the year of manufacture of your linear conveyor, the required quantity and the exact designation of the spare part.

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EC declaration of incorporation

The linear conveyor

Designation: HFA-L-540 HFA-L-560 HFA-L-580 HFA-L-599

Year of construction: starting from 05 / 2022

was developed, designed and produced in agreement with the named EC directives by:

The manufacturer:	Person responsible for documentation:
fimotec - fischer GmbH & Co. KG Friedhofstraße 13 78588 Denkingen, Germany Tel.: 07424-884-0	Holger Ehrenfried

The manufacturer hereby declares that the partly completed machinery complies with the requirements of the Machinery Directive (2006/42/EC) Annex II 1 B.

The following harmonized standards were applied:

- DIN EN ISO 12100: 2011-03 (D)	Safety of machinery - General principles for design; Risk assessment and risk reduction (ISO 12100: 2010)
- EN 60204-1: 2006	Safety of machinery - Electrical equipment of machines Part 1: General requirements

The special technical documents belonging to the machine were created in accordance with Annex VII Part B.
The manufacturer undertakes to provide the specific documentation relating to the partly completed machinery
to national authorities upon request.

The commissioning of this machine is prohibited until the machine or system in which the product is to be installed or of which it is a component meets the specifications of all relevant directives.

Denkingen	Oct 01, 2022	Ralf Fischer, Managing Director	R. Fr
Place	Date	Identification of signatory	Signature

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