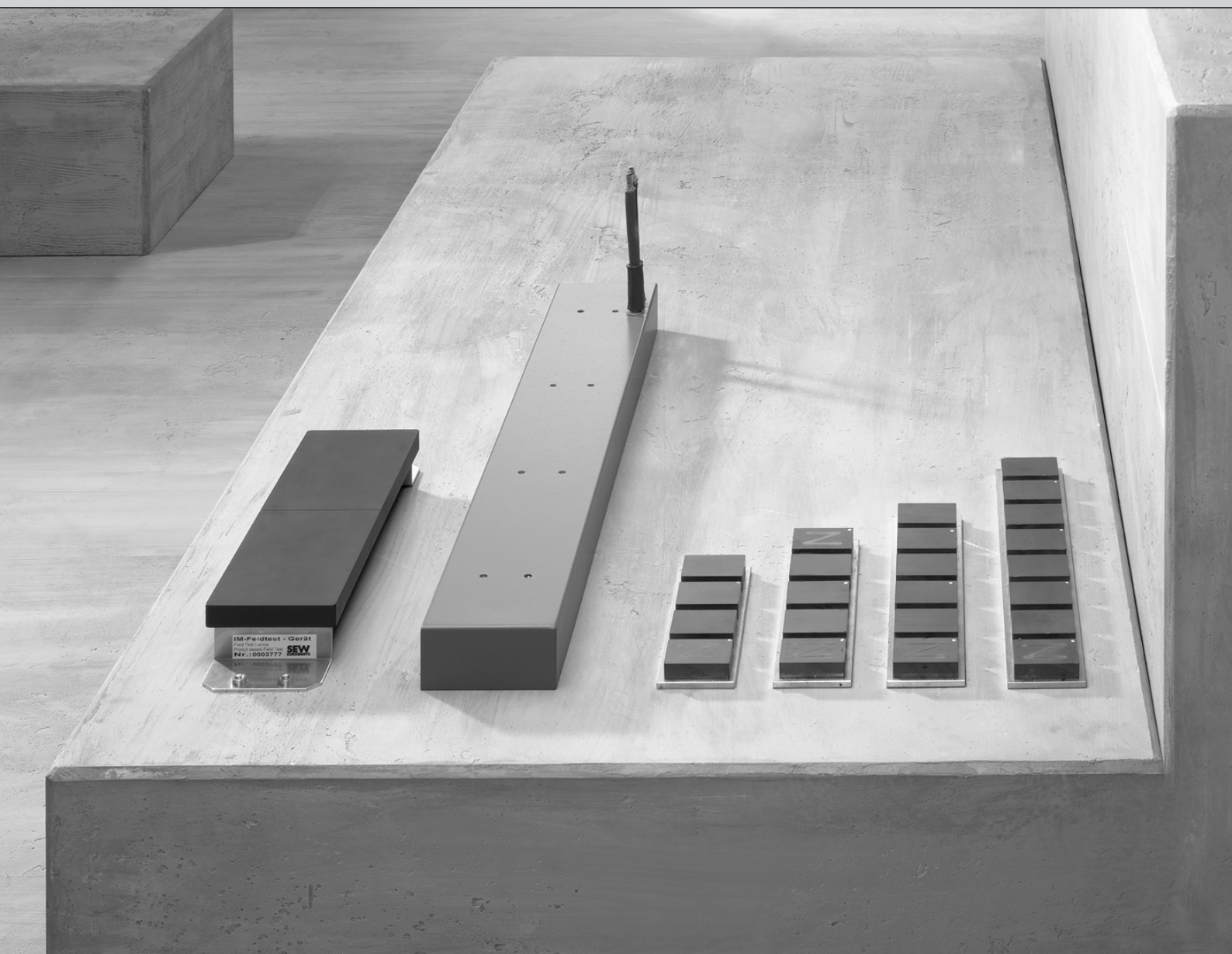




# Operating Instructions



## SLC Synchronous Linear Motors



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## 1 General information

### 1.1 About this documentation

This documentation is an integral part of the product. The documentation is intended for all employees who perform assembly, installation, startup, and service work on the product.

Make sure this documentation is accessible and legible. Ensure that persons responsible for the machinery and its operation as well as persons who work on the device independently have read through the documentation carefully and understood it. If you are unclear about any of the information in this documentation or require further information, contact SEW-EURODRIVE.

### 1.2 Structure of the safety notes

#### 1.2.1 Meaning of signal words

The following table shows the grading and meaning of the signal words for safety notes.

Signal word	Meaning	Consequences if disregarded
<b>▲ DANGER</b>	Imminent hazard	Severe or fatal injuries.
<b>▲ WARNING</b>	Possible dangerous situation	Severe or fatal injuries.
<b>▲ CAUTION</b>	Possible dangerous situation	Minor injuries
<b>NOTICE</b>	Possible damage to property	Damage to the drive system or its environment.
<b>INFORMATION</b>	Useful information or tip: Simplifies handling of the drive system.	

#### 1.2.2 Structure of section-related safety notes

Section-related safety notes do not apply to a specific action but to several actions pertaining to one subject. The hazard symbols used either indicate a general hazard or a specific hazard.

This is the formal structure of a safety note for a specific section:



##### **SIGNAL WORD**

Type and source of hazard.

Possible consequence(s) if disregarded.

- Measure(s) to prevent the hazard.

**1.2.3 Structure of embedded safety notes**

Embedded safety notes are directly integrated into the instructions just before the description of the dangerous action.

This is the formal structure of an embedded safety note:

**▲ SIGNAL WORD** Type and source of hazard. Possible consequence(s) if disregarded. Measure(s) to prevent the hazard.

**1.3 Rights to claim under limited warranty**

Read the information in this documentation. This is essential for fault-free operation and fulfillment of any rights to claim under limited warranty. Read the documentation before you start working with the unit!

**1.4 Content of the documentation**

**The current version of the documentation is the original.**

This document contains additional safety-relevant information and conditions for use in safety-related applications.

**1.5 Exclusion of liability**

Read the information in this documentation, otherwise safe operation is impossible. You must comply with the information contained in this documentation to achieve the specified product characteristics and performance features. SEW-EURODRIVE assumes no liability for injury to persons or damage to equipment or property resulting from non-observance of these operating instructions. In such cases, SEW-EURODRIVE assumes no liability for defects.

**1.6 Product names and trademarks**

The brands and product names in this documentation are trademarks or registered trademarks of their respective titleholders.

**1.7 Copyright notice**

© 2016 SEW-EURODRIVE. All rights reserved. Unauthorized reproduction, modification, distribution or any other use of the whole or any part of this documentation is strictly prohibited.

## 2 Safety notes

The following basic safety notes must be read carefully to prevent injury to persons and damage to property. The user must ensure that the basic safety notes are read and observed. Make sure that persons responsible for the system and its operation, as well as persons who work independently on the unit, have read through the operating instructions carefully and understood them. If you are unclear about any of the information in this documentation, or if you require further information, please contact SEW-EURODRIVE.

### 2.1 Preliminary information

#### INFORMATION



Due to the strong permanent magnets installed in the secondaries of the SLC linear motors, the following safety regulations must be observed.

Also observe the additional safety notes provided in the individual chapters of this documentation.

Due to the strong magnetic fields persons with cardiac pacemakers must not perform work on these units.

Even at a distance of 100 mm, the magnetic flux density of the present secondaries is  $< 2 \text{ mT}$  (at 150 mm  $< 1 \text{ mT}$ ). Since the magnetic flux density in SLC linear motors is generated exclusively by the magnetic fields of the secondaries, this value is independent from the operating status of the SLC linear motor.

Be cautious when in close proximity (distances  $< 50 \text{ mm}$ ) to the secondaries due to the high attraction forces. Magnetic forces are often underestimated since they are not visible.

Magnetic attraction forces often start abruptly in the immediate proximity range and can grow in up to 100 kg for medium-sized objects.



## 2.2 General information



### ▲ WARNING

During operation, the motors or gearmotors can have live, bare (in the event of open connectors/terminal boxes) and movable or rotating parts as well as hot surfaces, depending on their degree of protection.

Severe or fatal injuries.

- All work related to transportation, storage, installation, assembly, connection, startup, maintenance and repair may only be carried out by qualified personnel, in strict observance of the following points:
  - The applicable detailed documentation(s)
  - Warning and safety signs on the motor/gearmotor
  - All the project planning documents, startup instructions and wiring diagrams related to the drive
  - System-specific regulations and requirements
  - National/regional regulations governing safety and the prevention of accidents.
- Never install damaged drives.
- Report any damage to the shipping company immediately.

Removing required covers without authorization, improper use or incorrect installation and operation may result in severe injury to persons, or damage to machinery.

The magnetic forces are always present regardless of the operating status of the system.

Keep watches and magnetizable data carriers (such as credit cards, disks, etc.) away from close proximity (<100 mm) of the SLC synchronous linear motors.

Do not lead any metallic objects that are heavy (> 1 kg) or have a wide surface (> 1 dm<sup>2</sup>) to the secondary with unprotected hands to the secondary.

The surfaces are hot during operation and during the cool down phase after switch-off. Do not touch the linear motor during this time.

Refer to the following chapters for more information.



## 2.3 Target group

Any mechanical work may only be performed by adequately qualified personnel. Qualified personnel in the context of this documentation are persons familiar with the design, mechanical installation, troubleshooting and servicing of the product who possess the following qualifications:

- Training in mechanical engineering, e.g. as a mechanic or mechatronics technician (final examinations must have been passed).
- They are familiar with these operating instructions.

Any electronic work may only be performed by adequately qualified electricians. Qualified electricians in the context of this documentation are persons familiar with electrical installation, startup, troubleshooting and servicing of the product who possess the following qualifications:

- Training in electrical engineering, e.g. as an electrician, electronics or mechatronics technician (final examinations must have been passed).
- They are familiar with these operating instructions.

All work in the areas of transportation, storage, operation and waste disposal must be carried out by persons who are trained appropriately.

All qualified personnel must wear appropriate protective clothing.

## 2.4 Designated use

SLC series synchronous linear motors are motors for industrial and commercial systems.

When installed in machines, startup (i.e. start of designated operation) is prohibited until it is determined that the machine complies with the local laws and directives. In the individual area of application, you must especially observe the Machinery Directive 2006/42/EC as well as the EMC Directive 2014/30/EU. The EMC test specifications EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-6 and EN 61000-6-2 form the basis for this.

Using these products in potentially explosive atmospheres is prohibited, unless specifically designated otherwise.

Air-cooled linear motors are designed for ambient temperatures of -20 °C to +40 °C and installation altitudes ≤ 1000 m above sea level. Observe any differing specifications on the nameplate. The ambient conditions must comply with all the specifications on the nameplate.

## 2.5 Operational environment

**The following uses are prohibited unless the units are expressly designed for the purpose:**

- Use in potentially explosive atmospheres.
- Use in areas exposed to harmful oils, acids, gases, vapors, dust, radiation. Contact SEW-EURODRIVE if you have any questions on the ambient conditions.
- Use in non-stationary applications that are subject to mechanical vibration and impact loads in excess of the requirement of EN 50178.

## 2.6 Safety functions

SLC linear motors may not perform any safety functions without a higher-level safety systems.

Use higher-level safety systems to ensure protection of equipment and personnel.

## 2.7 Behavior and immediate measures in case of accidents



### ▲ WARNING

Danger caused by magnetic field.

Severe or fatal injuries.

- The magnetic forces are always present regardless of the operating status of the system.

Place at least two pointed wedges made of firm, non-magnetic material, such as brass or stainless steel (edge angle approx. 10° – 15°) and a hammer ready to free trapped body parts. If necessary, e.g. if mounting space is limited, customized installation appliances should be used to facilitate and safeguard work.

- If the machine is connected to the power supply system, press the emergency off button immediately.
- Request first aid immediately.
- You need the tools mentioned previously to free body parts jammed in between two secondaries or a secondary and a ferromagnetic component (e.g. steel plate, steel carrier, machine bed, tool). Separate the components at the separation gap using the pointed wedge.

## 2.8 Electrical connection



### ▲ WARNING

Risk of injury due to electric shock.

Severe or fatal injuries.

- Wire the motor according to the regulations.

All work may only be carried out by qualified personnel. During work, the low-voltage machine must be at standstill, de-energized, and safeguarded against accidental re-start. This also applies to auxiliary circuits (e.g. anti-condensation heating or forced cooling fan).

Perform electrical installation according to the pertinent regulations (e.g. cable cross sections, fusing, protective conductor connection). For any additional information, refer to the applicable documentation.

Comply with the regulations of the following standards and directives:

- EN 60034-1, rotating electrical machines
- EN 50110, operation of electrical installations
- IEC 60664, insulation coordination for equipment within low-voltage systems
- EN 60204-1, safety of machinery - electrical equipment of machines
- EN 61800-5-1, adjustable speed electrical power drive systems

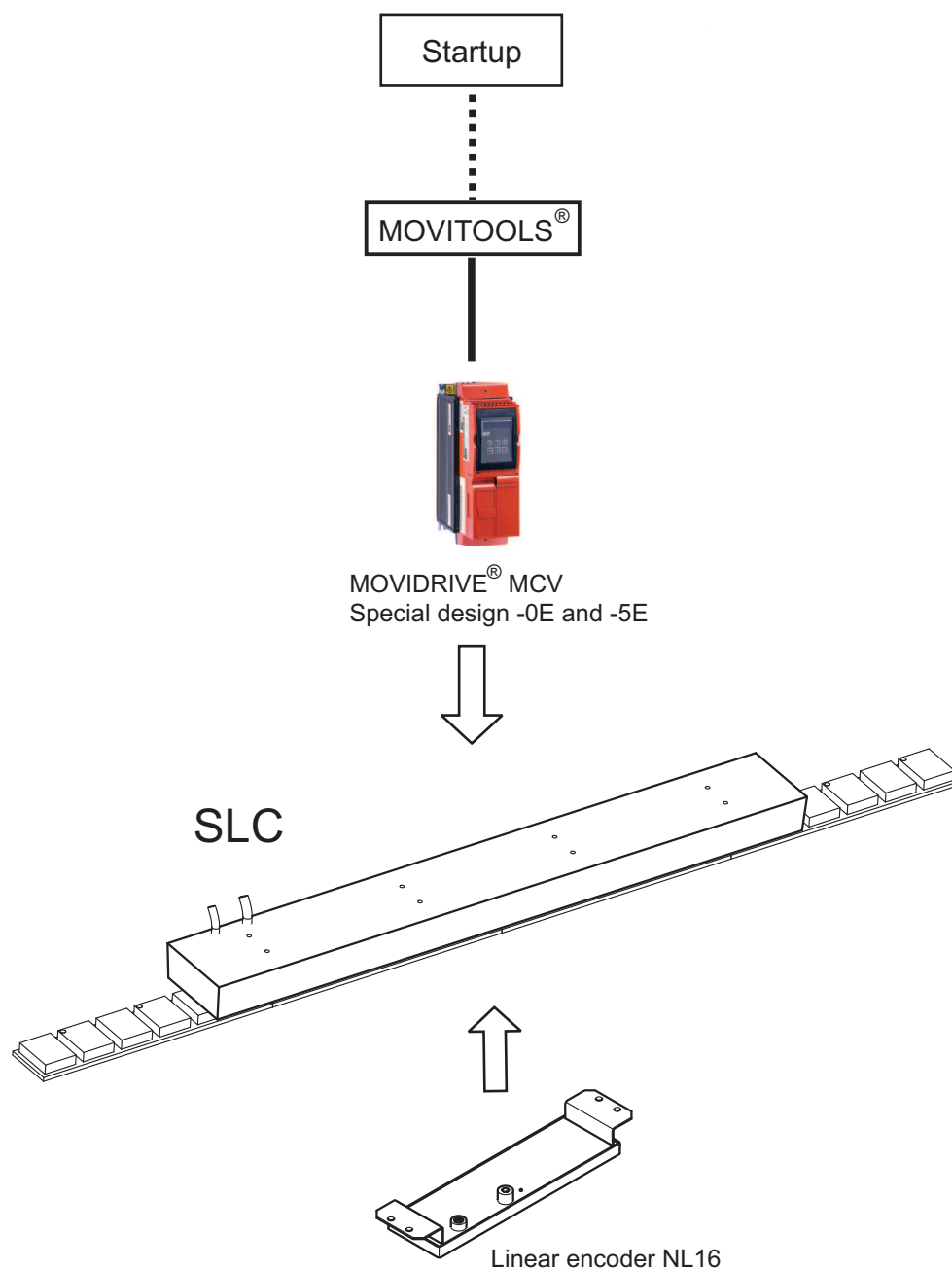
The connection must be a permanently secure electrical connection (no protruding wire ends); use the cable end equipment intended for this purpose. Establish a safe PE connection. When the motor is connected, the distances to non-insulated and live parts must not be shorter than the minimum values according to IEC 60664 and national regulations. With low voltage, the distances should be no shorter than the following values, in compliance with IEC 60664:

Nominal voltage $V_N$	Distance
$\leq 500 \text{ V}$	3 mm
$\leq 690 \text{ V}$	5.5 mm

Observe the notes in the "Electrical installation" chapter.

### 3 Product description and overview of types

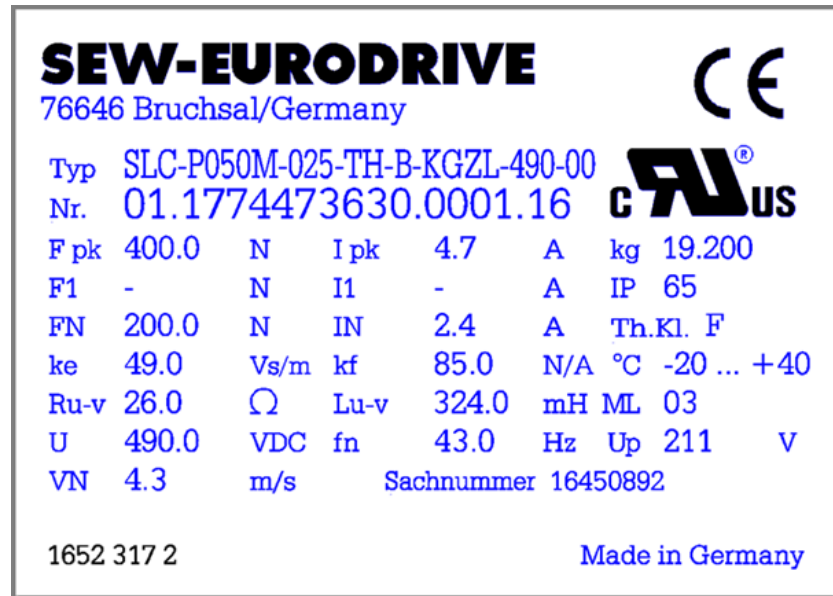
#### 3.1 System environment



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## 3.2 Nameplate






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Type	= Type code
No.	= Customer order number
F <sub>pk</sub>	= Maximum force
F <sub>N</sub>	= Rated data
k <sub>e</sub>	= Voltage
R <sub>u-v</sub>	= Winding resistance <sup>1)</sup>
V	= Voltage
v <sub>N</sub>	= Nominal speed
I <sub>PK</sub>	= Maximum current
I <sub>N</sub>	= Rated current
k <sub>f</sub>	= Force factor
L <sub>u-v</sub>	= Inductance <sup>1)</sup>
f <sub>N</sub>	= Rated frequency
kg	= Weight of the linear motor
IP	= Degree of protection
Th.cl.	= Thermal class of the linear motor
°C	= Ambient temperature range
ML	= Mounting location (UL)
V <sub>p</sub>	= Internal voltage at v <sub>N</sub>

1) Half the conductor value (UV value) is used for startup.

### 3.3 Markings

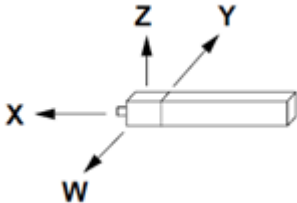
The following table lists all marking that can be given on a nameplate or attached to the motor and an explanation of what they mean.

Mark	Meaning
	CE mark to state compliance with European guidelines, such as the Low Voltage Directive
	UR logo to confirm that UL (Underwriters Laboratory) is informed about the registered components; register number by UL: E323544
	CSA mark to confirm the Canadian Standard Association (CSA) and the market conformity of AC motors

### 3.4 Type designation

#### Primary

Example: SLC-P050M-025-TH-B-KGZL-490-00		
Product name	SLC	Synchronous linear motor
Partial designation	P	Primary
Active width of the primary	050	50 mm
Length of the primary	M	M = Medium
Nominal velocity $v_N$	025	2.5 m/s
Motor protection	TH	
Motor design	B	Basic

Example: SLC-P050M-025-TH-B-KGZL-490-00		
Electrical connection	KGZL	<p>For basic design (e.g. KGZL, AGZ0)</p> <p><b>1. Letter:</b> K = Cable A = Cable with connector</p> <p><b>2. Letter:</b> G = Thermal protection / power rating of separate cables</p> <p><b>3. Letter:</b></p>  <p>Z = direction</p> <p><b>4. Letter:</b> 0 = Cable length 0.5 m<sup>1)</sup> L = Cable length 3.5 m</p>
DC link voltage	490	DC 490 V
Design	00	Design 00 = Standard

1) only for connector design

### Secondaries

Example: SLC-S050-200-01		
Product name	SLC	Synchronous linear motor
Partial designation	S	Secondary
Active magnet width of the secondary	050	50 mm
Length of the secondary	200	200 mm 250 mm 300 mm 400 mm 608.5 mm 708.5 mm 1108.5 mm
Design	01	01 = symmetrical magnet alignment 5/5 02 = asymmetrical magnet alignment 5/13.5



### 3.5 Scope of delivery for system components

The scope of delivery for SLC linear motors comprises:

- Primaries
- Secondaries with permanent magnets
- Control and regulation systems such as MOVIDRIVE®
- NL16 linear encoder
- NL16 prefabricated connection cable

## 4 Transportation/storage

### 4.1 Notes

#### NOTICE

Improper transport may result in damages to the linear motor.

Possible damage to property.

- Strictly adhere to the notes in this chapter.

- Use suitable, sufficiently rated handling equipment if necessary.
- Inspect the shipment for damage as soon as you receive the delivery. Inform the shipping company immediately about any damage. It may be necessary to suspend startup.  
If necessary, use suitable, sufficiently dimensioned handling equipment. Remove transport protection prior to startup.
- Mark the storage locations of secondaries ("Caution! Strong magnetic fields", symbols).
- Never store secondaries unpacked; use non-magnetic packaging material with a thickness of at least 2 cm (0.79 in) on the magnetic side.
- Observe the warning instructions on the packaging.
- Keep storage area dry.
- Protect storage sites from heat.
- For transportation of machines or components with primaries or secondaries already installed on travel axis/axes: Lock the axis/axes to prevent accidental movement (due to missing self-locking mechanism).



### 4.2 Corrosion protection and storage conditions

The motor parts are protected against corrosion for five years in closed original packaging.

Observe the following storage conditions for the linear motors:

- Store the linear motors inside
- Keep the storage area clean and dry
- Maintain a storage temperature between -5 °C and +70 °C
- Relative humidity not to exceed 95%
- The original packaging must not be damaged

Stored SLC linear motors must be equipped with the following warning labels:

Warning	Magnetic
	

### 4.3 Return delivery to SEW-EURODRIVE

Return primary and secondary components in original packaging only.



#### **▲ WARNING**

Danger caused by magnetic field.

Severe or fatal injuries.

- Cover the magnetic side of the secondaries with a wooden board (thickness 2 cm) over the entire surface and connect. Special caution needs to be the rule in close proximity (distances < 50 mm) to the secondaries due to the high attraction forces. Magnetic forces are often underestimated since they are not visible.
  - Magnetic attraction forces often arise abruptly in the immediate proximity range.
-

## 5 Mechanical installation

### 5.1 Notes



#### **⚠ DANGER**

Danger caused by magnetic field.

Severe or fatal injuries.

- Never place secondaries on metal.
- Never place a primary directly on a secondary.
- Hold the tools firmly (with both hands). Slowly guide the tools to the secondary.
- Wear work gloves during installation.
- Do not remove the packaging of the secondary until directly before it is installed.
- Carry out installation work in pairs only.
- Cover already installed secondaries with at least 2 cm of non-magnetic material (e.g. wood) during installation.
- Use customized installation appliances to facilitate and safeguard work, if necessary (e.g. if mounting space is limited).
- Make sure that the primary is grounded according to regulations with the PE grounding bar in the control cabinet as a reference potential.
- Attach the enclosed caution sign in a prominent position or in the vicinity of the secondaries installed.
- Note that depending on the local approval regulations for the entire system, the area of the primary facing the air gap is not considered as part of the housing. This might have to be taken into account when planning the system.



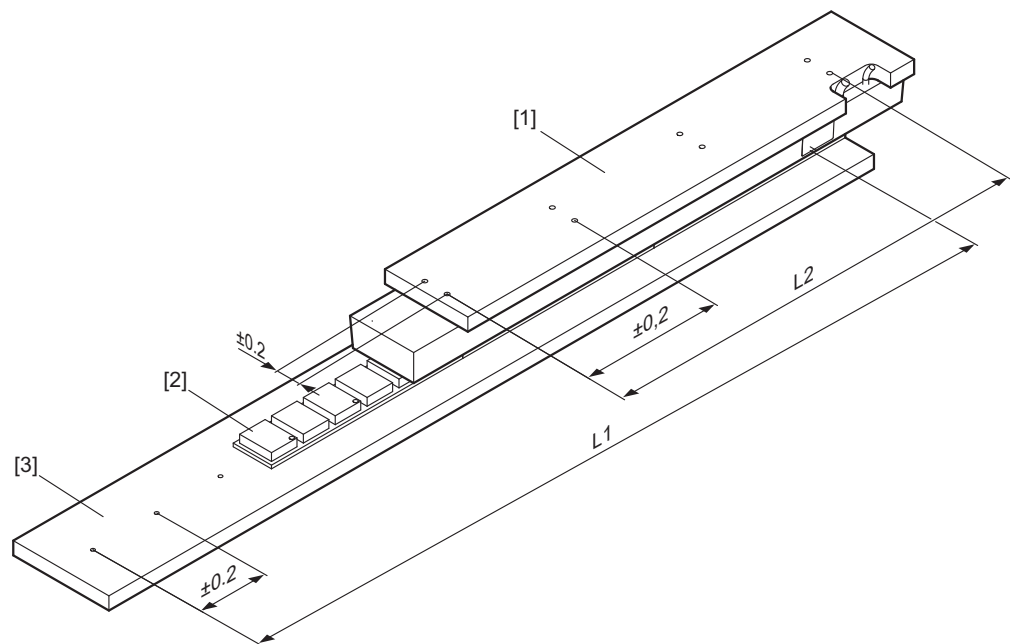
#### **⚠ DANGER**

Risk of injury due to electric shock.

Severe or fatal injuries.

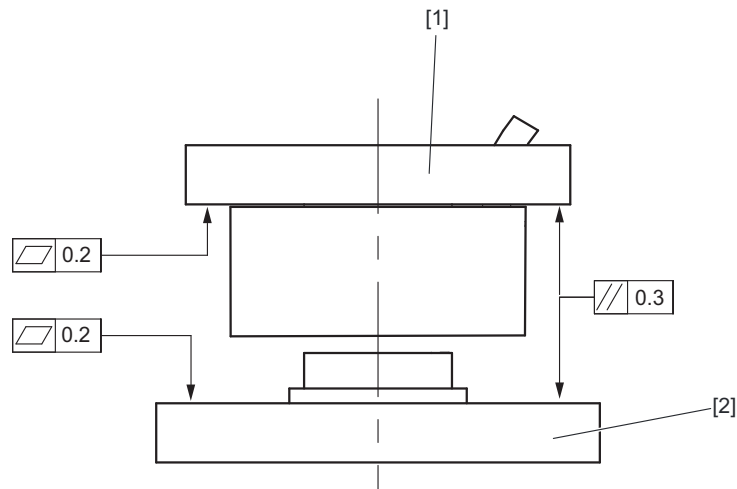
- Make sure that the primary is grounded according to regulations with the PE grounding bar in the control cabinet as a reference potential.

## 5.2 Installation tolerances



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- [1] Installation of primary  
**with reference to the primary, max. deflection length 0.3 mm / width 0.1 mm**
- [2] Secondary  
**with reference to 400 mm length, max. deflection 0.1 mm**
- [3] Installation of secondary
- [L1]  $\pm 0.3$  mm with reference to 1000 mm of the secondary
- [L2]  $\pm 0.2$  mm with reference to the total length of the primary



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- [1] Primary (mounting plate)  
[2] Installation of secondary (basic body, e. g machine base)

Shape and position tolerances in reference to 1000 mm length

Adhering to shape and position tolerances is necessary for the functionality of the linear motor. These accuracies are sufficient for the functionality of the NL16 linear encoder.

These shape and position tolerances will have to be observed in operating mode at steady-state temperature of the linear motor. Also consider the influence of the loads applied by the customer.

The primary has a construction-related flatness tolerance of max. 0.8 mm at the contact surface before installation.

To achieve a flatness of < 0.2 mm when installed, the primary must be bolted on a flat substructure with a bending stiffness corresponding to at least a square hollow section according to DIN EN 10210-60x60x6-S235JR.

During the mounting process, a force of max. 1000 N per bolt acts on the outer mounting bolts (distance 600 mm). The additional magnetic attraction forces have not been taken into account for this. They must be considered when dimensioning the customer substructure.

### 5.3 Installing the primary

Before you start

Check that

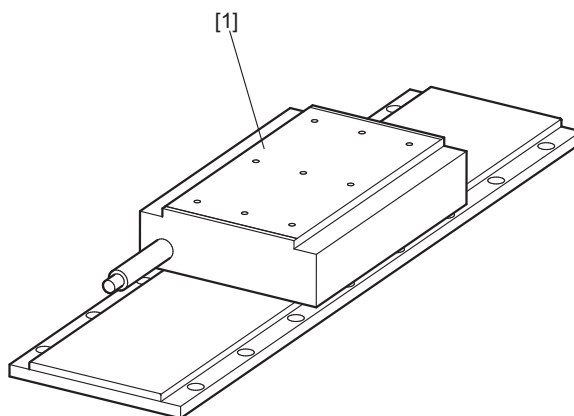
- the information on the nameplate of the drive and/or the output voltage of the servo inverter match the voltage supply system
- the drive is undamaged (no damage caused by transportation or storage)
- You are certain that the following requirements have been met:
  - Ambient temperature between -20 °C and +40°C
  - No oil, acid, gas, vapors, radiation, etc.
  - Max. installation altitude 1000 m above sea level.



### INFORMATION

Start with the installation of the primary. Install the secondaries once all other installation work has been completed, immediately prior to startup of the drive. Observe the safety notes when handling the secondaries (see chapter 2).

Preparing the  
primary for installa-  
tion



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Mounting surfaces [1]:

The mounting surfaces of the primary were treated with corrosion protection at the factory. Before installing the surface, wipe the surface with a lint free cloth to remove any dust, dirt, etc. clinging to the surface.

Retaining screws:

Use **all** M6 tapped holes in the mounting surface for retaining purposes. Use screws of size M6, strength class 8.8 or higher. The minimum depth of engagement is 10 mm. The tightening torque is always 10 Nm and may not be exceeded, even with screws of a higher strength class.



## 5.4 Installation of secondaries

### 5.4.1 Preparing the secondaries for installation



#### **! DANGER**

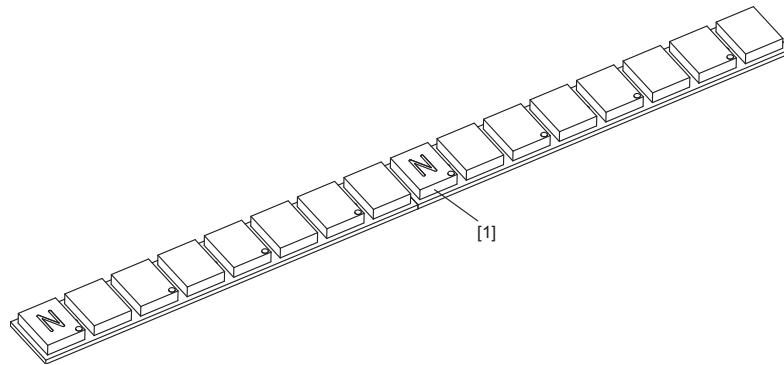
Danger caused by magnetic field.

Severe or fatal injuries.

- Do not unpack parts until you are ready for installation.
- Observe the safety notes in chapter "Safety notes" (→ 7).

### 5.4.2 Installation of secondaries

Install the first part at one end of the travel section and work your way down in one direction. The orientation of the first part can be random. The adjoining part will have the same orientation. The north [1] pole is marked on the secondaries (→ see figure below). You can combine secondaries of different lengths.



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[1] North pole

Move primary over secondaries by hand prior to startup of drive to check for un-hindered operation.

Use non-magnetic testing devices, such as feeler gauges made of stainless steel, aluminum, brass or copper sheets if you are planning to check the visible air gap.



#### **! DANGER**

Risk of injury due to electric shock.

Induced voltages of up to 500 V can be generated by movement of the primary (generator principle) even if the motor is not connected.

Severe or fatal injuries.

- Only remove the protection cap on the power plug of the primary immediately before connecting the power plug to the power supply.

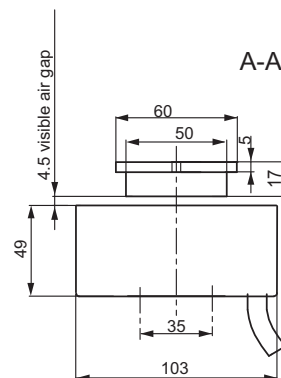
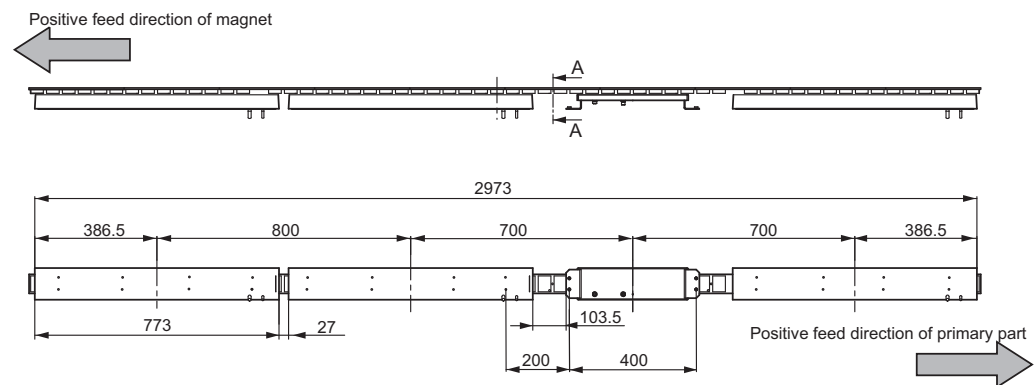
### 5.5 Installation of NL16 linear encoders

The NL16 linear encoder is screwed to a carrier plate with 4 screws. When designing the motor it was ensured that the SLC-P050M-030, for example, has the same height as the NL16 so that both can be directly mounted on the same carrier plate.

For the motor to be commutated and energized in the correct phases, the measuring system must be mounted according to the distances and orientation displayed in the figure.

Observe the following tolerances when installing:

- Nominal clearance: 4.5 mm
- Maximum air gap: 8.5 mm
- Misalignment at the sides at right angles to the direction of travel:  $\pm 0.5$  mm centered
- Distance of the NL16 linear encoder center to SLC-P center: 700 mm +  $(1 \dots n \times 100 \text{ mm}) \pm 1$  mm



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## 6 Electrical installation



### ⚠ DANGER

Risk of injury due to electric shock.

Severe or fatal injuries.

- Strictly observe the safety notes in the individual chapters.
- When motors are powered from inverters, you must observe the wiring instructions issued by the inverter manufacturer. Observe the operating instructions of the inverter.



### INFORMATION

A bag containing the following information is attached to the motor:

Safety notes

**Observe the following notes.**

### 6.1 Safety notes

#### EMC measures

The designated use of SEW-EURODRIVE synchronous linear motors is as components for installation in machinery and systems. The manufacturer of the machine or system is responsible for complying with the EMC Directive 2014/30/EU.

#### Encoder connection

Observe the following instructions when connecting an encoder:

- Use a shielded cable with twisted pair conductors only.
- Connect the shield to the PE potential on both ends over a large surface area.
- Install signal cables separately from power cables or brake cables (min. distance 200 mm [7.87 in]).

## 6.2 Electrical connection

### 6.2.1 SLC wiring diagrams

Type code	Part number of the primary	Approval	Wiring diagram
/KGZL	13333224	IEC	
	16450892	UL	
	16528085	IEC/UL	
/AGZ0	16528085	IEC/UL	<p>[1] = Evaluation motor protection</p>

### 6.2.2 Cable assignment

Power rating

The cables are provided with colored core identification.

Function	Lapp GmbH Ölflex HEAT 190 C MS	Leoni Studer AG BETA flam 145 C-flex
	Color coding	
Phase U	Black (BK)	Conductor 1 (BK)
Phase V	Brown (BN)	Conductor 2 (BK)
Phase W	Gray (GY)	Conductor 3 (BK)
PE	Yellow/green (YE/GN)	Conductor 4 (BK)

Thermal motor protection

Function	Lapp GmbH Ölflex HEAT 190 C MS	Leoni Studer AG BETA flam 145 C-flex
	Color coding	
TH1	Brown (BN)	Conductor 1
TH2	Blue (BL)	Conductor 2
PE	Yellow/green (YE/GN)	—

## 7 Startup



### ⚠ DANGER

Risk of injury due to electric shock.

Severe or fatal injuries.

- When motors are powered from inverters, you must observe the wiring instructions issued by the inverter manufacturer. Observe the operating instructions of the inverter.

### NOTICE

Improper startup may result in damages to the linear motor.

Possible damage to property.

- Strictly adhere to the notes in this chapter.
- Never work in the travel range when the machine is switched on.
- Ensure free axis travel.
- Check the final positions.
- Check the linear measuring system prior to starting the machine.
- Limit the maximum power in the inverter.
- Set the velocity limits in the inverter to small values.
- Observe the safety notes in the individual chapters.

### 7.1 Prerequisites for startup

Before startup, make sure that:

- The mobile part of the application moves along the entire travel section easily, without collisions and free from mechanical contact between the primary and secondary
- All connections have been made properly
- All protection devices have been installed correctly
- All motor protection devices are active
- The brake works correctly in hoists
- You have a MOVIDRIVE® MCV 0E or 5E
- There are no other sources of danger present
- The MOVITOOLS® startup software is installed on your PC.

## 7.2 Parameter set loaded at the factory

The MOVIDRIVE® MCV 0E includes a special parameter set loaded at the factory and a firmware optimized for special mechanical tolerances. The H variables H123-H127 have been assigned special functions for this optimization. They are initialized with the following values (status 03/2009):

H variables
H123 = 1820
H124 = 32716
H125 = 10000
H126 = 125
H127 = 651



### INFORMATION

SEW-EURODRIVE does not give warranty nor assume liability for any malfunctions of the system resulting from parameters differing from the default setting.

It is generally possible to reset the parameter set to the default setting via parameter 802 "Factory settings", or to change individual parameters.

The 5E special design is not delivered with uploaded parameter set, but with standard factory setting.

## 7.3 Startup procedure

### Parameterization

1. Make sure that the 0E or 5E servo controller is in controller inhibit or 24-V operation mode.
2. Using the factory setting, perform a startup for a CM servomotor, for which the continuous static current corresponds to the sum of the rated currents of all SLC motors used in parallel on MOVIDRIVE®. The following must also be set for start-up:
  - Temperature sensor is not connected (the TH sensor must be evaluated separately in a PLC)
  - Torque control operating mode
  - Current limitation P303 to the total maximum current of all SLC motors.
  - Stiffness, controller parameters and ramp times are not in effect in torque control operating mode.
3. Terminate motor startup with download.
4. Set the current controller index 8663 according to the formula  
 Index 8663 =  $L[\text{mH}] \times \text{nominal unit current} \times \text{MDX factor}$   
 MDX factor:
  - = 0.02 for MDX = size 0
  - = 0.016 for MDX > size 0



5. Set the scale of the actual speed value (optional) to:  
 $P850 = 1, P851 = 200, P852 = \text{m/s. (1m/s equals } 200 \text{ min}^{-1}\text{)}$

The setting does not have any effect on the functionality.

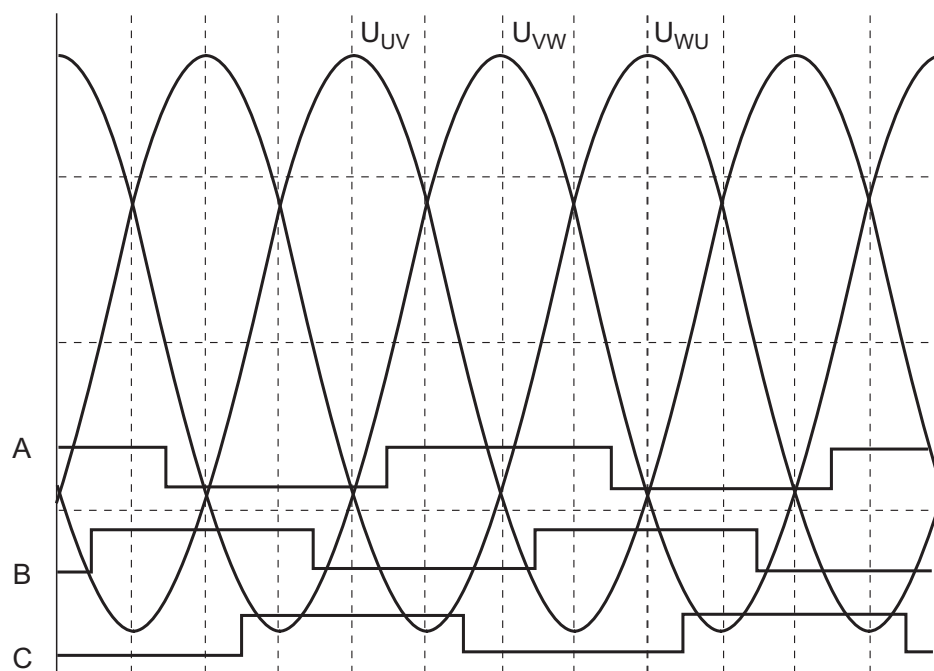
Checking encoder evaluation

Manually move the primary in one direction across the NL16 linear encoder, and observe parameter P003 (actual position) in the MOVITOOLS® shell. Determine the positive direction of movement. Check that you measure 6 increments for a travel path of 100 mm.

Axle movement

Check the limit switch is functioning correctly for axes with end limits. Move the axis with reduced torque setpoint.

If the axes do not move in a positive direction in a controlled manner when torque is in a positive direction of rotation, check that the correct motor phases have been assigned to the encoder signals. In extreme cases, you can push the motor in the positive direction and, using the oscilloscope, record the phase-to-phase voltage between U and V and the C track signal. The relationship between the two is shown in the following figure. The zero crossing in the positive direction of the phase-to-phase voltage U-V must coincide with the rising edge of the C track. (Note: The motor does not perform any commutation travel.)



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## 8 Malfunctions

The inverter indicates malfunctions depending on the type via diagnostic LEDs or a 7-segment display and an error code. Consult the system manual or the operating instructions of the respective MOVIDRIVE® for fault elimination.

## 9 Inspection/maintenance

### 9.1 Notes



#### ⚠ DANGER

##### **Risk of injury due to electric shock.**

Induced voltages of up to 500 V can be generated by movement of the primary (generator principle) even if the motor is not connected.

Only remove the protection cap on the power plug of the primary immediately before connecting the power plug to the power supply.

Severe or fatal injuries.

- After separating the inverter from the supply voltage, wait for at least five minutes before you touch any live parts (e.g. contacts, stud bolts) or loosen connections. To be on the safe side, measure the voltage on the DC link and wait until the voltage has dropped below 40 V.



#### ⚠ WARNING

Touching the linear motors when they have not cooled down could result in burns. Linear motors can have a surface temperature of over 100 °C.

Risk of burns.

- Never touch the linear motor during operation or in the cool down phase once it has been switched off.

#### ⚠ CAUTION

Improper inspection and maintenance may result in damages to the linear motor.

Possible damage to property.

- Observe the following notes.

- Keep motor area free from chips.
- Notice any noises.
- Power connections can conduct voltages even if the motor is not turning. Never disconnect electrical connections of motors while they are energized.
- Wear work gloves when carrying out maintenance and repair work.
- Ensure safe disconnection from the voltage supply before working on the machine.
- Never work in the travel range when the machine is switched on.
- Remove any chips from the motor area on a regular basis.
- Use only genuine spare parts in accordance with the valid spare parts list.
- Motors can become very hot during operation – danger of burns.
- Disconnect the linear motor from the power supply before starting work and protect it against unintentional re-start.

### 9.2 General maintenance work

The primaries and secondaries are maintenance-free and cannot be repaired. Replace defective parts.

Depending on the ambient conditions, remove any traces of dirt, chips, dust, etc. from the secondaries with a soft cloth.

Note that mobile cables are subject to wear. They have to be checked for external changes on a regular basis.

### 9.3 Waste disposal

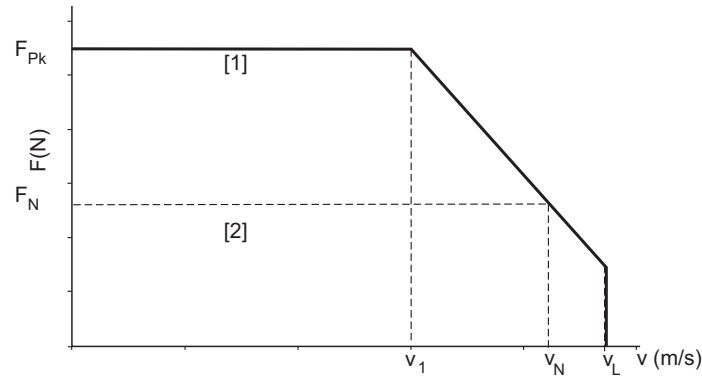
**This product consists of:**

- Iron
- Aluminum
- Copper
- Plastics
- Electronic components

**Dispose of all components in accordance with applicable regulations.**

## 10 Technical data

### 10.1 Motor data diagram



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[1] = Dynamic limit forces

[2] = Thermal limit forces

$F_N$  = Rated data

**when mounting to a horizontal aluminum cooling surface with**

- **four times primary flange surface**
- **10 mm thickness**
- **an ambient temperature of up to 40 °C**
- **an installation altitude of up to 1000 m**

$F_{pk}$  = Maximum force

$v_L$  = Theoretical maximum traveling velocity

$v_N$  = Nominal speed

$v_1$  = Base velocity up to which the force  $F_{pk}$  is available

$I_N$  = Rated current

$I_{pk}$  = Maximum current

$F_D$  = Force through magnetic attraction for 4.5 mm nominal air gap

## 10.2 Motor data

Motor type <sup>1)</sup>	Force			Velocity			Current	
	$F_{pk}$ N	$F_N$ N	$F_D$ N	$v_1$ m/s	$v_N$ m/s	$v_L$ m/s	$I_{pk}$ A	$I_N$ A
SLC-050M	400	200	480	2.5	4.3	5	4.7	2.4

1) All values are string values (50% of the value measured between 2 phases)

Motor type <sup>1)</sup>	Cable cross section mm	Phase inductance $L_1$ mH	Phase resistance $R_1$ $\Omega$	Total power loss at the rating point $\Delta_{PN}$ W
SLC-050M	3 × 1.5	162	13	335

1) All values are string values (50% of the value measured between 2 phases)

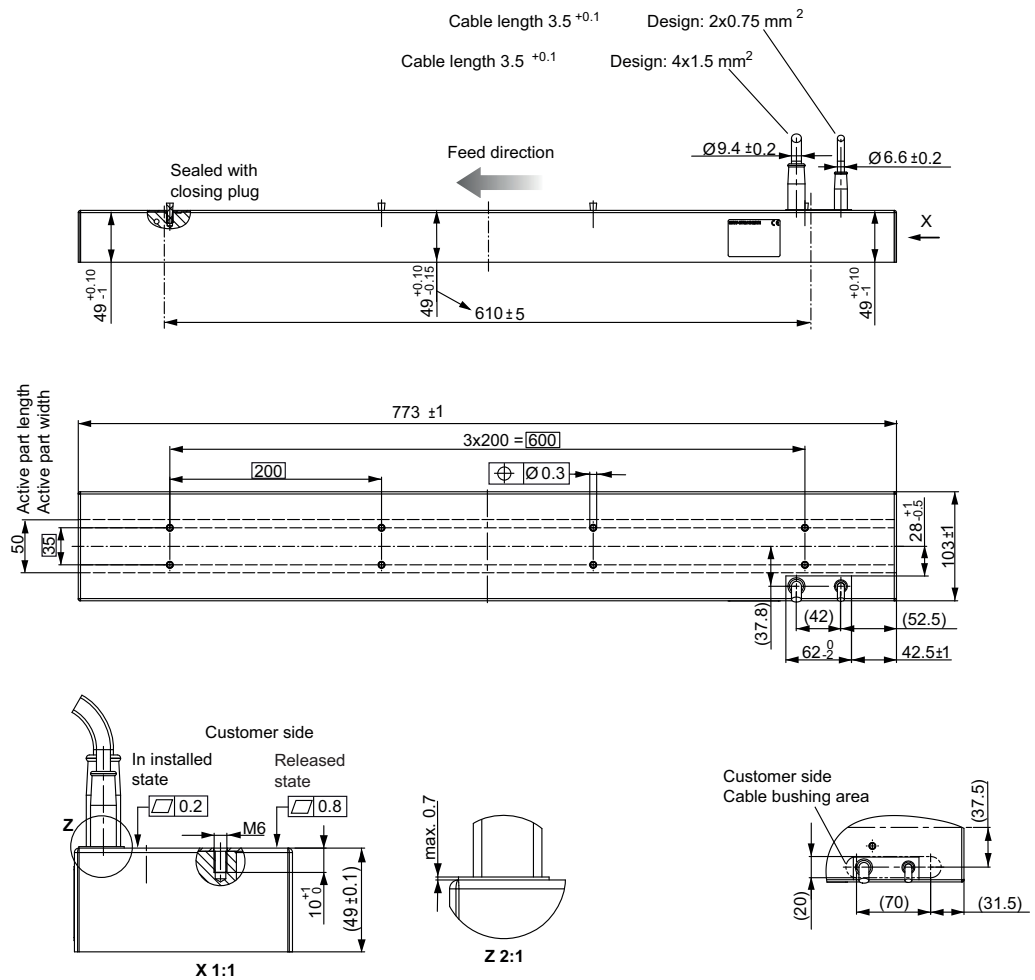
Electrical values refer to sine-shaped commutation and are indicated as effective values or refer to them.

$L_1$  = Inductivity between connection phase and star point

$R_1$  = Resistance between connection phase and star point

### 10.3 Installation dimensions

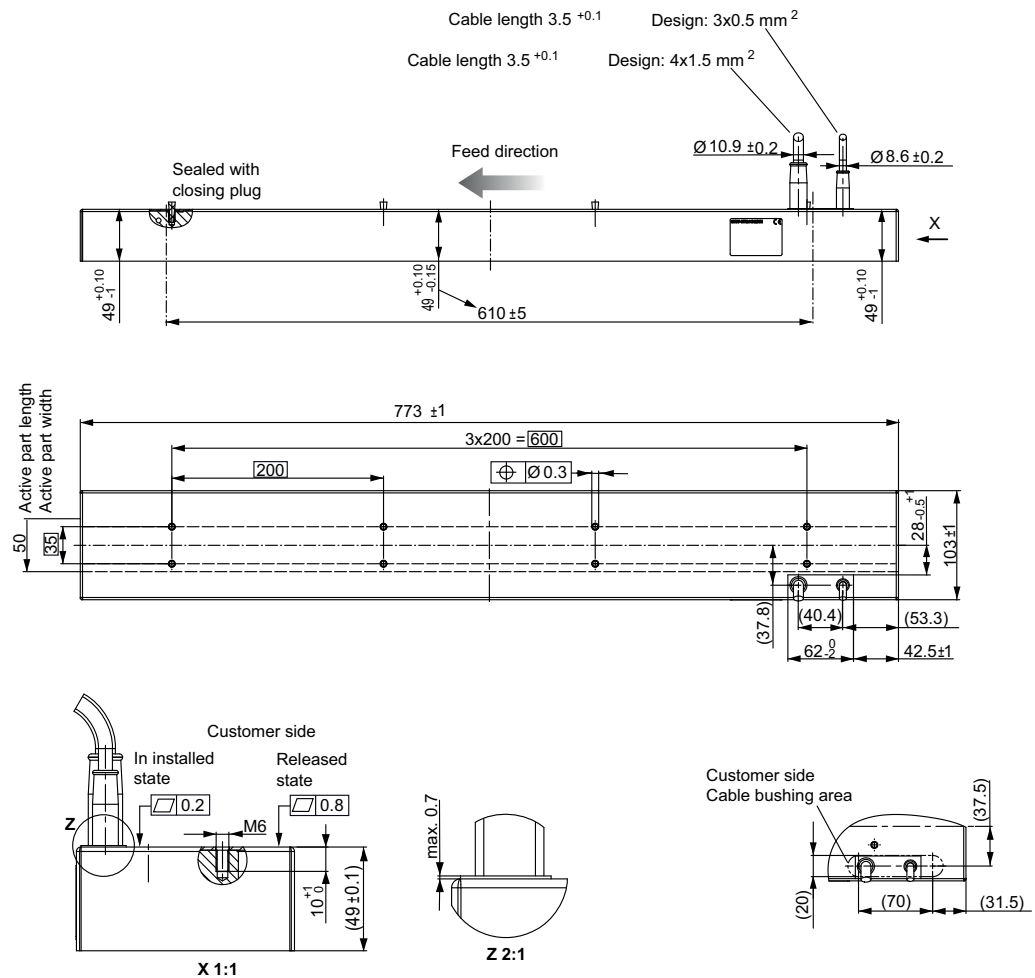
Primary



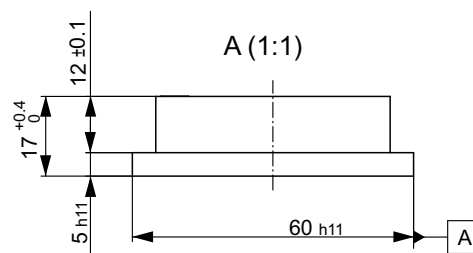
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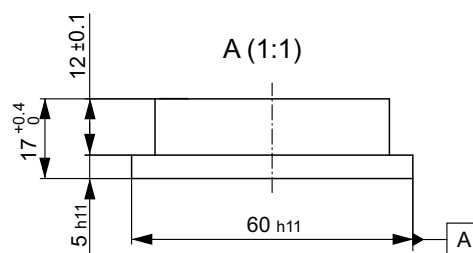
Primary (with UL)



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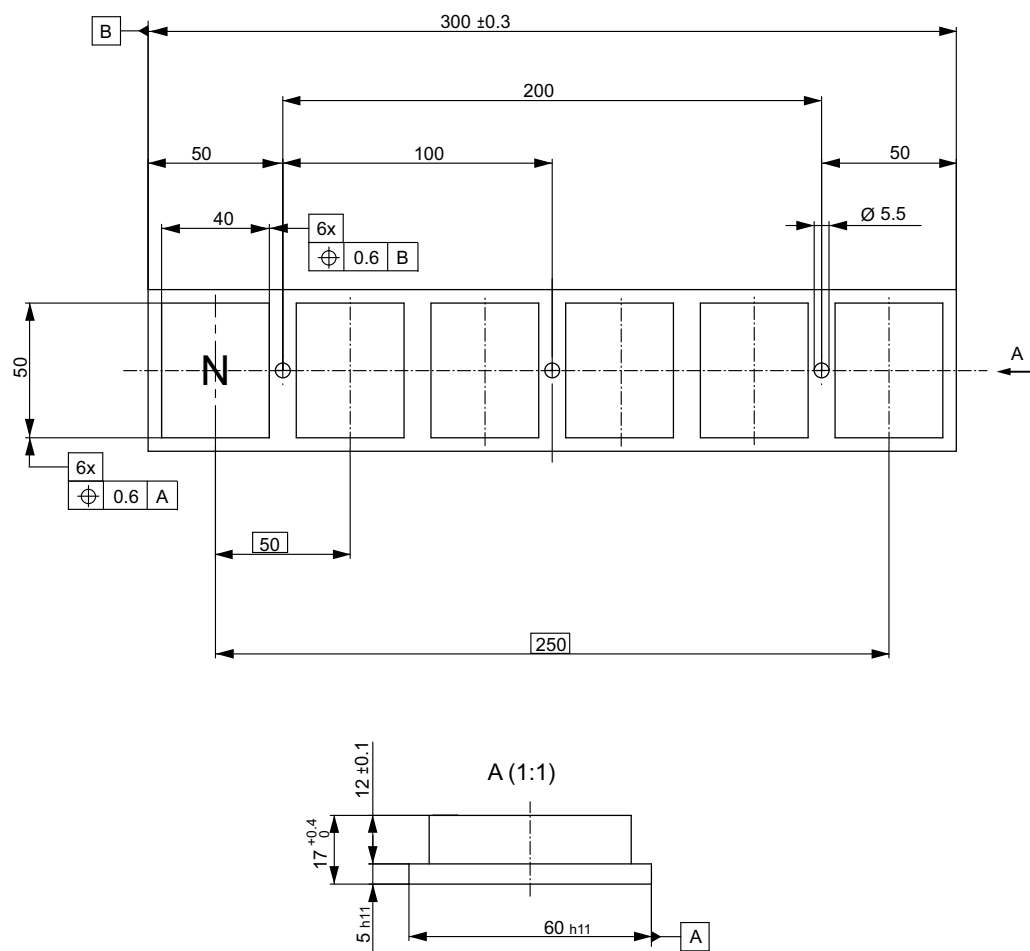
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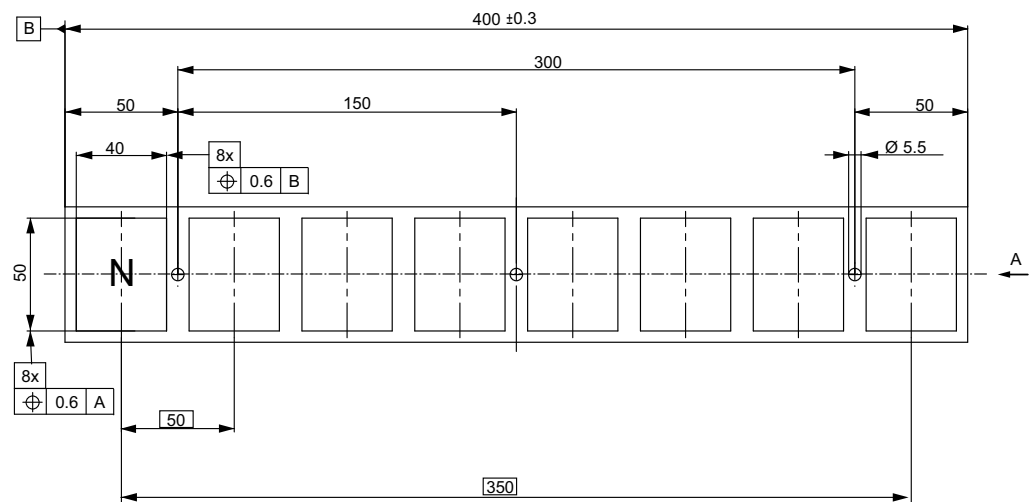
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Length of the secondary 300



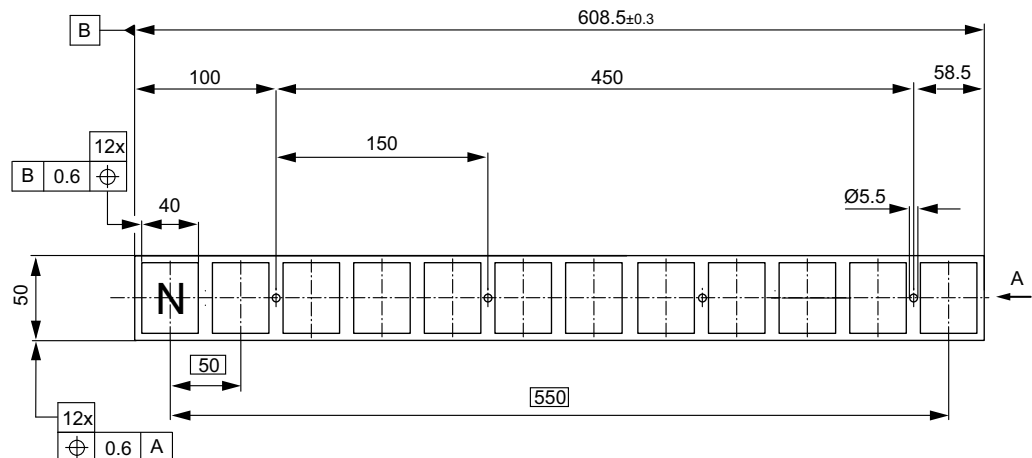
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Length of the secondary 400



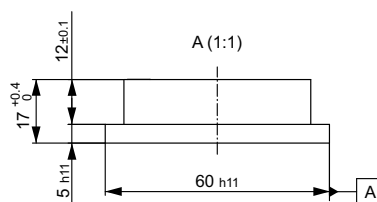
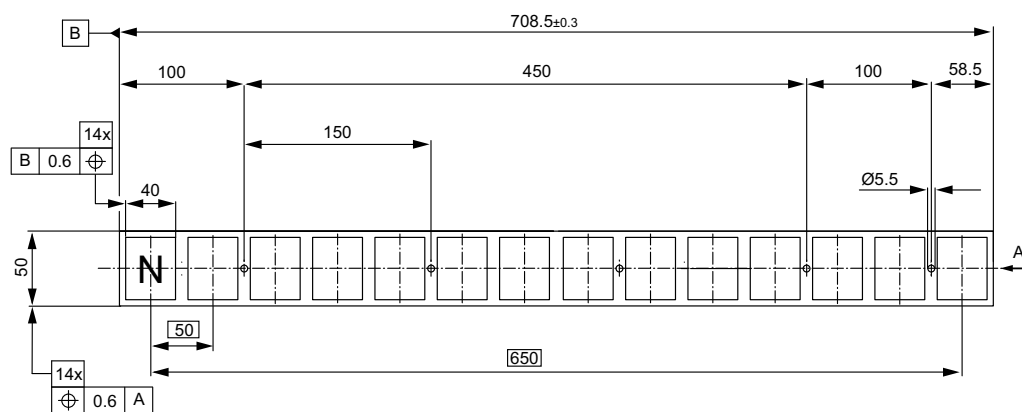
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Length of the secondary 608.5



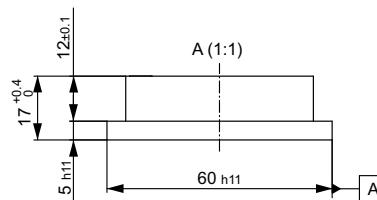
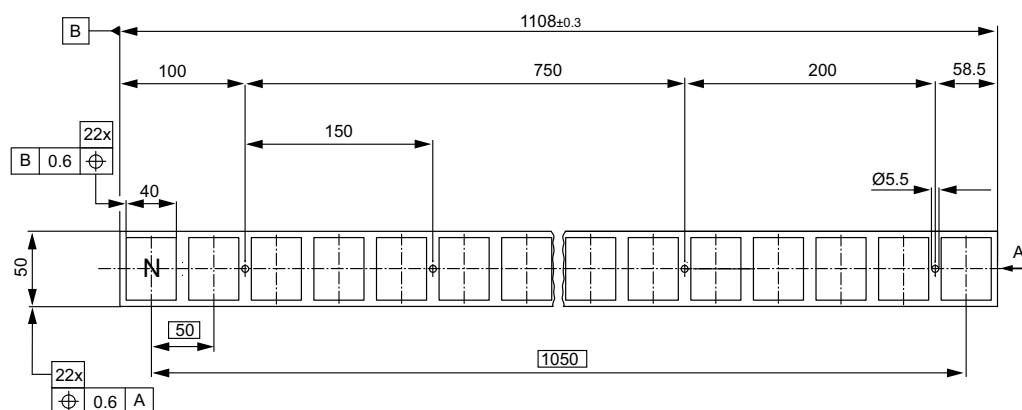
15840129035

Length of the secondary 708.5



15840131723

Length of the secondary 1108.5

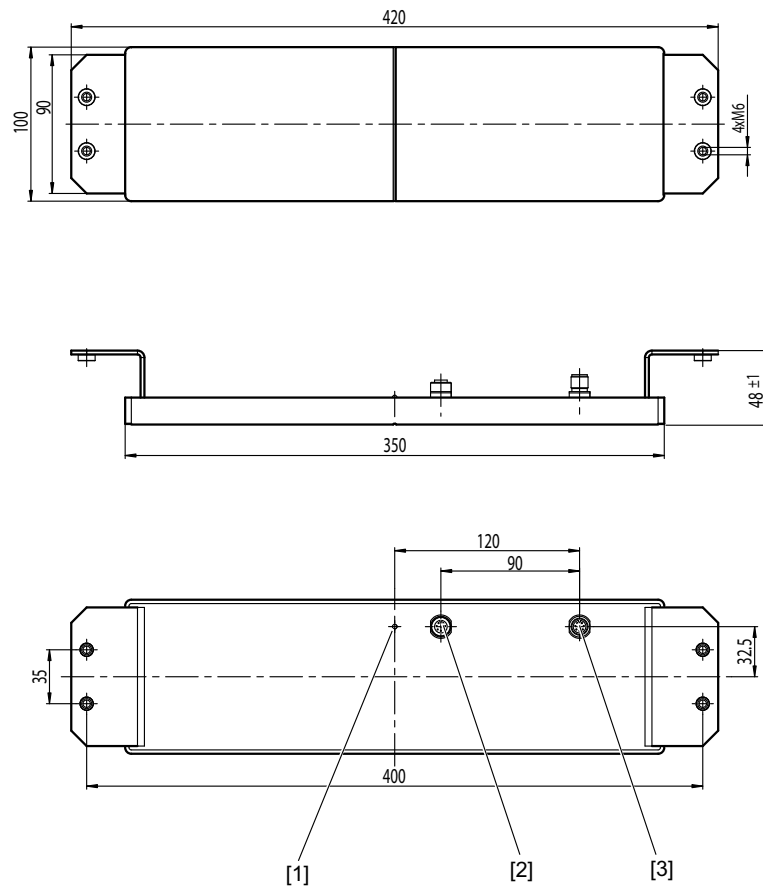


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## 10.4 Technical data of NL16 linear encoders

General data	
Weight	0.9 kg
Ambient temperature	-20 °C to +60 °C
Storage temperature	-25 °C to 75 °C
Max. cable length	100 m
Supply voltage	12 – 30 V
Current consumption without load	Max. 180 mA
Current carrying capacity of outputs	Max. ±25 mA
Resolution	6 inc./0.1 m = 16.67 mm/inc.
Traveling velocity	Max. 5 m/s
Phase offset of tracks A, B, C and /A, /B, /C	120° ± 20°
Pulse duty factor	50% ± 15%
Permitted air gap (clearance of magnet surface to housing of the NL16)	Type 4.5 mm max. 8.5 mm
Lateral offset (parallel or twisted over the entire length of the NL16) on the sensor level	Max. ±4 mm
Retaining bores	Ø 6.4 H12 (EN 20273:1991)
Degree of protection	IP65
Tolerance of missing/damaged magnets of the secondary	At least 2 marked and 2 unmarked poles (undamaged) must be present in a consequent sequence of 6 magnets (NSNSNS or SNSNSN) in scanning direction at a right angle to the secondary.



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## [1] Status

- Green: Normal operation
- Yellow: Normal operation – with magnet missing
- Red: Error in the commutation signal (e.g. no magnet or gap too large, incorrect distance between magnets)

## [2] Programming interface M12 (female contacts): Not always available. Used by SEW-EURODRIVE. The M12 must always have a protection cap to meet the requirements of the degree of protection.

## [3] Encoder connection M12 (male contacts)



## 11 Attachment

### 11.1 Part numbers

Item no.	Product description	Weight
05956501	Secondary 200 mm	1 kg
05956498	Secondary 250 mm	1.2 kg
05956455	Secondary 300 mm	1.4 kg
05956463	Secondary 400 mm	1.9 kg
13334034	Secondary 608,5	2.9 kg
13334018	Secondary 708,5	3.4 kg
13333984	Secondary 1108,5	5.3 kg
13333224	Primary	19 kg
16528085	Primary	19 kg
16450892	Primary with UL approval	19 kg
13002325	NL16 linear encoder	0.9 kg
08295107	MCV40-A0055-5A3-4-0E	
18253431	MCV40-A0055-503-4-5E	
18166245	NL16 prefabricated encoder cable	

### 11.2 Technical information on MOVIDRIVE®

In general, SLC linear motors can also be operated with MOVIAXIS® or MOVIDRIVE® B with a suitable encoder system. In connection with NL16 linear encoders, operation is only possible with MCV special design -0E.

#### INFORMATION



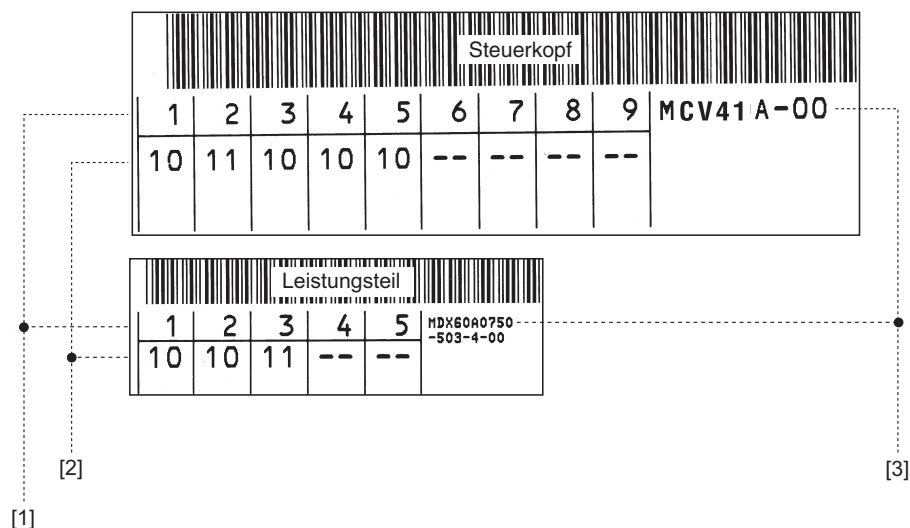
You will find additional information in the MOVIDRIVE® *compact* system manual.

Part number and status

MCV40A0066-5A3-4-0E is available via part number 08295107.

The units have a status label for the power section and one for the control unit. They are attached to the side of the unit next to the nameplate.

At least version 71 must be displayed in the first status field of the control unit for operation according to chapter 7.2.



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- [1] Component/part
- [2] Status
- [3] Type designation

### 11.3 Painting

Primary

The primaries are treated with an anti-corrosion coating OS1.

Secondary

The base plate of the secondaries is electrogalvanized.

## 11.4 Configuring cable cross section of the power cable

Cable dimensioning to EN 60402

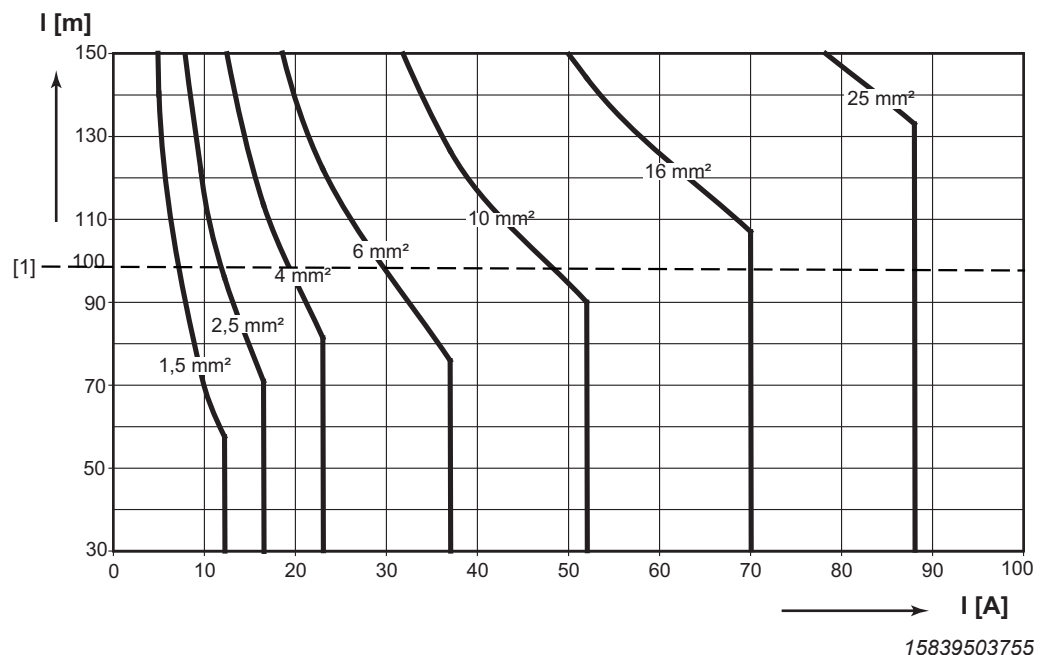


Figure 1: Required minimum cable cross section depending on cable length  $l$  [m] and current  $I$  [A]

[1] Permitted maximum cable length to SEW-EURODRIVE specification = 100 m

The diagram (see above) is used as the basis for cable assignment (see following pages).

Hybrid cables with cross-sections of 1.5 mm<sup>2</sup> to 10 mm<sup>2</sup> can be ordered from SEW-EURODRIVE.

Cable load through current  $I$  in [A] according to EN 60204-1 table 55, ambient temperature 40 °C (104 °F)

Cable cross section mm <sup>2</sup>	Three-core sheathed cable in pipe or cable A	Three-core sheathed cable on top of each other on wall A	Three-core sheathed cable lined up horizontally A
1.5	12.2	15.2	16.1
2.5	16.5	21.0	22
4	23	28.0	30
6	29	36.0	37
10	40	50.0	52
16	53	66.0	70
25	67	84.0	88
35	83	104.0	114

These data are merely recommended values and are **no substitute for the detailed project planning** of the cables depending on the concrete application considering the applicable regulations.

## 11.5 TH winding thermostats

Thermal motor protection prevents the motor from overheating and consequently from being damaged. The TH has a triplet design, which means that each motor phase contains a thermostat NC contact. These are connected in series.

The thermostats are connected in series and open when the permitted winding temperature is exceeded. They can be connected in the drive monitoring loop.

## 11.6 Prefabricated cables

### INFORMATION



The cables also have low capacitive characteristics for operation on the inverter.

#### 11.6.1 NL16 prefabricated connection cable

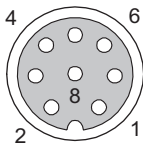
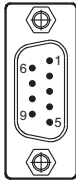
SEW-EURODRIVE offers a prefabricated connection cable for NL16 linear encoders.

Part number: 18166245.

Enter the length in the order (max. 100 m).

#### 11.6.2 Cable for NL16 encoder

Pin assignment of NL16 connection cable

Encoder end				Connection MOVIDRIVE® MCV	
Plug connector	Pin no.	Description	Description	Pin no.	Plug connector
<b>M12, 8-pole, with female contacts</b> 	1	A	A	1	<b>D-sub, 9-pole, with male contacts</b> <b>MCV X15</b> 
	2	B	B	2	
	3	C	C	3	
	4	GND	GND	5	
	5	/A	/A	6	
	6	/B	/B	7	
	7	/C	/C	8	
	8	24 V	24 V	9	
		Reserved	Reserved		

## 12 Address list

<b>Algeria</b>			
Sales	Algiers	REDUCOM Sarl 16, rue des Frères Zaghroune Bellevue 16200 El Harrach Alger	Tel. +213 21 8214-91 Fax +213 21 8222-84 <a href="http://www.reducom-dz.com">http://www.reducom-dz.com</a> <a href="mailto:info@reducom-dz.com">info@reducom-dz.com</a>
<b>Argentina</b>			
Assembly Sales	Buenos Aires	SEW EURODRIVE ARGENTINA S.A. Ruta Panamericana Km 37.5, Lote 35 (B1619IEA) Centro Industrial Garín Prov. de Buenos Aires	Tel. +54 3327 4572-84 Fax +54 3327 4572-21 <a href="http://www.sew-eurodrive.com.ar">http://www.sew-eurodrive.com.ar</a> <a href="mailto:sewar@sew-eurodrive.com.ar">sewar@sew-eurodrive.com.ar</a>
<b>Australia</b>			
Assembly Sales Service	Melbourne	SEW-EURODRIVE PTY. LTD. 27 Beverage Drive Tullamarine, Victoria 3043	Tel. +61 3 9933-1000 Fax +61 3 9933-1003 <a href="http://www.sew-eurodrive.com.au">http://www.sew-eurodrive.com.au</a> <a href="mailto:enquires@sew-eurodrive.com.au">enquires@sew-eurodrive.com.au</a>
	Sydney	SEW-EURODRIVE PTY. LTD. 9, Sleigh Place, Wetherill Park New South Wales, 2164	Tel. +61 2 9725-9900 Fax +61 2 9725-9905 <a href="mailto:enquires@sew-eurodrive.com.au">enquires@sew-eurodrive.com.au</a>
<b>Austria</b>			
Assembly Sales Service	Vienna	SEW-EURODRIVE Ges.m.b.H. Richard-Strauss-Straße 24 1230 Wien	Tel. +43 1 617 55 00-0 Fax +43 1 617 55 00-30 <a href="http://www.sew-eurodrive.at">http://www.sew-eurodrive.at</a> <a href="mailto:sew@sew-eurodrive.at">sew@sew-eurodrive.at</a>
<b>Bangladesh</b>			
Sales	Bangladesh	SEW-EURODRIVE INDIA PRIVATE LIMITED 345 DIT Road East Rampura Dhaka-1219, Bangladesh	Tel. +88 01729 097309 <a href="mailto:salesdhaka@seweurodrivebangladesh.com">salesdhaka@seweurodrivebangladesh.com</a>
<b>Belarus</b>			
Sales	Minsk	Foreign unitary production enterprise SEW- EURODRIVE RybalkoStr. 26 220033 Minsk	Tel. +375 17 298 47 56 / 298 47 58 Fax +375 17 298 47 54 <a href="http://www.sew.by">http://www.sew.by</a> <a href="mailto:sales@sew.by">sales@sew.by</a>
<b>Belgium</b>			
Assembly Sales Service	Brussels	SEW-EURODRIVE n.v./s.a. Researchpark Haasrode 1060 Evenementenlaan 7 3001 Leuven	Tel. +32 16 386-311 Fax +32 16 386-336 <a href="http://www.sew-eurodrive.be">http://www.sew-eurodrive.be</a> <a href="mailto:info@sew-eurodrive.be">info@sew-eurodrive.be</a>
Service Competence Center	Industrial Gears	SEW-EURODRIVE n.v./s.a. Rue de Parc Industriel, 31 6900 Marche-en-Famenne	Tel. +32 84 219-878 Fax +32 84 219-879 <a href="http://www.sew-eurodrive.be">http://www.sew-eurodrive.be</a> <a href="mailto:service-IG@sew-eurodrive.be">service-IG@sew-eurodrive.be</a>
<b>Brazil</b>			
Production Sales Service	São Paulo	SEW-EURODRIVE Brasil Ltda. Estrada Municipal José Rubim, 205 – Rodovia Santos Dumont Km 49 Indaiatuba – 13347-510 – SP	Tel. +55 19 3835-8000 <a href="mailto:sew@sew.com.br">sew@sew.com.br</a>
Assembly Sales Service	Rio Claro	SEW-EURODRIVE Brasil Ltda. Rodovia Washington Luiz, Km 172 Condomínio Industrial Conpark Caixa Postal: 327 13501-600 – Rio Claro / SP	Tel. +55 19 3522-3100 Fax +55 19 3524-6653 <a href="mailto:montadora.rc@sew.com.br">montadora.rc@sew.com.br</a>
	Joinville	SEW-EURODRIVE Brasil Ltda. Rua Dona Francisca, 12.346 – Pirabeiraba 89239-270 – Joinville / SC	Tel. +55 47 3027-6886 Fax +55 47 3027-6888 <a href="mailto:filial.sc@sew.com.br">filial.sc@sew.com.br</a>
<b>Bulgaria</b>			
Sales	Sofia	BEVER-DRIVE GmbH Bogdanovetz Str.1 1606 Sofia	Tel. +359 2 9151160 Fax +359 2 9151166 <a href="mailto:bever@bever.bg">bever@bever.bg</a>

Cameroon			
Sales	Douala	SEW-EURODRIVE S.A.R.L. Ancienne Route Bonabéri P.O. Box B.P 8674 Douala-Cameroun	Tel. +237 233 39 02 10 Fax +237 233 39 02 10 info@sew-eurodrive-cm
Canada			
Assembly Sales Service	Toronto	SEW-EURODRIVE CO. OF CANADA LTD. 210 Walker Drive Bramalea, ON L6T 3W1	Tel. +1 905 791-1553 Fax +1 905 791-2999 http://www.sew-eurodrive.ca l.watson@sew-eurodrive.ca
	Vancouver	SEW-EURODRIVE CO. OF CANADA LTD. Tilbury Industrial Park 7188 Honeyman Street Delta, BC V4G 1G1	Tel. +1 604 946-5535 Fax +1 604 946-2513 b.wake@sew-eurodrive.ca
	Montreal	SEW-EURODRIVE CO. OF CANADA LTD. 2555 Rue Leger Lasalle, PQ H8N 2V9	Tel. +1 514 367-1124 Fax +1 514 367-3677 a.peluso@sew-eurodrive.ca
Chile			
Assembly Sales Service	Santiago de Chile	SEW-EURODRIVE CHILE LTDA Las Encinas 1295 Parque Industrial Valle Grande LAMP Santiago de Chile P.O. Box Casilla 23 Correo Quilicura - Santiago - Chile	Tel. +56 2 2757 7000 Fax +56 2 2757 7001 http://www.sew-eurodrive.cl ventas@sew-eurodrive.cl
China			
Production Assembly Sales Service	Tianjin	SEW-EURODRIVE (Tianjin) Co., Ltd. No. 78, 13th Avenue, TEDA Tianjin 300457	Tel. +86 22 25322612 Fax +86 22 25323273 http://www.sew-eurodrive.cn info@sew-eurodrive.cn
Assembly Sales Service	Suzhou	SEW-EURODRIVE (Suzhou) Co., Ltd. 333, Suhong Middle Road Suzhou Industrial Park Jiangsu Province, 215021	Tel. +86 512 62581781 Fax +86 512 62581783 suzhou@sew-eurodrive.cn
	Guangzhou	SEW-EURODRIVE (Guangzhou) Co., Ltd. No. 9, JunDa Road East Section of GETDD Guangzhou 510530	Tel. +86 20 82267890 Fax +86 20 82267922 guangzhou@sew-eurodrive.cn
	Shenyang	SEW-EURODRIVE (Shenyang) Co., Ltd. 10A-2, 6th Road Shenyang Economic Technological Development Area Shenyang, 110141	Tel. +86 24 25382538 Fax +86 24 25382580 shenyang@sew-eurodrive.cn
	Taiyuan	SEW-EURODRIVE (Taiyuan) Co., Ltd. No.3, HuaZhang Street, TaiYuan Economic & Technical Development Zone ShanXi, 030032	Tel. +86-351-7117520 Fax +86-351-7117522 taiyuan@sew-eurodrive.cn
	Wuhan	SEW-EURODRIVE (Wuhan) Co., Ltd. 10A-2, 6th Road No. 59, the 4th Quanli Road, WEDA 430056 Wuhan	Tel. +86 27 84478388 Fax +86 27 84478389 wuhan@sew-eurodrive.cn
	Xi'An	SEW-EURODRIVE (Xi'An) Co., Ltd. No. 12 Jinye 2nd Road Xi'An High-Technology Industrial Development Zone Xi'An 710065	Tel. +86 29 68686262 Fax +86 29 68686311 xian@sew-eurodrive.cn
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**South Africa**

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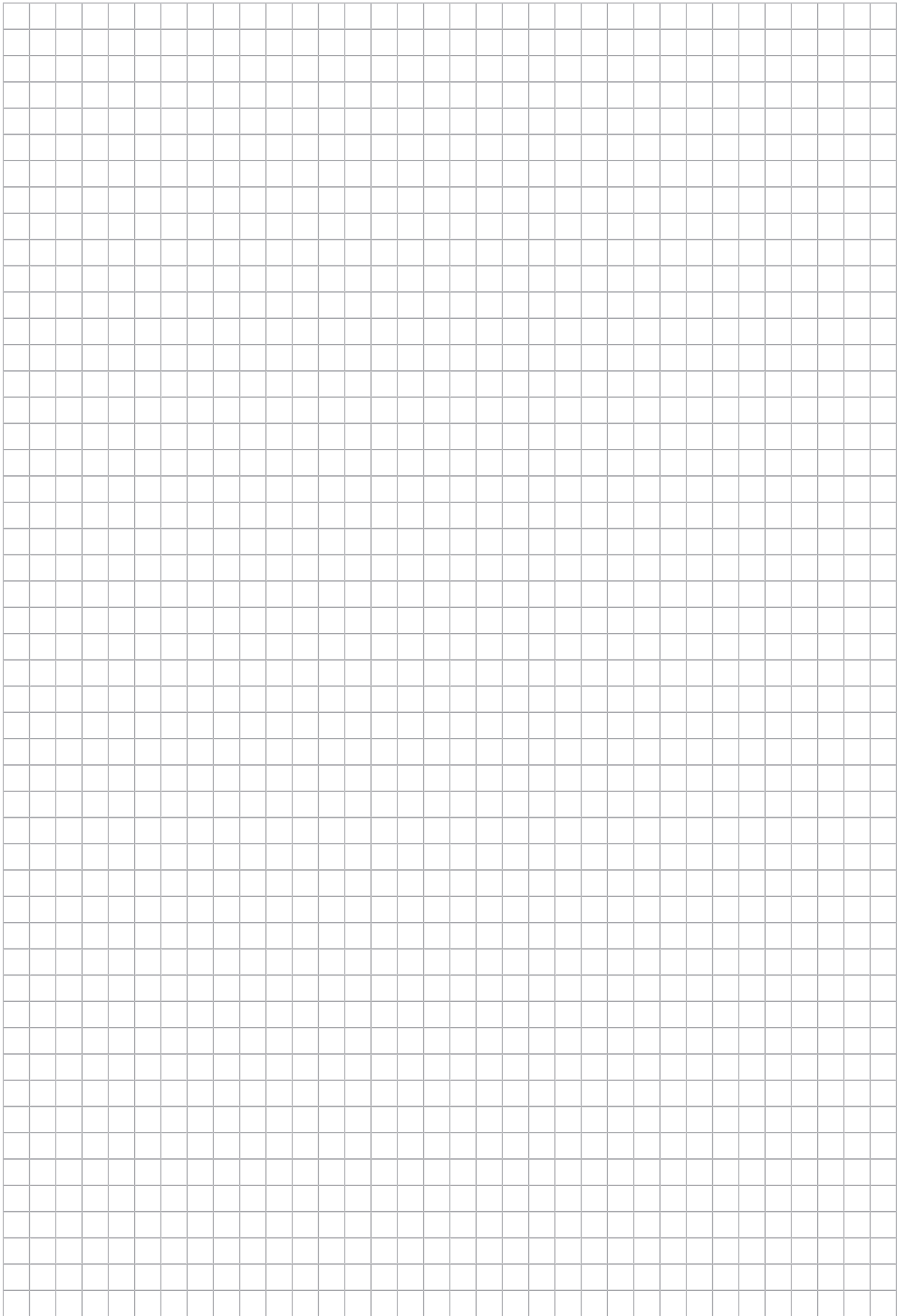
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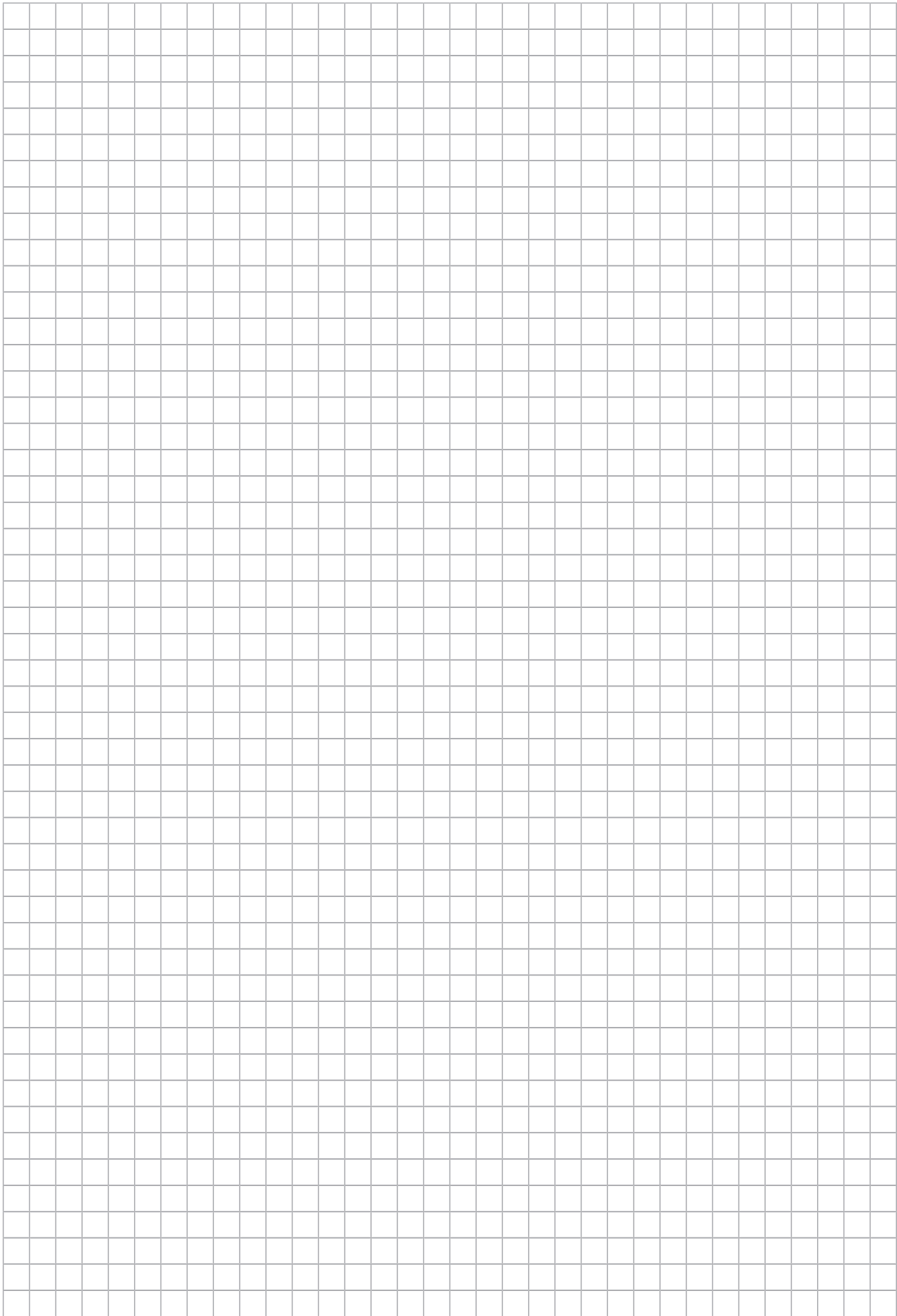
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