Assembly instruction

linear unit LES4, 5, 6
ball screw unit with spindle drive.

Item number: 234xxx xxxx

Manufacturer:
isel Germany GmbH
Bürgermeister-Ebert-Str., 40
D-36124, Eichenzell
+49 6659 981 800
+49 6659 981 782
info@isel.com
www.isel.com
Managing Directors: Werner Kister, Thomas Breser
Registergericht Fulda, Registernummer: 8643

Revision index	Date of change	Reason for change	Modified by
1.2	07.02.2024	Standards changed	Christian Bley
1.1	13.02.2020	correction version	Christian Bley
1	23.09.2019	First version	Christian Bley

Contents

List of figures

List of tables

1 General

Dear Customer,

dear operator,

with this Assembly instruction we would like to support you in your work on the linear unit LES 4, 5, 6, hereinafter referred to as the machine. It contains information and everything you need to know about the machine and will be a helpful companion for you.

NOTE	
	Before commissioning the machine, working with the machine or making additions or changes to the electrical installation of the machine/in the control cabinet of the machine, be sure to read carefully: > the safety instructions in this Assembly instruction as well as > the safety instructions for the attachment parts in the applicable documents.

If you still have questions, please contact us. Despite all due care, we cannot rule out printing errors and mistakes. If you notice any printing errors or mistakes or if you see any possibilities for improving our technical documentation, we would be grateful for any information or suggestions!

1.1 Importance of the documentation

These Assembly instruction and the associated documentation are an integral part of the linear unit. The operator is obliged to keep the Assembly instruction for the entire service life of the linear unit and to grant access to the personnel working with the machine.

If the linear unit is modified, the Assembly instruction and the associated documentation must be revised accordingly. If the linear unit is dismantled and reassembled at a new location, the owner is obliged to pass on the Assembly instruction and the associated documentation to the new owner.

The Assembly instruction in German language is the original Assembly instruction. All other language versions are translations of the original Assembly instruction.

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1.2 Scope of delivery

The scope of delivery of the linear unit LES 4, 5, 6 234xxx xxxx includes:

- Assembly instructions with installation declaration according to Machinery directive 2006/42/EC

1.3 Co-Applicable Documents

Apart from the Assembly instruction the following documents for the use of the machine are necessary. These documents are partially submitted in annexe in the printed form of the machine or are contained as PDF document on the data medium (USB data medium) for the installation data of the provided control software / . The number specified in /<**number**>/ can be found as the leading number in the file name of the document.

Applicable documentsisel Germany GmbH

No.	Document
/1/	Dimensional drawing
/3/	Operating Instructions Positioning module IMD20/ IMD40 with CANopen interface: isel Germany AG, 12/2018

Applicable documents from other manufacturers

1.4 EU-Declaration of incorporation acc. to Machinery directive 2006/42/EC Annex II B

The manufacturer

isel Germany GmbH

Bürgermeister-Ebert-Str., 40

D-36124, Eichenzell

hereby declares that the following product

product description:	ball screw unit with spindle drive LES 4, 5, 6
model name:	LES 4, 5, 6
item number:	234xxx xxxx

meets the essential health and safety requirements of Machinery directive 2006/42/EC Annex II.

The following harmonized norms were applied:

DIN EN ISO 12100:2011-03	Safety of machinery - General principles for design - Risk assessment and risk reduction.
DIN EN 60204-1:2019-06; VDE 0113-1:2019-06	Safety of machinery - Electrical equipment of machines - Part 1: General requirements

The technical documentation for this machine has been prepared in accordance with Annex VII, part B. The manufacturer undertakes to electronically transmit these specific technical documentations to national authorities on request.

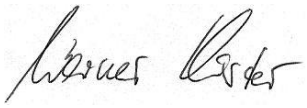
The authorized representative for the compilation of the special technical documentation is:

name:	Christian Bley	**capacity:**	CE Beauftragter
company:	isel Germany GmbH	**address:**	Bürgermeister-Ebert-Str., 40, D-36124, Eichenzell

The product (incomplete machine) is intended for incorporation into a machine or for assembly with other incomplete machines into a machine within the meaning of MRL, 2006/42/EC, Article 1, Section (1), letter a.

The commissioning of the incomplete machine (product) is prohibited until the machine in which this product has been incorporated or of which it is a component complies with the requirements of all relevant directives and this complete machine has a CE marking.

Eichenzell, 07.02.2024



Werner Kister, Chairperson isel Germany GmbH

1.5 General data, contact persons

Client	
Operator (if different from the client)	n.v.
Manufacturer	isel Germany GmbH Bürgermeister-Ebert-Str., 40 D-36124, Eichenzell +49 6659 981 800 +49 6659 981 782 info@isel.com

You can reach our contact persons for the technical consultancy and the sale as well as the service under the following contact data.

Technical advice and sales	+49 6659 981 800 info@isel.com
Service and Support	+49 6659 981 800 support@isel.com

1.6 User requirements

User groups

Capacity	Training, qualification
Operator/skilled worker	Instruction in the operation of the machine
Machine setter	Instruction in the operation of the machine Instruction in the safety functions of the machine
Electrical maintenance engineer	Electrician Instruction in the operation of the machine Instruction in the safety functions of the machine
Mechanical maintenance engineer	Specialist in pneumatics Instruction in the operation of the machine Instruction in the safety functions of the machine

1.7 Explanation of symbols and instructions

Notes on hazards that occur in connection with work on the machine are marked as follows in these Assembly instruction. They warn you of possible personal injury or property damage or give you work aids.

NOTE
 If, when a dangerous situation occurs, the consequence of an accident is at most damage to property, the notice bears the mark "NOTE".

⚠ CAUTION
 If, when a dangerous situation occurs, the result of an accident is at most a minor injury, the notice bears the marking "CAUTION".

⚠ WARNING
 If an accident resulting in **serious** or **fatal injury is possible** when a hazardous situation occurs, the notice carries the label "WARNING".

Information
 Indicates important information, application tips and useful hints for proper work.

Environment
 Information concerning environmental protection is marked in this way.

/ Number /
Refers to a document in the list of applicable documents. See chapter 1.3

1.8 List of abbreviations

	Declaration	
EN	European Norm	Harmonised European Standard
ISO	International Organization for Standardization	International Organization for Standardization
LES	Linear unit with spindle drive (LES4, LES5 and LES6)	Components used in the machine.
Gantry	also called gantry mode or gantry axis	Two synchronously running linear or rotary units with separate drives which can be mechanically connected to each other are considered as one drive axis. Both drives are operated angle-synchronously via the controller and the control software.
PSA	Personal protective equipment	e.g. gloves, work shoes, safety goggles, hearing protection

1.9 Symbols used in the Assembly instruction and on the machine

The use of the symbols is in accordance with the valid regulations of the country of operation.

warning symbol	description
	General warning sign
	Warning against hand injuries
	Warning of danger of pulling in
	Warning against hot surfaces

mandatory sign	description
	Use eye protection!
	Use hand protection!
	Use foot protection!
	Request to read instructions and regulations

2 Overview

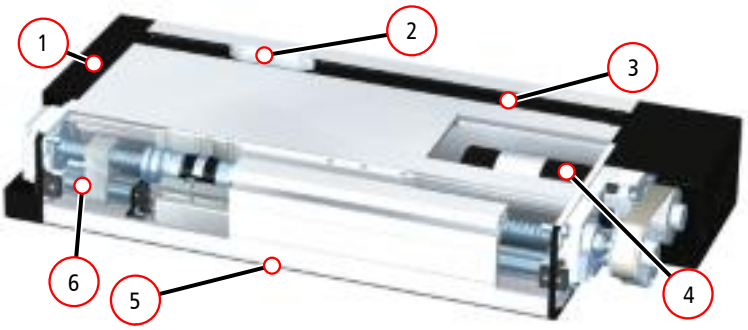
2.1 General information

In this chapter you will first get an overview of the mechanical design, the installation or assembly of the linear units as well as a description of the mode of operation. Then the various linear units are explained in detail.

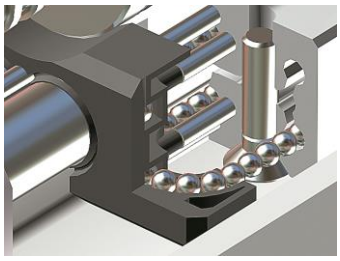
The instructions for commissioning / parameterization and user programming of the axis system depend on the motors used, the corresponding controllers with output stages and their documentation.

General structure of the linear units of the LES series

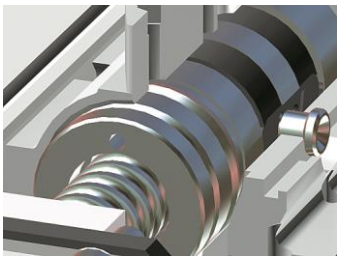
The structure of the linear units is shown in the following pictures, drawings and parts lists.



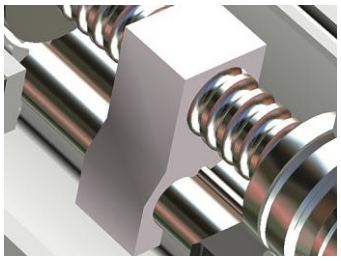
1. Plastic cap electromagnetically shielded
2. Clamping surface face milled
3. Abrasion-resistant sealing lips to protect the guide elements
4. Motor integrated in profile
5. Profile bottom side face milled
6. Shaft mounting contour precision milled



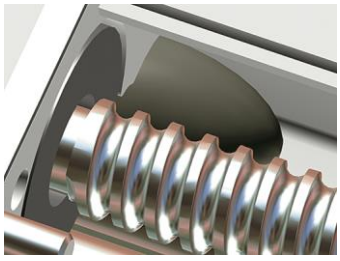
- Ball circulation in aluminium linear slide
- Glass fibre reinforced deflection parts with wipers



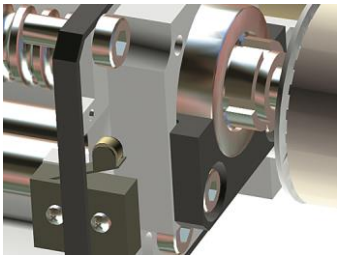
- Backlash-free pre-set KG nut with wipers
- Central lubrication device for KG nut and slide



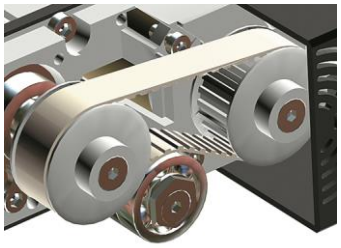
- Spindle support from profile length L=1500



- End position buffering on both sides
- Counter bearing with needle bearing



- Integrated overrun limit switches
- Spindle bearing arrangement with angular contact ball bearings
- Axially backlash-free due to self-locking locknut



- Belt deflection and connection electronics covered by protective cap

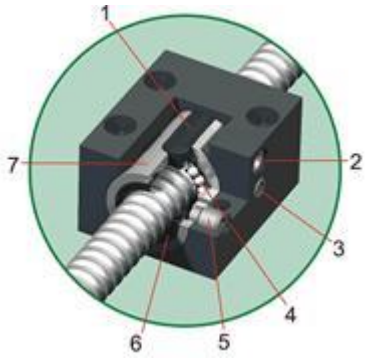
2.2 Functionality of the linear unit

The linear units of the LES series (spindle drive) are of modular design.

These linear units are based on linear guide rails (LFS) with the corresponding shaft slides (WS), a ball screw drive and the optional motor drive module. The linear guide rails consist of rigid aluminium profiles with precision steel shafts. The shaft slides are based on the rolling of steel balls on steel inserts guided in aluminium profiles and the precision steel shafts. 4 recirculating ball bearing units are used per shaft slide. The ball deflections are glass fibre reinforced.

Fig. 1 - Linear guide LFS 12-2 with guide carriage WS 5

Ball screws convert a rotary motion into a linear motion. They consist of the ball screw spindle (6), the ball screw nut (7) with ball return system (1) and the balls (4) as rolling elements. The balls make the connection between spindle and nut by rolling in the raceways of the ball screw spindle and the ball screw nut. Ball screw nuts of isel Germany GmbH have several ball circuits with internal ball returns. Backlash-free adjustment of the run on the spindles is made possible by set screws (3).



2.3 Versions of the linear units of the LES series

2.3.1 Linear unit LES 4

Normally the linear unit LES 4 are delivered without drive module. They are either prepared for mounting flange-mounted direct drive modules or lateral belt drive modules. However, the respective drive modules can also be mounted on request.

Design variants LES 4

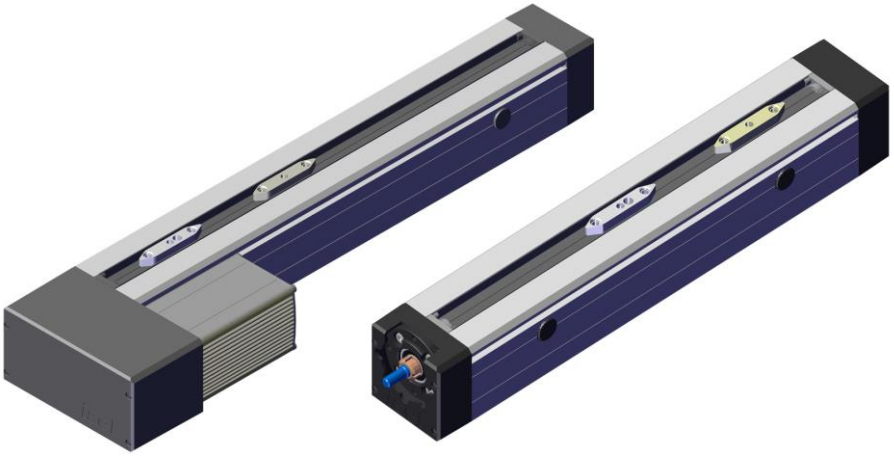


Fig. 2 - LES 4with belt drive module or prepared for direct drive

Ordering key LES 4

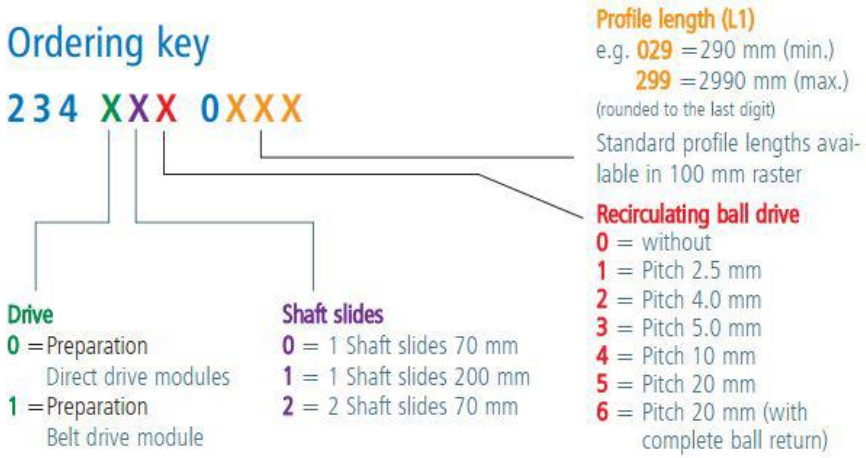


Fig. 3 - Ordering key LES 4

2.3.2 Linear unit LES 5

Normally the linear unit LES 5 are delivered without drive module. They are either prepared for mounting flange-mounted direct drive modules or integrated belt drive modules. However, the respective drive modules can also be mounted on request.

Design variants LES 5

Fig. 4 - LES 5with integrated belt drive module or prepared for direct drive

Ordering key LES 5

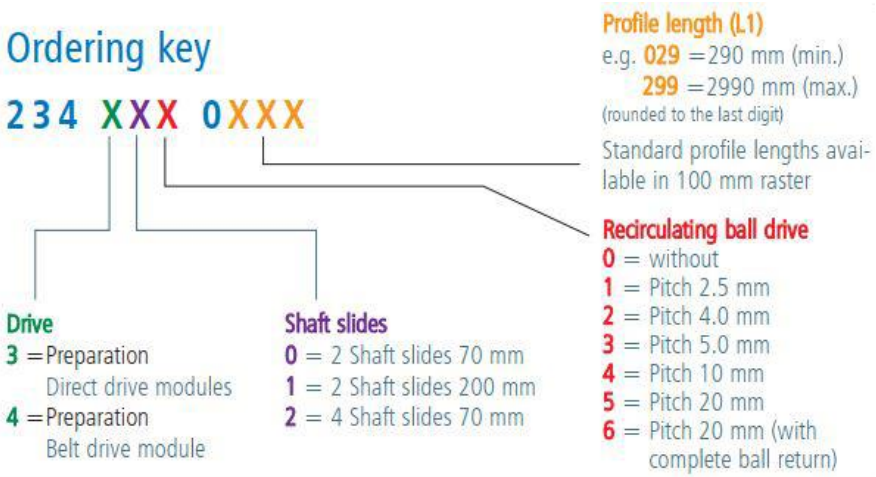


Fig. 5 - Ordering keyLES 5

2.3.3 Linear unit LES 6

Normally the linear unit LES 6 are delivered without drive module. They are either prepared for mounting flange-mounted direct drive modules or integrated belt drive modules. However, the respective drive modules can also be mounted on request.

Design variants LES 6

Fig. 6 - LES 6 with belt drive module or prepared for direct drive

Ordering key LES 6

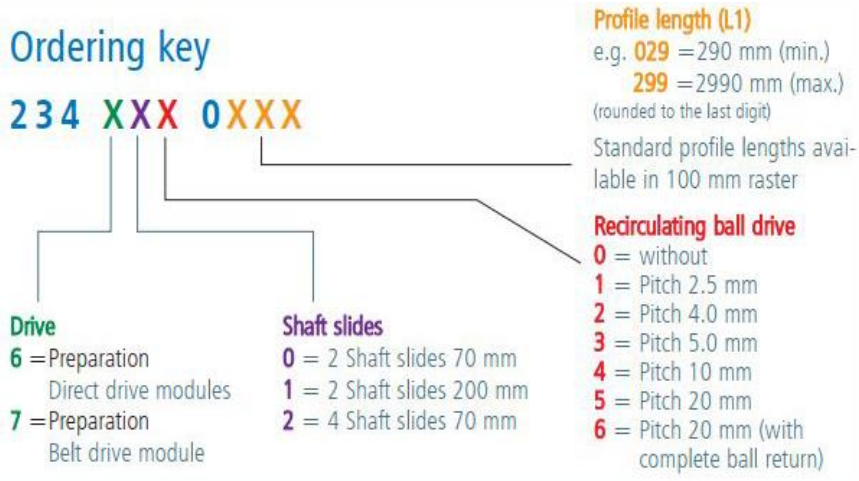


Fig. 7 - Ordering key LES 6

2.4 Technical data

2.4.1 Mechanical data and dimensions

2.4.1.1 Linear unit LES 4

Linear unit LES 4

	Unit	Value
Aluminium profile WxH	mm	75 x 75
Profile lengths	mm	290 - 2990 [1]
Material		AlMgSiO, 5F22
Anodizing		E6/EV1
Spindle pitch	mm	2.5 / 4 / 5 / 10 / 20
Repeat accuracy	mm	0.02
Moment of inertia I_x	cm^4	107.711
Moment of inertia I_y	cm^4	125.843
Focus	mm	33.23
cross-sectional area	cm^2	18.81
Temperature range bearing	°C	0-40
Temperature range operation	°C	0 - 60 (80)
relative air humidity	%	90 (non-condensing)
Weight linear unit	kg/m	6.2
Weight linear unit and spindle	kg/m	7.6
Shaft slides		
Shaft slides		1x WS 5 - 70 / 2x WS 5 - 70
Weight shaft slides	kg	0.34 / 0.68
Traverse path	mm	Profile length L1 - 150mm / Profile length L1 - 280mm

No-load running torques

No-load torques (Ncm)					
Speed (1/min)	Spindle pitch				
	2.5	4	5	10	20
500	15	15	16	17	18
1500	19	19	19	20	21
3000	23	24	24	25	26

[1] Standard grid dimensions 100mm

Bending

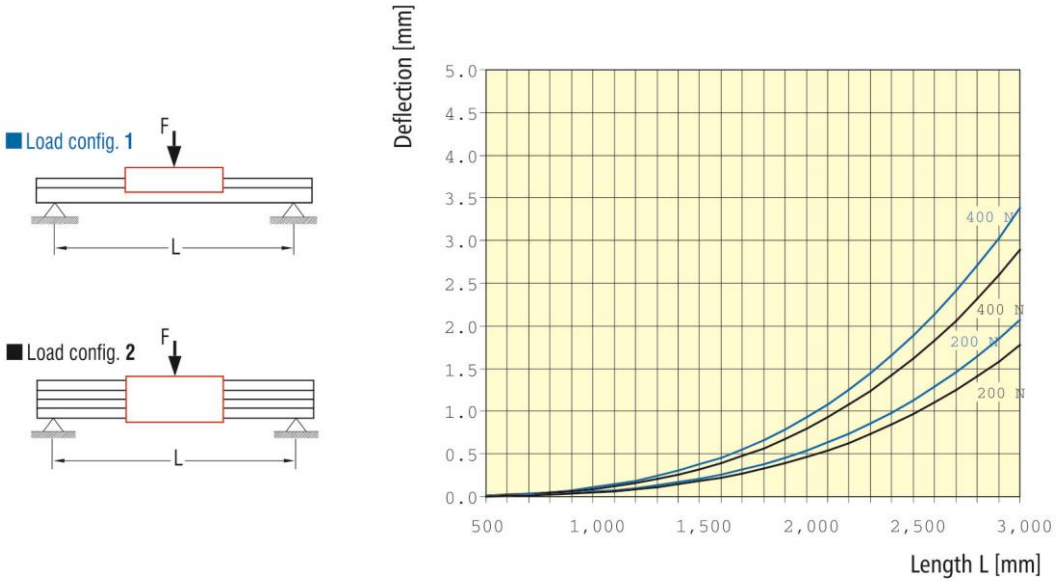


Fig. 8 - Deflection data LES 4

Load factors

$$Fr(\alpha) = \frac{F2}{\cos \alpha}$$

$$Fr(\alpha) = \frac{F1}{\sin \alpha}$$

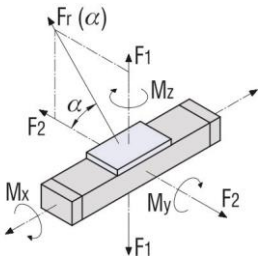


Fig. 9 - Load diagramLES 4

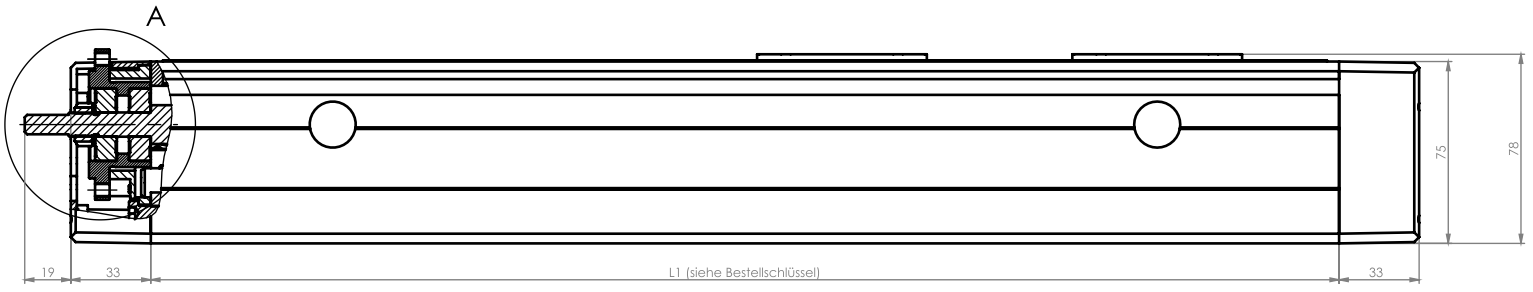
	LES 4 with a WS 5/70	LES 4 with two WS 5/70
C_0	3303 N	4955 N
C	1873 N	2810 N
F_1 stat.	2821 N	4232 N
F_1 dyn.	1599 N	2399 N
F_2 stat.	3303 N	4955 N
F_2 dyn.	1873 N	2810 N
M_x stat.	30 Nm	45 Nm
M_y stat.	105 Nm	275 Nm
M_z stat.	123 Nm	322 Nm
M_x dyn	17 Nm	25 Nm
M_y dyn.	60 Nm	156 Nm
M_z dyn.	70 Nm	183 Nm

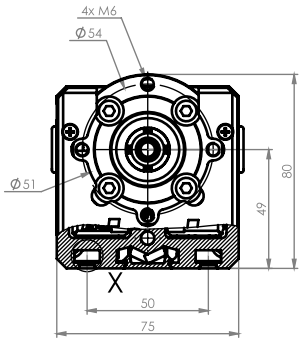
Permissible spindle speeds

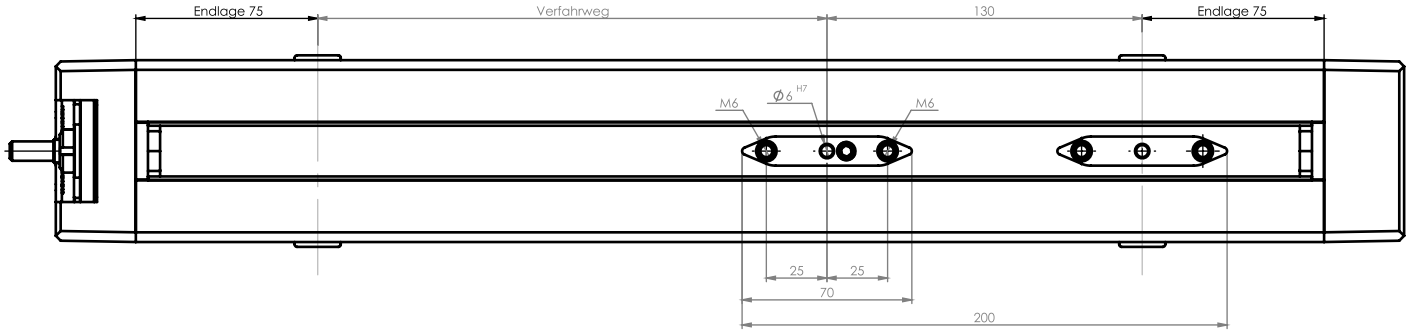
LES 4 / 5 / 6 Profile length L [mm]	Spindle pitch p [mm]	2.5	4	5	10	20
	max. permissible spindle speed n [1/min]	max. permissible feed speed v [mm/s]				
490	4000	167	267	333	667	1333
990	3000	125	200	250	500	1000
1390	1500	63	100	125	250	500
1490[1]	3000	125	200	250	500	1000
1990	1650	69	110	138	275	550
2490	1050	44	70	88	175	350
2990	750	31	50	63	125	250

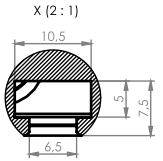
2.4.1.1.1 Dimension sheet LES 4 - Preparation direct drive according to TE2479

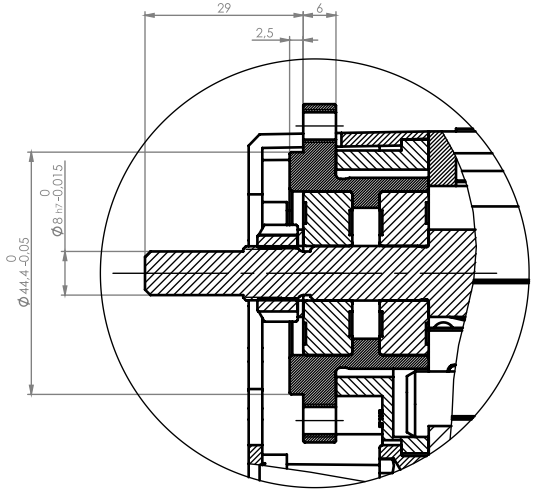
[1] 1490 - 2990 mm with spindle support



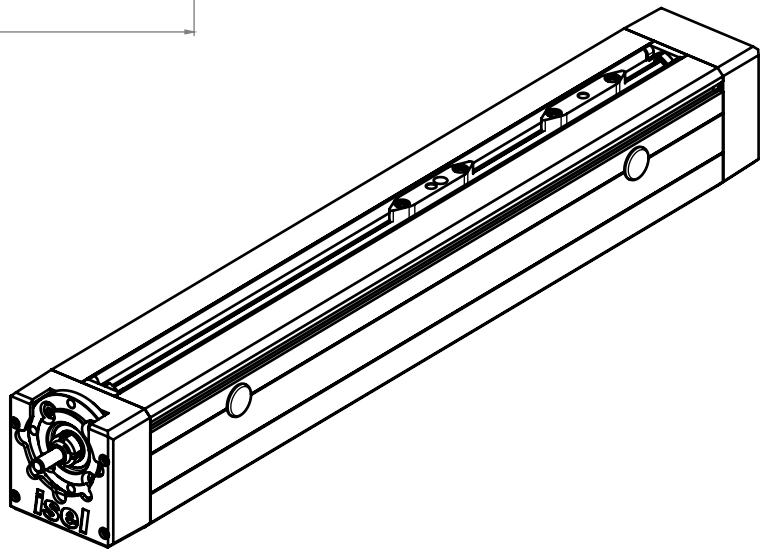








A (1.5 : 1)



Bestellschlüssel

234 0XX 0XXX

Profillänge
z.B.029 = 290mm (min)
299 = 2990mm (max)

Kugelgewindetrieb
0 = ohne
1 = Steigung 2,5mm
2 = Steigung 4,0mm
3 = Steigung 5,0mm
4 =Steigung 10mm
5 = Steigung 20mm

Wellenschlitten
0 = 1 Wellenschlitten 70mm
1 = 1 Wellenschlitten 200mm
2 = 2 Wellenschlitten 70mm

Verfahrweg

bei 1x WS 5/70 = L1 - 150mm
bei 2x WS 5/70 = L1 - 280mm
bei 1x WS 5/200 = L1 - 280mm

07	Gegenlagerung/ Flansch Direktantrieb	02.03.18	Bearb.	29.10.97		
06	EC 60 TM ergänzt	10.02.17	Gepr.	29.10.97		
05	Endschalter / Maßblatt ergä.	04.04.14				
04	überarbeitet. Motormodule	11.07.11				
03	Datenübernahme SW, Spindelunterstützung	30.04.08				
02	Stückliste	18.02.99				
Zust.	Änderung	Datum	Name			

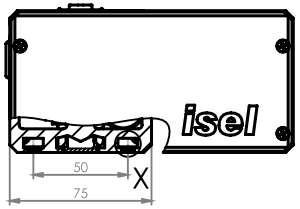
Toleranz DIN ISO 2768-mK | Oberfläche

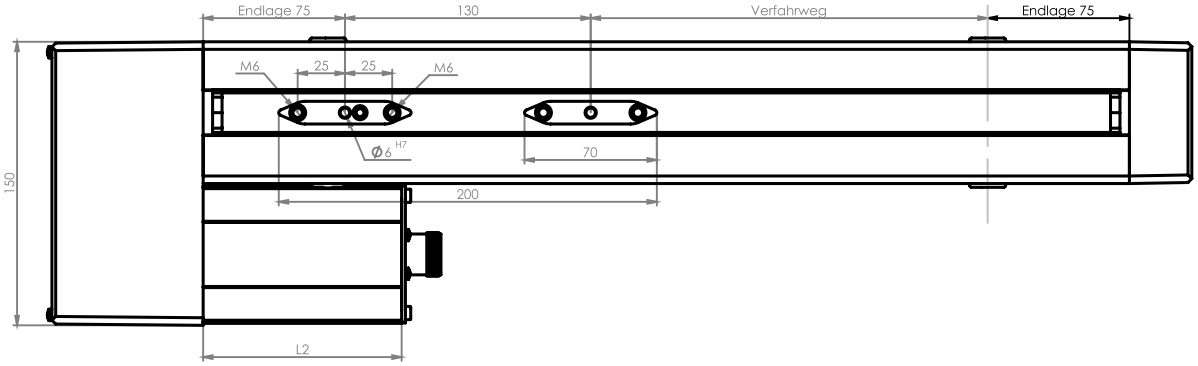
Blattgröße DIN A2

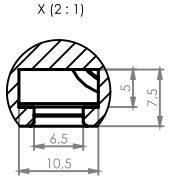
isel®

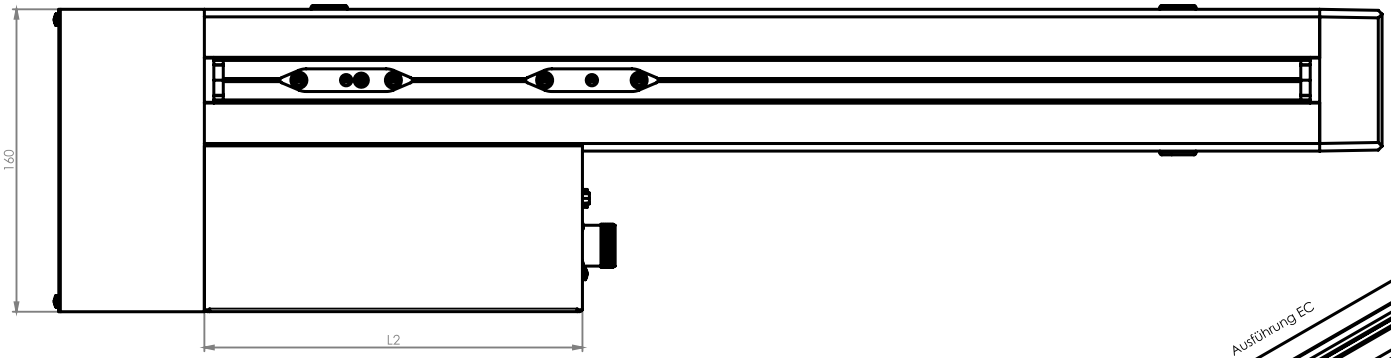
Maßstab	1:1.5	Gewicht	Pos. Nr.
Werkstoff		Halbzeug	
Benennung	LES 4 Direktantrieb		
Zeichnungsnummer	TE2479	Blatt	2
		von	2
Artikelnummer	siehe Zeichnung		
Baugruppe			
Projektbezeichnung			

2.4.1.1.2 Dimension sheet LES 4 - Belt drive according to TE2465









Bestellschlüssel

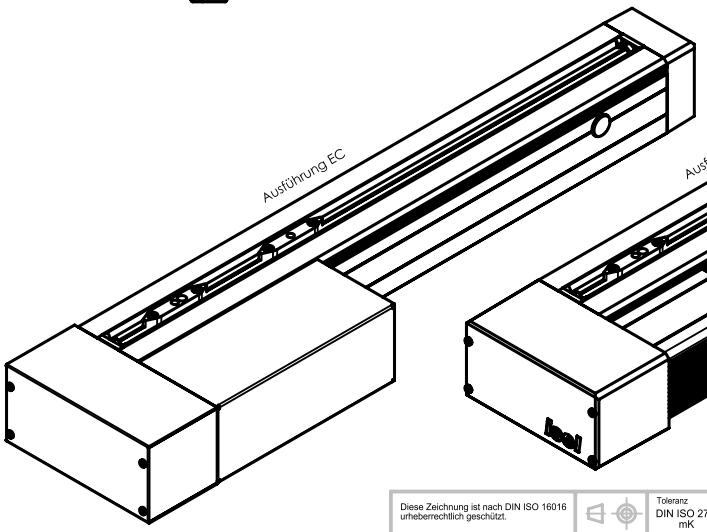
234 1XX 0XXX

Profillänge
z.B.029 = 290mm (min)
299 = 2990mm (max)

Kugelgewindetrieb
0 = ohne
1 = Steigung 2,5mm
2 = Steigung 4,0mm
3 = Steigung 5,0mm
4 = Steigung 10mm
5 = Steigung 20mm

Wellenschlitten
0 = 1 Wellenschlitten 70mm
1 = 1 Wellenschlitten 200mm
2 = 2 Wellenschlitten 70mm

Motormodul	Artikelnummer	L2
MS 135 HT	396055 2060	105
MS 135 HT + Bremse	396055 2360	155
MS 200 HT	396058 2060	105
MS 200 HT + Bremse	396058 2360	155
DC 100	396112 2060	155
EC 60 S	396415 2060	200
EC 60 S + Bremse	396415 2260	200
EC 60L 48V	396423 2060	200
EC 60L 310V	396423 2070	200
EC 60 TM 200W 48V	396421 2060	200
EC 60 TM 200W 48V + Bremse	396421 2260	200
EC 60 TM 200W 220V	396421 2070	200
EC 60 TM 200W 220V + Bremse	396421 2270	200
EC 60 TM 400W 48V	396440 2080	200
EC 60 TM 400W 48V + Bremse	396440 2280	200
EC 60 TM 400W 220V	396440 2070	200
EC 60 TM 400W 220V + Bremse	396440 2270	200



Verfahrweg

bei 1x WS 5/70 = L1 - 150mm
bei 1x WS 5/200 = L1 - 280mm
bei 2x WS 5/70 = L1 - 280mm

Toleranz DIN ISO 2768-mK | Oberfläche | Maßstab 1:2 | Gewicht | Pos. Nr. | Werkstoff | Halbzeug

08	Lagerflansch Gegenlager getauscht	05.03.18		
07	EC 60 TM ergänzt	14.02.17		
06	Endschalter überarbeitet; Maßblatt TE2717 ergä.	10.04.14		
05	Überarbeitet; Motormodule	22.07.11		
04	Datenübernahme; Spindekunterst.	30.04.08		
03	Artikelnummer	18.02.99		
02	Stückliste	27.05.97		
Zust.	Änderung	Datum	Name	

Datum | Name
Bearb. 17.10.97
Gepr. 17.10.97

Blattgröße DIN A2

Benennung: LES4 Riemenantriebsmodul seitlich

Zeichnungsnummer: **TE2465** | Blatt 2 von 2

Artikelnummer: siehe Zeichnung

Baugruppe

Projektbezeichnung

isel®

2.4.1.2 Linear unit LES 5

Linear unit LES 5

	Unit	Value
Aluminium profile WxH	mm	225 x 75
Profile lengths	mm	290 - 2990 [1]
Material		AlMgSiO, 5F22
Anodizing		E6/EV1
Spindle pitch	mm	2.5 / 4 / 5 / 10 / 20
Repeat accuracy	mm	0.02
Moment of inertia	lx cm^4	292
Moment of inertia	ly cm^4	2290
Centre of gravity	mm	33.39
cross-sectional area	cm^2	42.49
Temperature range bearing	°C	0-40
Temperature range operation	°C	0 - 60 (80)
Relative air humidity	%	90 (non-condensing)
Weight linear unit	kg/m	13.5
Weight linear unit and spindle	kg/m	14.9
Shaft slides		
Shaft slides		2x WS 5 - 70 / 4x WS 5 - 70
Weight shaft slide	kg	0.68 / 1.36
Traverse path	mm	Profile length L1 - 150mm / Profile length L1 - 280mm

No-load running torques

No-load running torques (Ncm)					
Speed (1/min)	Spindle pitch				
	2.5	4	5	10	20
500	15	15	16	17	18
1500	19	19	19	20	21
3000	23	24	24	25	26

[1] Standard grid dimensions 100mm

Bending

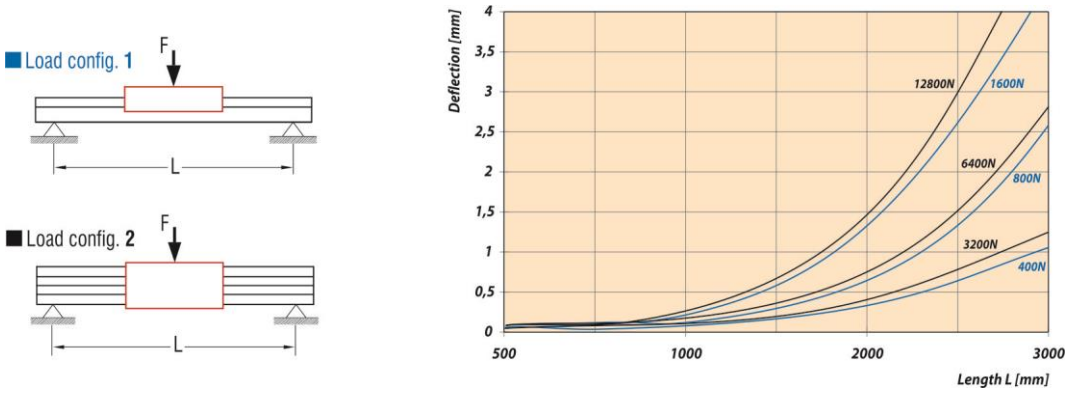


Fig. 10 - Deflection data LES 5

Load factors

$$Fr(\alpha) = \frac{F2}{\cos \alpha}$$

$$Fr(\alpha) = \frac{F1}{\sin \alpha}$$

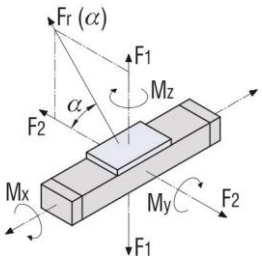


Fig. 11 - Load diagramLES 5

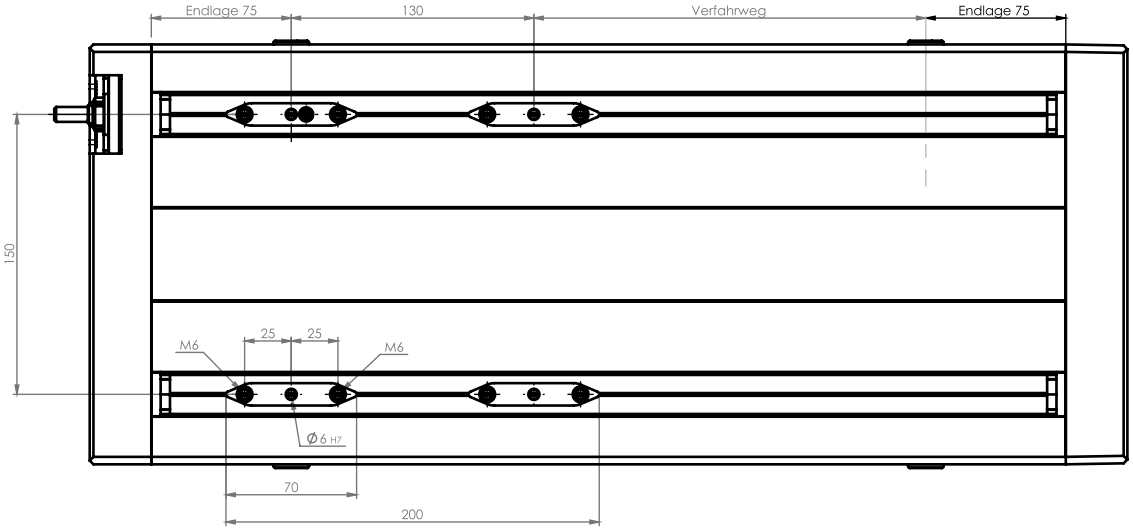
	LES 5with two WS 5/70	LES 5 with four WS 5/70
C_0	4955 N	6606 N
C	2810 N	3746 N
F_1 stat.	4232 N	5642 N
F_1 dyn.	2399 N	3198 N
F_2 stat.	4955 N	6606 N
F_2 dyn.	2810 N	3746 N
M_x stat.	317 Nm	423 Nm
M_y stat.	127 Nm	367 Nm
M_z stat.	149 Nm	429 Nm
M_x dyn	180 Nm	240 Nm
M_y dyn.	72 Nm	208 Nm
M_z dyn.	84 Nm	243 Nm

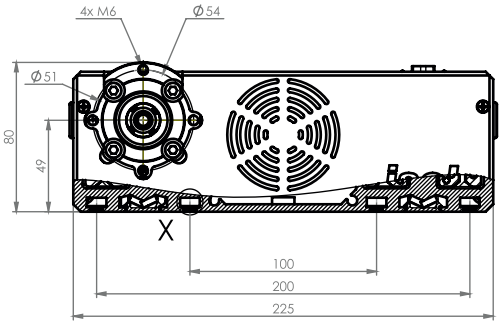
Permissible spindle speeds

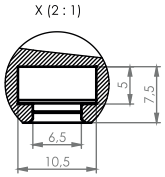
LES 4 / 5 / 6 Profile length L [mm]	Spindle pitch p [mm]	2.5	4	5	10	20
	max. permissible spindle speed n [1/min]	max. permissible feed speed v [mm/s]				
490	4000	167	267	333	667	1333
990	3000	125	200	250	500	1000
1390	1500	63	100	125	250	500
1490[1]	3000	125	200	250	500	1000
1990	1650	69	110	138	275	550
2490	1050	44	70	88	175	350
2990	750	31	50	63	125	250

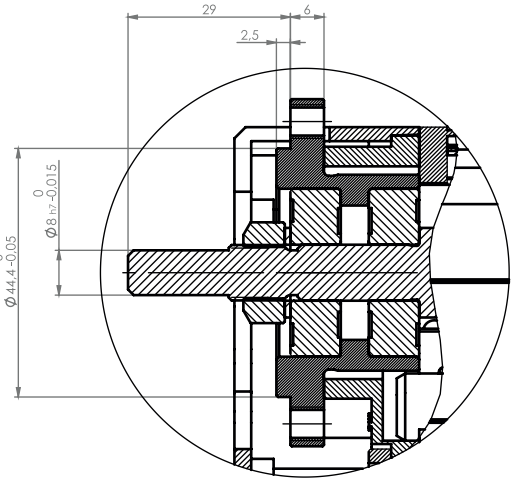
2.4.1.2.1 Dimension sheet LES 5 - Preparation for direct drive to TE2480

[1] 1490 - 2990 mm with spindle support

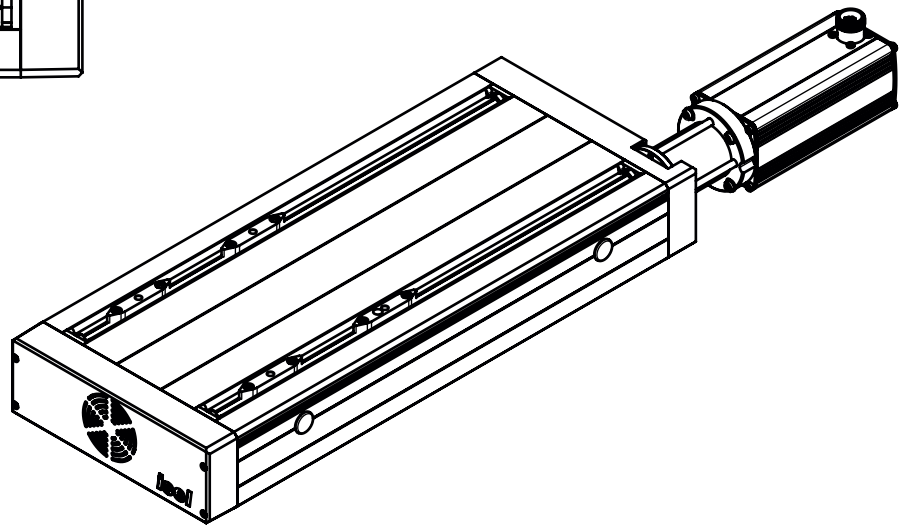








A (1.5 : 1)



Bestellschlüssel

234 3XX 0XXX

Profillänge
z.B.029 = 290mm (min)
299 = 2990mm (max)
(um die letzte Stelle gestuft)

Kugelgewindetrieb
0 = ohne
1 = Steigung 2,5mm
2 = Steigung 4,0mm
3 = Steigung 5,0mm
4 =Steigung 10mm
5 = Steigung 20mm

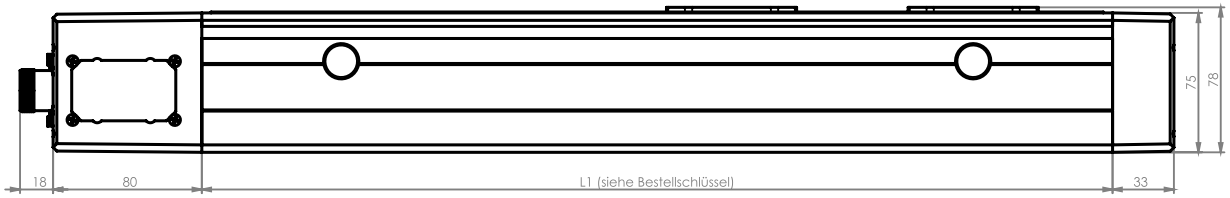
Wellenschlitten
0 = 2 Wellenschlitten 70mm
1 = 2 Wellenschlitten 200mm
2 = 4 Wellenschlitten 70mm

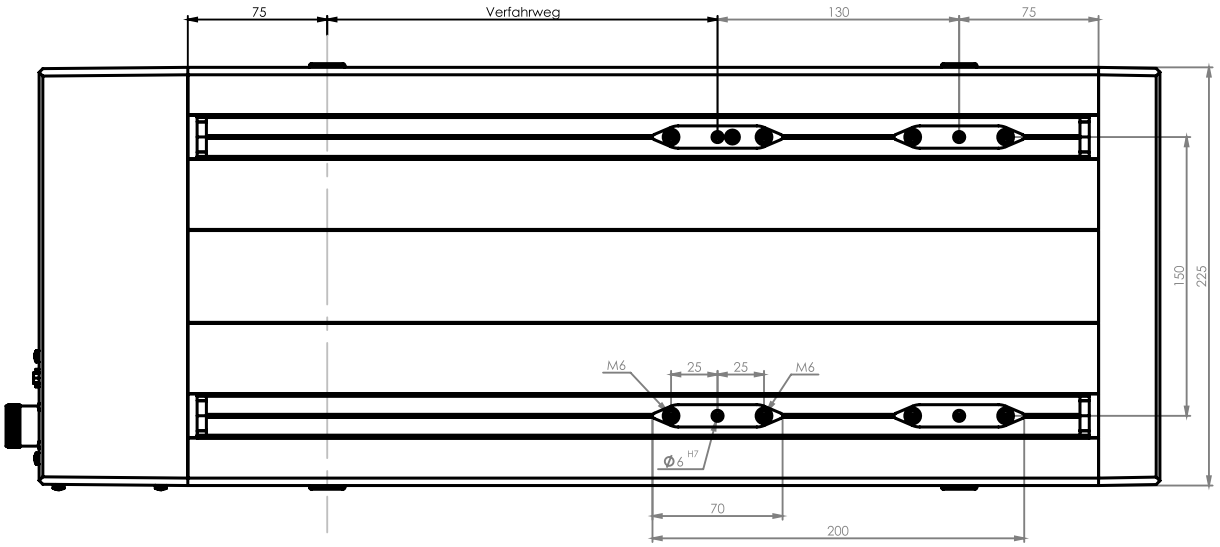
Verfahrweg

bei 2x WS5/70 = L1 - 150mm
bei 2x WS5 / 200 = L1 - 280mm
bei 4x WS5/70 = L1 - 280mm

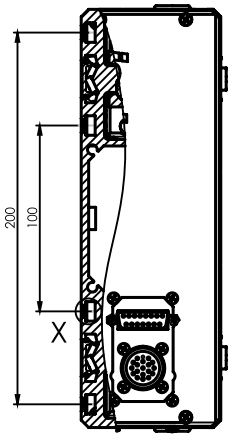
Diese Zeichnung ist nach DIN ISO 16016 urheberrechtlich geschützt.		Toleranz DIN ISO 2768-mK	Oberfläche	Maßstab 1:2	Gewicht	Pos. Nr.			
				Werkstoff	Halbzeug				
			Datum	Name	Benennung	LES5 Direktantrieb			
07	Gegenlagerflansch u. Flansch f. Direktantrieb getauscht	06.03.18	Bearb.	10.11.97					
06	EC60 TM ergänzt	07.02.17	Gepr.	10.11.97					
05	Endschalter überarbeitet; Maßblatt (TE2709) ergän.	14.04.14	Blattgröße	DIN A2	Zeichnungsnummer	TE2480	Blatt	2	
04	überarbeitet; Motormodul	12.07.11					von	2	
03	Datenübernahme SW; Spindelunterst.	04.06.08	isel®		Artikelnummer	siehe Zeichnung			
02	Stückliste	18.02.99			Baugruppe				
Zust.	Änderung	Datum Name			Projektbezeichnung				

2.4.1.2.2 Dimension sheet LES 5 - Integrated belt drive according to TE2478

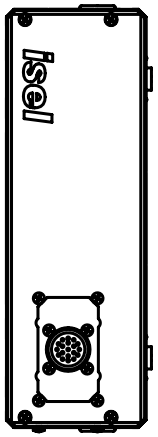




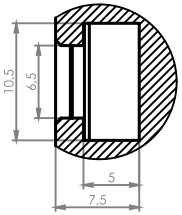
EC/DC - Seromotor



MS135 / MS200



X (3 : 1)

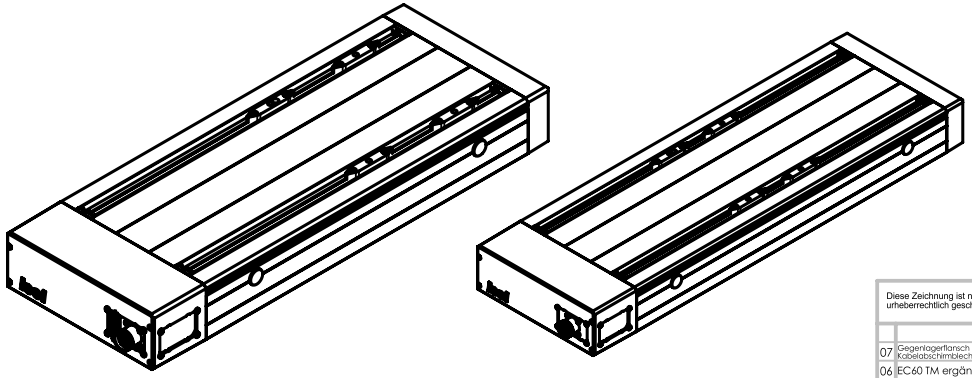


Bestellschlüssel
234 4XX 0XXX

Profillänge
z.B.029 = 290mm (min)
299 = 2990mm (max)

Kugelgewindetrieb
0 = ohne
1 = Steigung 2,5mm
2 = Steigung 4,0mm
3 = Steigung 5,0mm
4 =Steigung 10mm
5 = Steigung 20mm

Wellenschlitten
0 = 2 Wellenschlitten 70mm
1 = 2 Wellenschlitten 200mm
2 = 4 Wellenschlitten 70mm



Verfahrwege	
2x WS 5/70	L1 - 150mm
2x WS 5/200	L1 - 280mm
4x WS 5/70	L1 - 280mm

Toleranz DIN ISO 2768-mK | Oberfläche | Maßstab 1:2 | Gewicht | Pos. Nr.
Werkstoff | Halbzeug

			Datum	Name
07	Gegenlagerflansch getauscht, Kabelabschirmblech ergänzt	06.03.18	Bearb.	27.10.97
06	EC60 TM ergänzt	06.02.17	Gepr.	27.10.97
05	Endschalter-Motormodule überarbeitet Maßblatt ergä. (TE2719)	13.02.14		
04	überarbeitet; Motormodule	10.08.11		
03	Datenübernahme SW; Spindelunterst.	26.05.08		
02	Stückliste	18.02.99		
Zust.	Änderung	Datum	Name	

Blattgröße DIN A2

Benennung: LES 5 Motor integriert

Zeichnungsnummer **TE2478** | Blatt 1 von 2

Artikelnummer: siehe Zeichnung

Baugruppe

Projektbezeichnung

isel®

2.4.1.3 Linear unit LES 6

Linear unit LES 6

	Unit	Value
Aluminium profile WxH	mm	150 x 75
Profile lengths	mm	290 - 2990 [1]
Material		AlMgSiO, 5F22
Anodizing		E6/EV1
Spindle pitch	mm	2.5 / 4 / 5 / 10 / 20
Repeat accuracy	mm	0.02
Moment of inertia	lx cm^4	212
Moment of inertia	ly cm^4	707
Centre of gravity	mm	33.39
cross-sectional area	cm^2	42.49
Temperature range bearing	°C	0-40
Temperature range operation	°C	0 - 60 (80)
relative air humidity	%	<90 (non-condensing)
Weight linear unit	kg/m	11.4
Weight linear unit and spindle	kg/m	12.8
Shaft slides		
Shaft slides		2x WS 5 - 70 / 4x WS 5 - 70
Weight shaft slide	kg	0.68 / 1.36
Traverse path	mm	Profile length L1 - 150mm / Profile length L1 - 280mm

No-load running torques

No-load running torques (Ncm)					
Speed (1/min)	Spindle pitch				
	2,5	4	5	10	20
500	17	17	18	20	21
1500	20	20	22	24	25
3000	24	25	26	29	30

[1] Standard grid dimensions 100mm

Bending

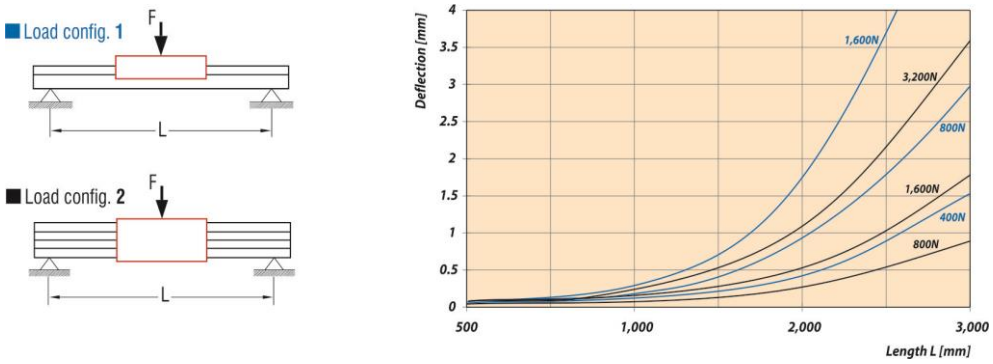


Fig. 12 - Deflection data LES

Load factors

$$F_r(\alpha) = \frac{F_2}{\cos \alpha}$$

$$F_r(\alpha) = \frac{F_1}{\sin \alpha}$$

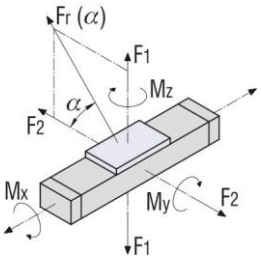


Fig. 13 - Load diagram LES

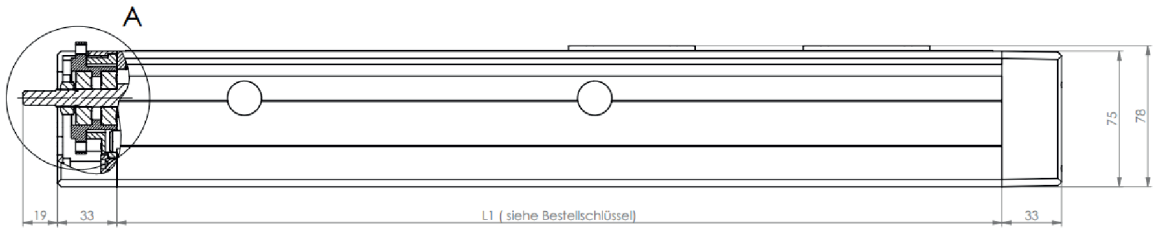
	LES 6 with two WS 5/70	LES 6 with four WS 5/70
C_0	4955 N	6606 N
C	2810 N	3746 N
F_1 stat.	4232 N	5642 N
F_1 dyn.	2399 N	3198 N
F_2 stat.	4955 N	6606 N
F_2 dyn.	2810 N	3746 N
M_x stat.	159 Nm	212 Nm
M_y stat.	127 Nm	367 Nm
M_z stat.	149 Nm	429 Nm
M_x dyn	90 Nm	120 Nm
M_y dyn.	72 Nm	208 Nm
M_z dyn.	84 Nm	243 Nm

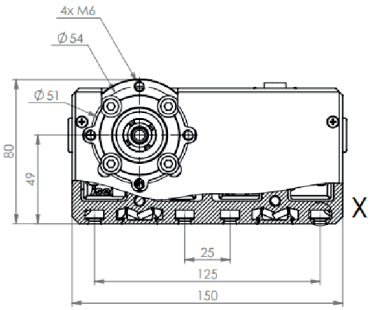
Permissible spindle speeds

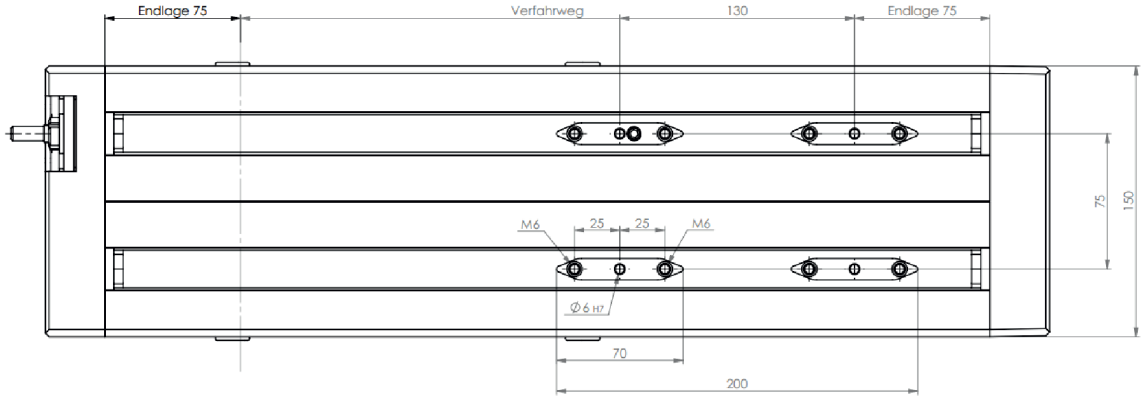
LES 4 / 5 / 6 Profile length L [mm]	Spindle pitch p [mm]	2,5	4	5	10	20
	max. permissible spindle speed n [1/min]	max. permissible feed speed v [mm/s]				
490	4000	167	267	333	667	1333
990	3000	125	200	250	500	1000
1390	1500	63	100	125	250	500
1490[1]	3000	125	200	250	500	1000
1990	1650	69	110	138	275	550
2490	1050	44	70	88	175	350
2990	750	31	50	63	125	250

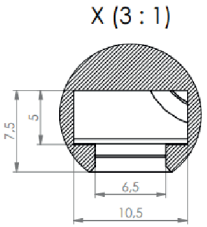
2.4.1.3.1 Dimension sheet LES 6 - Preparation direct drive according to TE2481

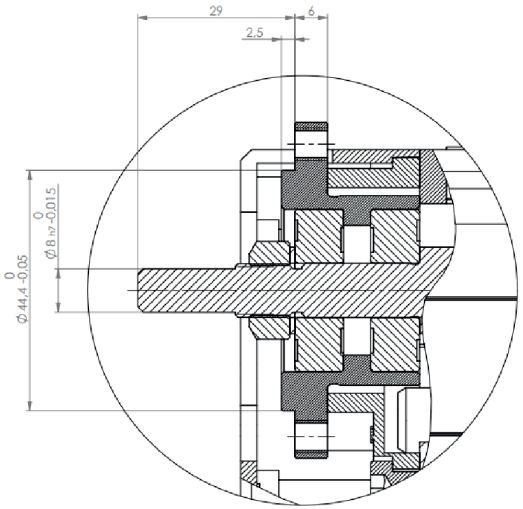
[1] 1490 - 2990 mm with spindle support



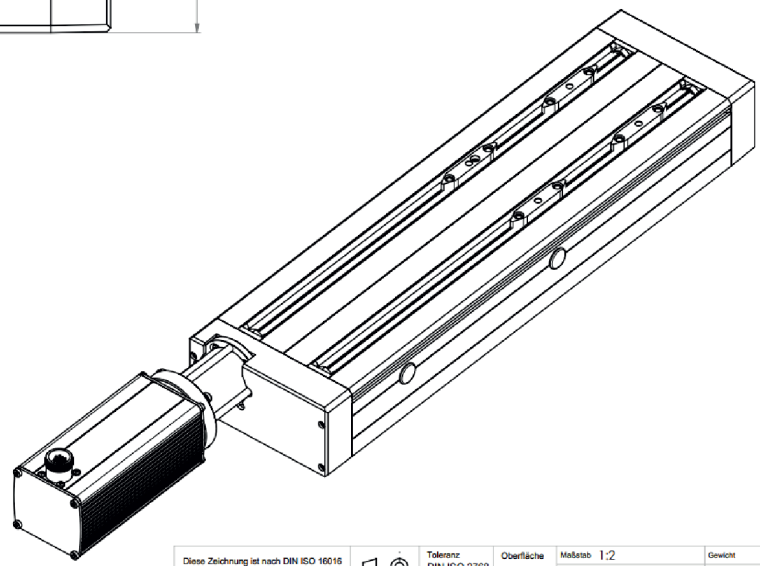








A (1.5 : 1)



Bestellschlüssel
234 6 X X 0 X X X

- Profillänge
  z.B.029 = 290mm (min)
  299 = 2990mm (max)
- Kugelgewindetrieb
  0 = ohne
  1 = Steigung 2,5mm
  2 = Steigung 4,0mm
  3 = Steigung 5,0mm
  4 =Steigung 10mm
  5 = Steigung 20mm
- Wellenschlitten
  0 = 1 Wellenschlitten 70mm
  1 = 1 Wellenschlitten 200mm
  2 = 2 Wellenschlitten 70mm

Verfahrwege

bei 2x WS5 / 70 = L1 - 150mm
bei 2x WS5 / 200 = L1 - 280mm
bei 4x WS5 / 70 = L1 - 280mm

Diese Zeichnung ist nach DIN ISO 16016 urheberrechtlich geschützt.			Toleranz DIN ISO 2768-mK	Oberfläche	Maßstab 1:2	Gewicht	Pos. Nr.
					Werkstoff	Halbzeug	
			Datum	Name	Benennung	LES6 Direktantrieb	
07	Gegenlagerflansch u. Ritzel f. Direktantrieb getauscht	06.03.18	Bearb.	30.10.97			
06	IEC 60 TM ergänzt	10.02.17	Gepr.	30.10.97			
05	Endschalter überarbeitet Maßblatt TE2710 ergä.	23.04.14	Blattgröße	DIN A2	Zeichnungsnummer	TE2481	Blatt 2 von 2
04	Überarbeitet: Motormodule	10.08.11			Artikelnummer	siehe Zeichnung	
03	Datenübernahme: Spindelunterst.	04.06.08			Baugruppe		
02	Stückliste	18.02.99			Projektbezeichnung		
Zust.	Änderung	Datum Name			isel®		

2.4.1.3.2 Dimension sheet LES 6 - Belt drive according to TE2474

2.4.2 Ambient conditions

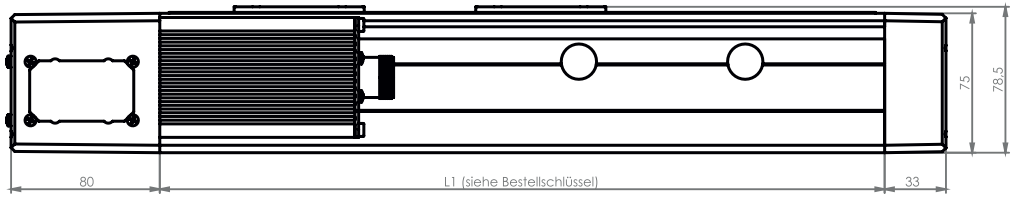
	Limit value
Installation site	Max. 2000m above sea level
Surrounding temperature	5° C to 40° C
Storage temperature	-5 to 50° C
Humidity	Max. 85% non-condensing

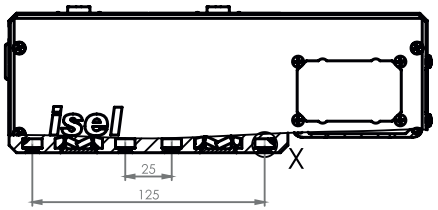
2.4.3 Sound pressure

The Machinery directive 2006/42/EC obliges the manufacturer and/or the distributor of a machine to indicate the noise emitted by the machine in the operating instructions. The noise emission level at the workplace L_{PA} is the first thing required as a noise emission characteristic.

Noise emission	Unit	Values
A-weighted emission sound pressure level L_{PA} at work	dB(A) re 1 pW	68
Applied measuring method	[Standard]	DIN EN 13128:2009-09 Appendix D
Sound power level L_{WA}	dB(A) re 1 pW	
Uncertainty K_{WA} in dB	dB(A)	
Applied measuring method	[Standard]	
Maximum value of the instantaneous C-rated sound pressure at the workstations of the operating personnel	dB(C)	

The numerical values mentioned are emission and not necessarily safe working levels. The factors influencing the actual exposure level of the employees include the characteristics of the work area, other noise sources, like the number of machines, the other processes running nearby and the processing itself. This information should allow the machine user to make a better hazard and risk assessment. Any necessary measures concerning the use of personal protective equipment result from the risk assessment of the workplace in according with the Ordinance on Industrial Safety and Health (BetrSichV) or other national requirements in the country of operation.

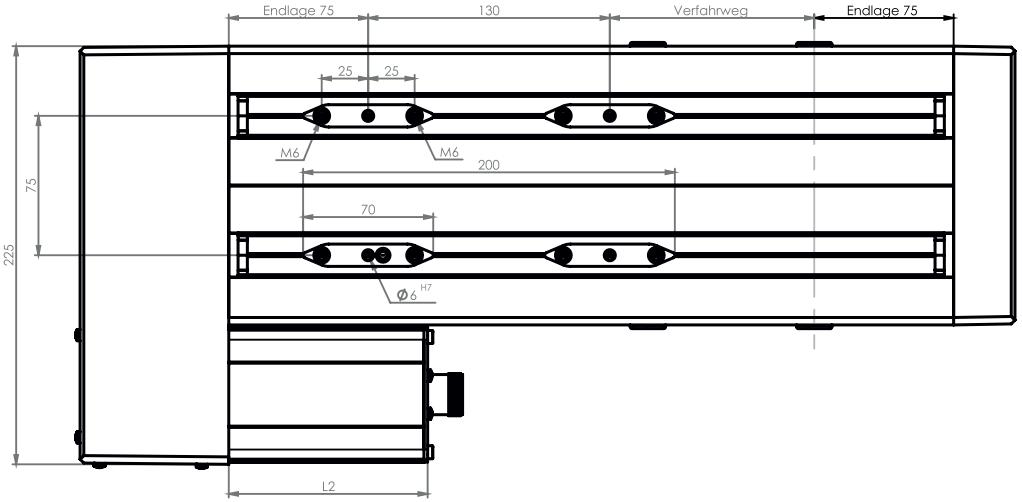


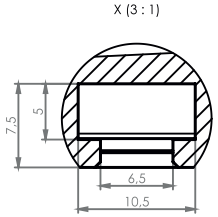


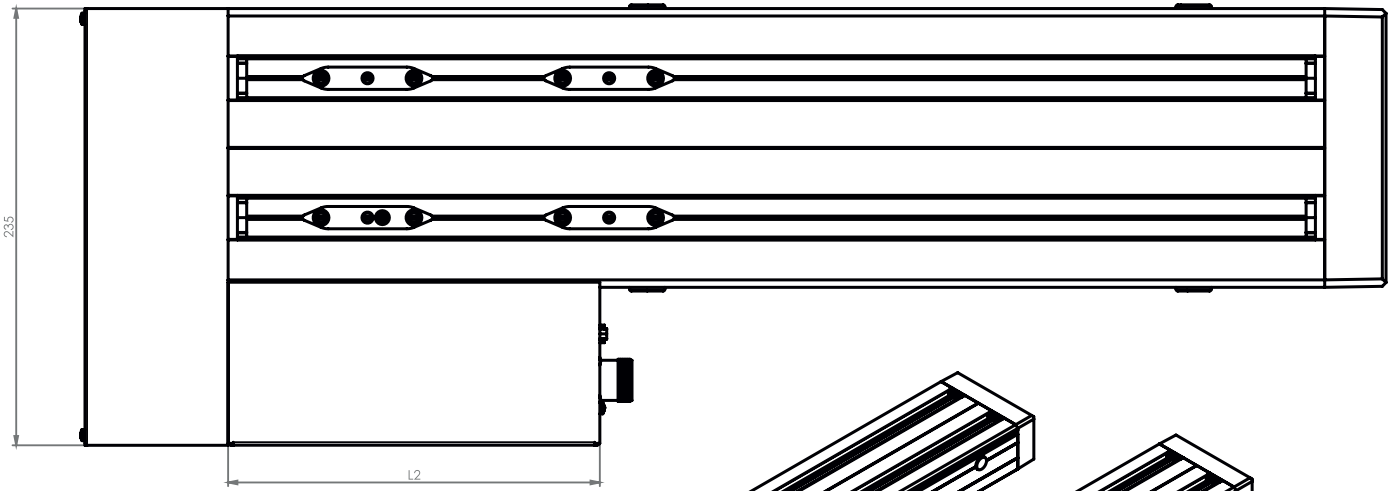
Bestellschlüssel

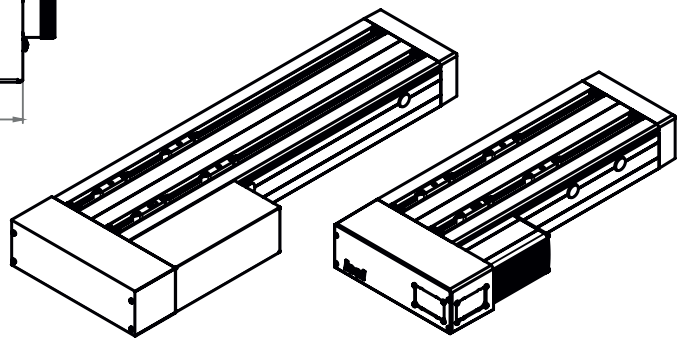
234 7XX 0XXX

- Profillänge
  - z.B.029 = 290mm (min)
  - 299 = 2990mm (max)
- Kugelgewindetrieb
  - 0 = ohne
  - 1 = Steigung 2,5mm
  - 2 = Steigung 4,0mm
  - 3 = Steigung 5,0mm
  - 4 = Steigung 10mm
  - 5 = Steigung 20mm
- Wellenschlitten
  - 0 = 2 Wellenschlitten 70mm
  - 1 = 2 Wellenschlitten 200mm
  - 2 = 4 Wellenschlitten 70mm









Motormodul	Artikelnummer	L2
MS 135 HT	396055 2060	105
MS 135 HT + Bremse	396055 2360	155
MS 200 HT	396058 2060	105
MS 200 HT + Bremse	396058 2360	155
DC 100	396112 2060	155
EC 60 S	396415 2060	200
EC 60 S + Bremse	396415 2260	200
EC 60L 48V	396423 2060	200
EC 60L 310V	396423 2070	200
EC 60 TM 200W 48V	396421 2060	200
EC 60 TM 200W 48V + Bremse	396421 2260	200
EC 60 TM 200W 220V	396421 2070	200
EC 60 TM 200W 220V + Bremse	396421 2270	200
EC 60 TM 400W 48V	396440 2080	200
EC 60 TM 400W 48V + Bremse	396440 2280	200
EC 60 TM 400W 220V	396440 2070	200
EC 60 TM 400W 220V + Bremse	396440 2270	200

Verfahrwege

bei 2x WS 5/70 = L1 - 150mm
bei 2x WS 5/200 = L1 - 280mm
bei 4x WS 5/70 = L1 - 280mm

08	Gegenlagerflansch getauscht	06.03.18
07	EC 60 TM ergänzt	06.03.18
06	Maß42; Tiefe 17	22.02.16
05	Endschalter überarbeitet; Maßblatt (TE2718) ergänzt	15.05.14
04	Überarbeitet; Motormodule	10.08.11
03	Datenübernahme SW; Spindelunterstützung	04.06.08
02	Stückliste	18.02.99
Zust.	Änderung	Datum / Name

Toleranz DIN ISO 2768-mK | Oberfläche

Maßstab 1:2 | Gewicht | Pos. Nr.

Werkstoff | Halbzeug

	Datum	Name
Bearb.	22.10.97	
Gepr.	22.10.97	

Benennung: LES 6 Riemenantriebsmodul seitlich

Blattgröße DIN A2 | Zeichnungsnummer **TE2474** | Blatt 2 von 2

Artikelnummer: siehe Zeichnung

Baugruppe

Projektbezeichnung

isel®

2.5 Type plate

The type plate is attached to the front left of the machine. Maintain the type plate in readable condition.

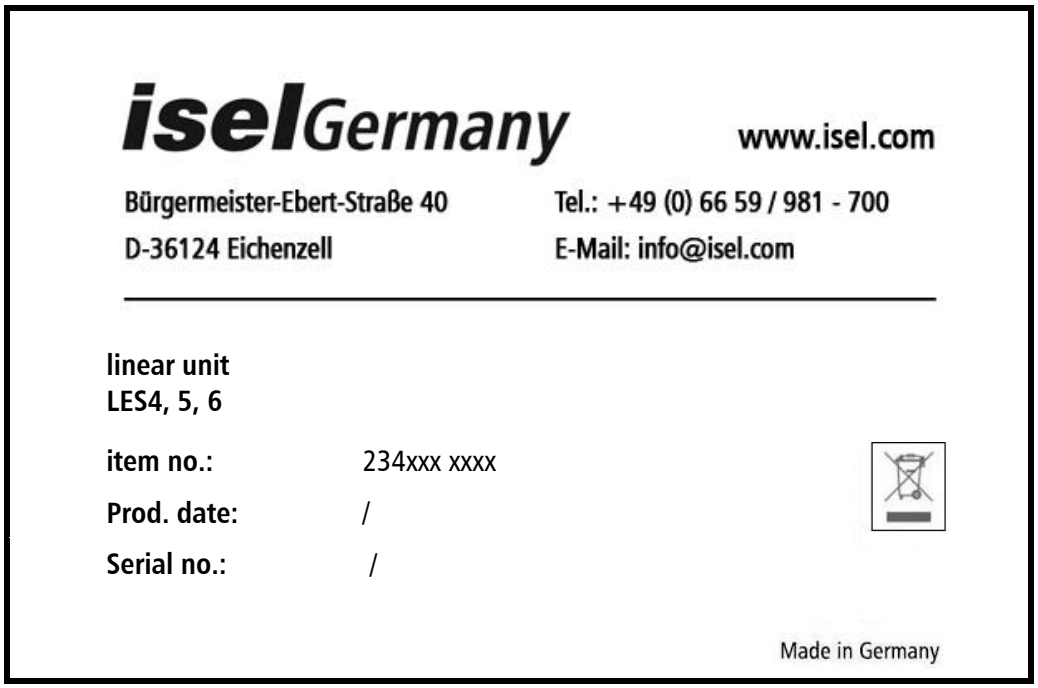


Fig. 14 - Type plate

3 Safety

This chapter informs you about possible dangers and about your protection options against these dangers when handling the machine.

You will receive information on personal and accident protection and on safety-related behaviour when working with this machine. The basic prerequisite for the safe handling and trouble-free operation of this machine is the knowledge of the safety instructions, the safety regulations and the safety equipment of the machine as well as their function. This information, in particular the safety instructions, must be observed by all persons working on the machine.

In addition, the generally applicable rules and regulations for accident prevention must be observed.

⚠ DANGER!

Failure to observe the safety instructions in the operating instructions

Failure to observe the safety instructions will result in serious injury or death!

> Carefully read this section of the operating instructions before connecting and commissioning the machine!

> As with all technical systems, perfect functioning and operational safety are only guaranteed with this machine if the usual safety precautions as well as the special safety instructions are observed during operation.

> Store the operating instructions near the machine

3.1 Operator's liability

Instruction duty

The safety in the plant can only be implemented in operational practice if all necessary measures have been taken. It is the operator's duty of care to plan these measures and to monitor the execution of the same.

- The operator must instruct the employees before the initial start-up of the potential risks, remaining risk and measures during the use of this machine so that they can use it. This instruction must be given to every employee operating the system or being in the immediate danger zone. The operating personnel must have understood the instruction and it must be ensured that it is complied with.
- The knowledge of the operation and maintenance according to the following maintenance, repair and cleaning regulations of the machine is a prerequisite for the perfect machine operation. The machine operator must have an appropriate qualification for such tasks (to be able to carry out the corresponding work according to the state of the art). This qualification includes the ability to assess the remaining risks.
- The plant may only be used under a technically perfect condition as well as according to its intended purpose and with regard to safety and dangers by taking into consideration these operating instructions! Especially, malfunctions which could impair safety must be remedied immediately!
- The machine operator is responsible for ensuring that these operating instructions are supplemented and followed by in-house instructions concerning work instructions, supervision and reporting duty, organization of work, personnel qualifications, etc. The individual competencies related to the different tasks on and with the machine and in the immediate vicinity of the same must be clearly defined, identified and observed by the operator. In this context, potential hazards and risks must be taken into account.
- The applicable work safety regulations as well as any other applicable rules and regulations concerning work safety and health protection must be observed.

- The competences for the various activities in the context of the operation, maintenance and repair of the plant must be clearly defined and complied with. This is the only way to avoid wrongdoing - especially in dangerous situations.
- The operator must oblige the operating personnel to wear personal protective equipment if this is provided by the local regulations. If necessary or required by the regulations, an additional personal protective equipment must be used.
- If safety-relevant changes to the operating behaviour or malfunctions occur on the plant, the latter must be immediately shut down and the process must be reported to the responsible body/person in charge!

Determination of technological parameters

- The machine operator is responsible for the selection and processing of the materials. In addition, a risk assessment of the workplace according to the paragraphs 5 and 6 of the Work Protection Law ArbSchG must be carried out.

3.2 Intended use

Die Lineareinheiten werden für die lineare Bewegung von Lasten, die fest auf dem Führungsschlitten / der Schlittenplatte oder dem Trägerprofil montiert sind, in einer nicht explosionsgefährdeten Umgebung unter den für dieses Produkt definierten Betriebs- und Umgebungsbedingungen eingesetzt. Die Einbaulage kann beliebig sein (horizontal, vertikal oder geneigt).

The linear units are an incomplete machine (see article 2g of Machinery directive 2006/42/EC. An incomplete machine is defined there as follows (quote)

"A partly completed machinery" means an assembly which is almost a machine, but which cannot fulfil a specific function by itself. A drive system constitutes a partly completed machinery. A partly completed machinery is only intended to be incorporated into or assembled with other machinery or with other partly completed machinery or equipment in order to constitute machinery within the meaning of this Directive."

The product Linear unit linear unitLES 4, 5, 6 is intended to be incorporated into a machine or other partly completed machinery.

The intended use includes

- the observance of Assembly instruction, the safety instructions and accident prevention regulations.
- the operation and maintenance of the linear unit exclusively by instructed technical personnel
- the use of the linear unit exclusively in technically correct condition.
- the compliance with the intervals specified in the maintenance plan.
- to use only materials and accessories, approved by isel Germany GmbH as well as the spare parts listed in the Assembly instruction
- the use of the linear unit in dry rooms (workshops, laboratories or similar rooms) and industrial plants (maximum ambient temperature: 40°C)

The product must not be used:

- in the open air
- for the transport of persons
- in the food sector
- in the clean room

Any other use than that described above, is not intended and may result in personal injury or damage to property.

3.2.1 Reasonably foreseeable misuse

Reasonably foreseeable misuse includes

- any use beyond the intended use.
- the processing/use of non-approved components.
- operation outside the specified performance data.
- disregarding the documentation
- unauthorized additions and modifications that impair safety
- if faults are not rectified immediately, that affect safety

3.3 Safety instructions

⚠ WARNING!

Non-compliance with the safety instructions in the operating manual

Non-observance of the safety instructions may cause slight to severe injuries and damage to the machine!

> Read this section of the operating manual carefully before connecting and commissioning the machine!

> As with all technical systems, perfect functioning and operational safety of this machine can only be guaranteed if both the generally applicable safety measures and the special safety instructions are observed during operation.

> Keep the operating instruction near the machine

3.3.1 General safety instructions

Safety instructions

The following safety and hazard warnings are for your protection, the protection of third parties and the protection of the product. You should therefore observe them without fail.

- Observe all instructions attached to the product.
- The safety rules and regulations of the country in which the product is used/applied must be observed.
- The valid regulations for accident prevention and environmental protection must be observed.
- Persons who assemble, operate, disassemble or maintain this product must not be under the influence of alcohol, other drugs or medicines that influence the ability to react.
- Check the product for obvious damage and only use it in a technically perfect condition.
- The product must not come into direct contact with moisture or water. The system (the machine/plant in which the product is installed) is only suitable for dry indoor areas. When changing from cold to warm environments, allow the product to warm up for a few hours before use, otherwise damages from condensated water may occur.
- Do not install the product near equipment that generates strong electromagnetic fields. This could interfere with the function. Avoid environments with direct sunlight, intense heat, cold, humidity or wetness.
- Only accessories and spare parts approved by isel Germany GmbH may be used in order to avoid personal hazards due to unsuitable spare parts.
- Observe the technical data and ambient conditions specified in the product and accessory documentation.
- Do not put the product into operation until it has been determined that the end product (for example, a machine or system) in which the product is installed complies with the country-specific regulations, safety regulations and standards of the application.
- Ensure that the product is not modified or converted unless permitted in the product documentation.

- Never disassemble the product.
- Parts of the product can become very hot during the operation. Allow these parts to cool before touching.
- Do not place any loose objects on the product.

3.3.2 Special safety instructions

You have to work on and with the machine exclusively with authorised, trained and instructed personnel. These personnel must have received special instruction about potential dangers (especially about remaining risk).

product-specific safety instructions

NOTE!

Service life / wear

Non-observance of the safety instructions may result in damage to property!

> The linear unit is not designed for continuous operation and must be serviced at regular intervals. In order to be able to detect possible failures due to wear or material fatigue at an early stage, regular visual and functional checks must be carried out.

> Unauthorised conversion and/or modification of the linear unit is not permitted.

> Do not subject the linear unit to any impermissible mechanical load under any circumstances. Please observe the technical data in this Assembly instruction.

> During operation, the linear unit must not be covered by supply lines, objects or tarpaulins, packaging material or fabrics, etc., as this may cause mechanical damage or heat accumulation and possibly lead to fire.

NOTE!

Falling / sagging during vertical mounting

Non-observance of the safety instructions may result in damage to property!

> The ball screws in the linear units are generally not self-locking. For vertical installation, the motor of the linear unit should therefore be equipped with a holding brake (in this case, the spindle pitch of the ball screw and the weight of the loaded carriage plate must be calculated), which secures the movable guide carriage of the linear axis against falling down when the power is switched off.

> If no holding brake (e.g. magnetic brake) is mounted on the motor, another (electro-)mechanical brake must be used, e.g. on the counter bearing of the ball screw. Further information on this can be found in the specialist journal "Gravity loaded axes" published by the DGUV Wood and Metal Division.

NOTE!

electrical drives

Non-observance of the safety instructions may result in damage to property and/or personal injury!

> Before handling the product, read and observe the safety instructions in the manuals regarding the motor, controller and control system.

NOTE!

Transport

Non-observance of the safety instructions may result in damage to property and/or personal injury!

> Please observe the transport instructions.
> During transport, support the product only in the designated places.
> Observe the weight and use suitable and tested load carrying equipment for lifting and transport.

NOTE!

Commissioning / Operation

Non-observance of the safety instructions may result in damage to property and/or personal injury!

> Only operate a fully installed and secured product.
> Do not touch into moving parts (e.g. slides).
> In case of excessive noise, wear suitable hearing protection.
> Ensure that only persons authorised by the operator operate adjustment devices on components and parts within the scope of the intended use of the linear unit adjustment devices and have access to the working area of the linear unit.
> Sicherstellen, dass nur vom Betreiber autorisierte Personen Zutritt zum unmittelbare
> In case of emergency, fault or other irregularities, shut down the product and secure it against restarting.
> Observe safety functions and equipment and do not put them out of operation.

3.3.3 Fire protection

ATTENTION!

Risk of fire if machine parts overheat due to overload, dust formation and irregular cleaning / maintenance of motors and storage of drives!

Non-observance of the safety instructions may result in damage to the linear unit and the environment!

> Regular instruction of the operating personnel.
> Pollutions on the components must be removed immediately.
> Regularly check the tool for wear.
> Do not operate components such as motors and gears above the specified nominal values.
> Maximum feed speed (with optional drive motor mounted) must not be exceeded.

3.4 Personal Protective Equipment

In the following chapters, the operating instructions explicitly describe the use of the personal protective equipment.

⚠ WARNING!	
	**Do not wear personal protective equipment!** If you do not wear the specified personal protective equipment or you use faulty personal protective equipment, you may be involved in an occupational accident. > Always wear the instructed personal protective equipment. > Immediately exchange damages personal protective equipment.

4 Transport

Below you will find information on how to transport the machine correctly, without damaging it and without endangering persons.

NOTE!	
	**Improper lifting of the linear unit** If you do not lift the linear unit correctly, damage may occur due to deflection! If you do not lift the linear unit correctly, injuries to the musculoskeletal system may occur due to incorrect lifting! > Find out about the weight of the unit. > Please observe the DGUV and BG instructions for the correct carrying and lifting of loads. > Avoid long transport distances after lifting. If necessary, use a transport table or place the unit on a pallet to transport it further with a suitable industrial truck.

The following specifications should be observed:

- Lifting by one person:
  - max. ≤ 20 kg and/or max. ≤ 1000mm length.
  - Encompassing the unit with two hands, with maximum distance between the right and left hand.
- Lifting by two persons:
  - max. ≤ 40 kg and/or max. ≤ 2000mm length.
  - Encompassing the unit with two hands, with maximum distance between the right and left hand.
  - Encompassing the unit at the beginning and end of the last third to prevent the unit from bending in the middle.
- Lifting by several persons:
  - max. ≤ 60 kg und/oder max. ≤ 3000mm Länge.
  - Encompassing the unit with two hands, with maximum distance between the right and left hand.
  - Encompassing the unit at the beginning or end of the last third and in the middle to prevent the unit from bending in the middle.

5 Assembly and commissioning

5.1 Assembly

Mounting on the guide profile

Free positioning

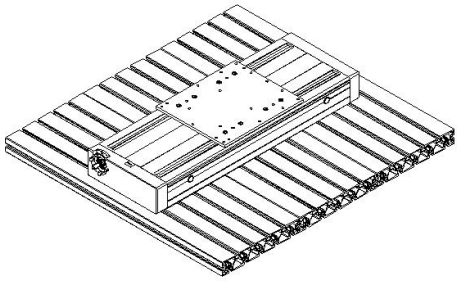


Fig. 15 - linear unit LES 4, 5, 6 for installation as free standing

	You can place the linear unit on a frame, a work table or any other suitable stable base. Select the installation location so that the product cannot fall down by itself or by an impact or pulling on the cable.

Rack mounting (recommended)

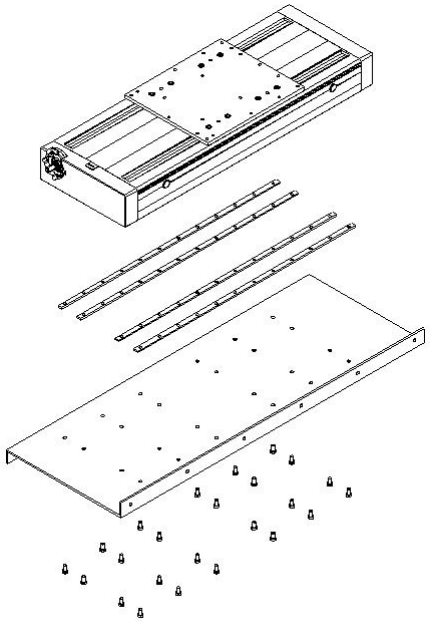


Fig. 16 - linear unit LES 4, 5, 6 for rack mounting

The shaft mounting profiles have several T-slots on the underside to mount thelinear unit to your frame. These are used to accommodate threaded rails or sliding nuts (accessories). Use fastening screws - M6 to mount the linear unit from below on your frame.

Ensure that the mounting surfaces are sufficiently clean.

The used aluminium profiles are extruded profiles which, due to the manufacturing process, showed deviations in terms of straightness and torsion. The tolerance of this deviation is defined in DIN EN 12020-2. linear unit are face milled and therefore these deviations are usually undercut. In order to achieve the desired guiding accuracy and running behaviour, however, it is necessary to clamp the axis system on a correspondingly precise bearing surface or to align it using levelling plates. This allows tolerances of a minimum of 0.1mm / 1000mm to be achieved.

Foot mounting

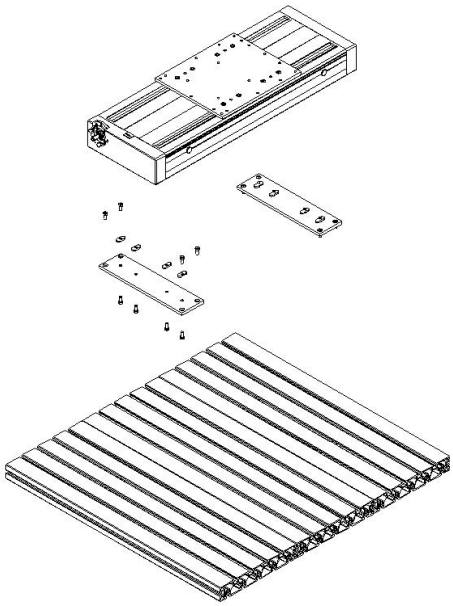


Fig. 17 - linear unit LES 4, 5, 6 for foot mounting

If mounting the linear unit from below is not possible or too complex, it is also possible to mount the linear unit from above using special mounting strips or appropriate adapter plates. For this purpose, the respective adapters must be fastened to the linear guide rail again using sliding nuts or threaded rails and the unit must then be mounted completely from above.

Ensure that the mounting surfaces are sufficiently clean and level.

Mounting on the guide carriages

Carriage mounting

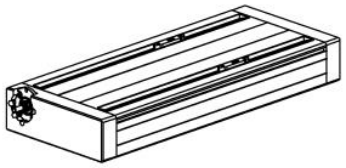


Fig. 18 - linear unit LES 4, 5, 6 for mounting the carriage

The guide carriages have tapped holes - M6 - for fastening transport loads to the guide carriages. Fitting holes 6h7 enable precise positioning and reproducibility of the mounting position. The clamping surface of the guide carriages is face milled.

	Ensure that the mounting surfaces are sufficiently clean and level. Clamping of the guide carriages leads to reduced performance, unclean running, increased running noise and premature wear.

Slide plate mounting

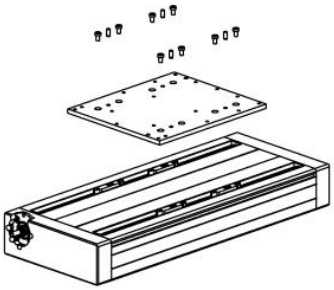


Fig. 19 - linear unit LES 4, 5, 6 for slide plate mounting

Carriage plates (accessories) offers another possibility for fastening transport loads. These are made of steel, grounded and have an M6 fastening thread. The carriage plates are mounted to the guide carriages with M6 fixing screws and positioned using pins. The flatness of the plane-parallel plates is less than 0.2mm. Slide plates also allow the combination of different linear unit to cross tables.

Slide plate mounting

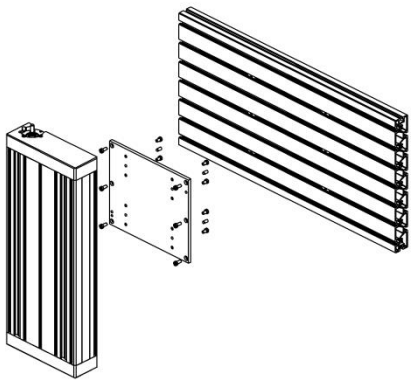


Fig. 20 - linear unit LES 4, 5, 6 for slide plate mounting - frame

Laterally protruding carriage plates enable the guide carriages to be fixed to the frame and thus enable linear movement of the linear guide rail relative to the frame. The fixing and positioning of these ground steel plates on the carriages is again carried out with socket head screws - M6 and pins. End countersinks for socket head screws - M6 enable the adaptation of the linear unit on the frame.

Mounting of optional motor modules

Direct drive modules

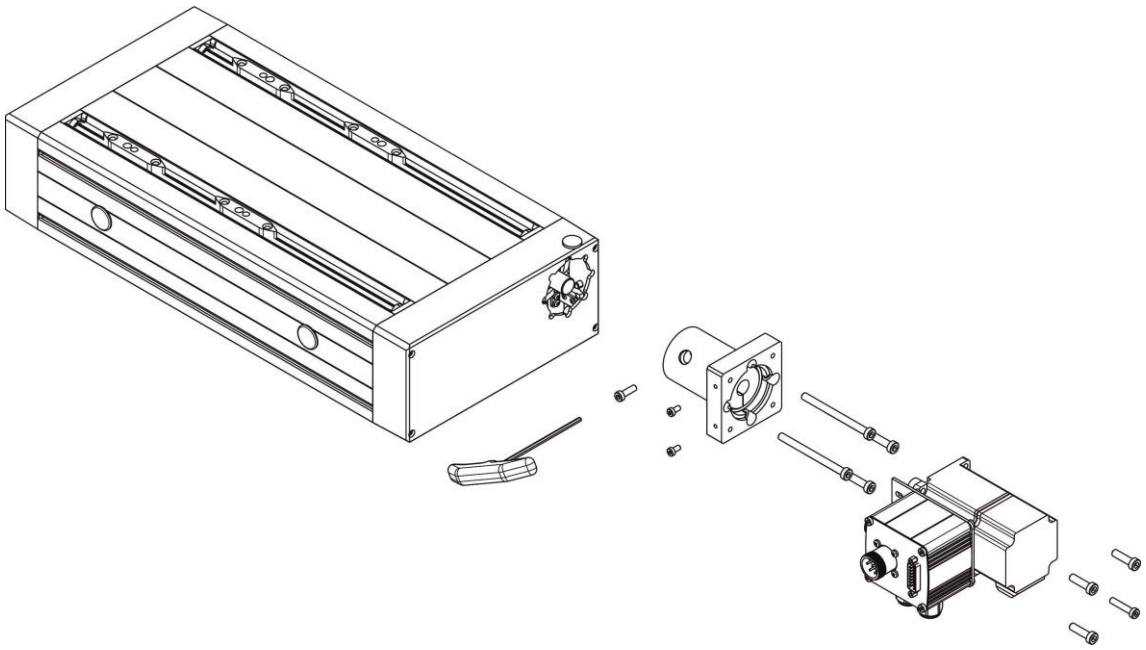


Fig. 21 - Mounting direct drive module

The mounting of the direct drive module to the linear units is shown in the above figure. It must be ensured that the parts to be connected are free of burrs, rust and dirt.

Before tightening the coupling halves, make sure that the spindle and motor axis are well aligned.

The tightening torque of the clutch clamping screws is 3 Nm.

Belt drive modules

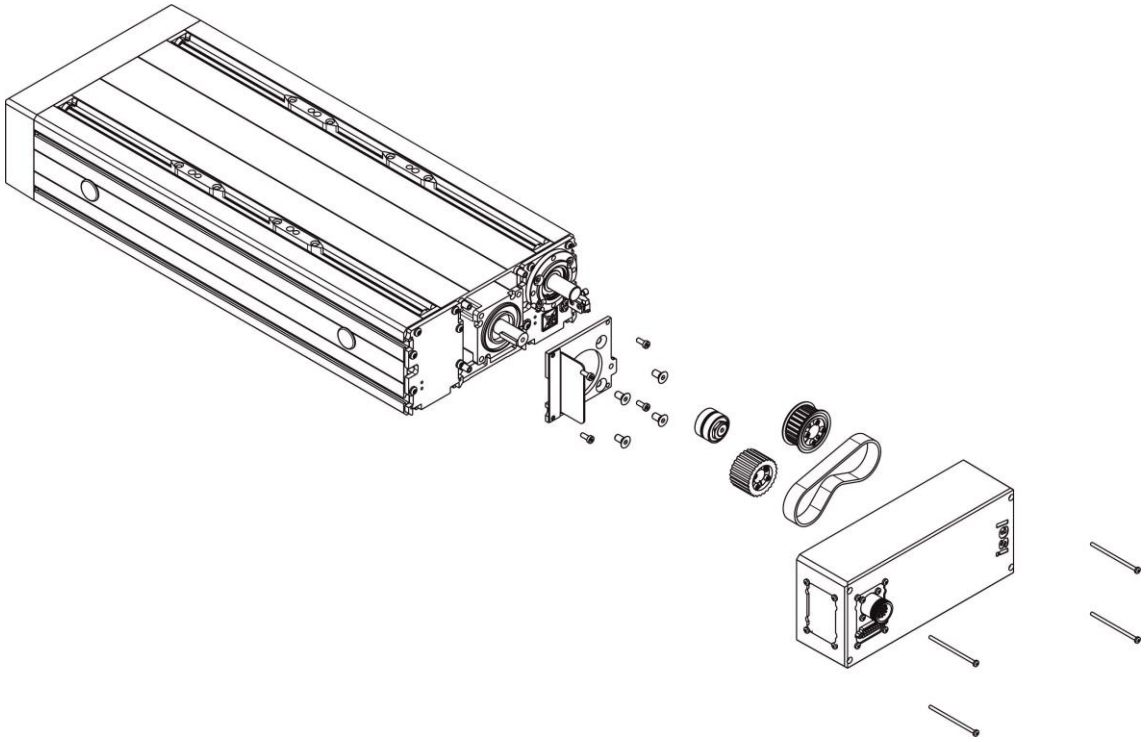


Fig. 22 - Mounting belt drive module

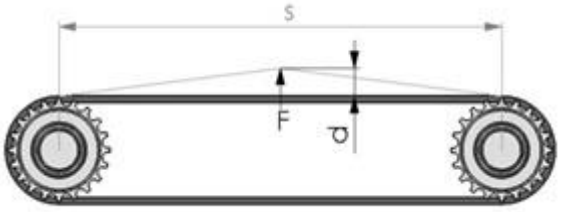
The picture above shows the assembly of a belt drive module. The pulleys must have the same pitch as the toothed belt. Both shaft ends and the pulleys should be free of burrs, rust and dirt. As shaft-hub connection, we recommend forceful connections using clamping bushes.

Before mounting the toothed belt and the belt pulleys, the shaft ends must be aligned. The installation of the toothed belt must be carried out easily by hand. For this purpose, the centre distance must be reduced when using on-board pulleys or both belt pulleys must be fitted together. Under no circumstances should the toothed belt be forced onto the pulleys with force or mounting levers, as the belt can be damaged - often invisibly.

The pretension of the belt depends on the power to be transmitted and the drive characteristics. However, due to the positive power transmission of the timing belt, only a low pretension is required. We recommend the use of eccentric tension rollers to set the pretension or to correct tolerances.

Information

Too much pre-tension causes higher running noise, premature belt wear and can even lead to the shaft ends tearing off. Too little pretension leads to synchronisation fluctuations and promotes skipping of the belt teeth.



We give the following recommendation for adjusting the preload:

- Test force: F= 16,5N
- Belt deflection: d=3,5mm

5.2 Commissioning

The linear unit LES is commissioned after the respective drive modules have been mounted and the necessary cabling has been installed. To do this, follow the relevant instructions in the documentation of the motor modules, power amplifiers or entire control system used.

	Incorrect installation (including loading of the axis system), cabling or commissioning increases the risk.

6 Mounting parts

In this chapter you will find information about the components that are mounted when your axis is delivered.

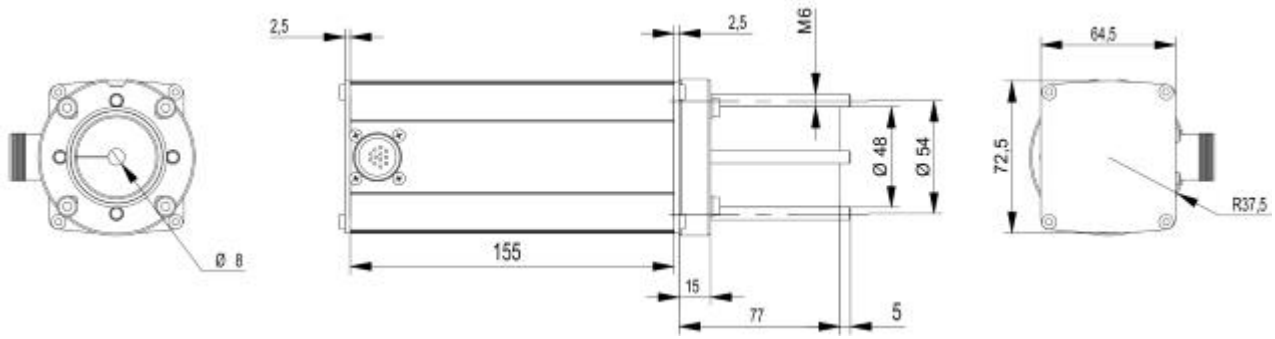
6.1 Motor modules

Various drive modules with stepper motors and servo motors are offered as standard for the LESlinear unit. These can be mounted either directly via a coupling, spacer and adapter flange in extension of the ball screw spindle or laterally or integrated by means of a toothed belt step.

- Version **Direct drive** possible for:
  - LES 4
  - LES 5
  - LES 6
- Version **Belt drive lateral (right)** possible for:
  - LES 4
  - LES 6
- Version **Belt drive integrated** possible for:
  - LES 5

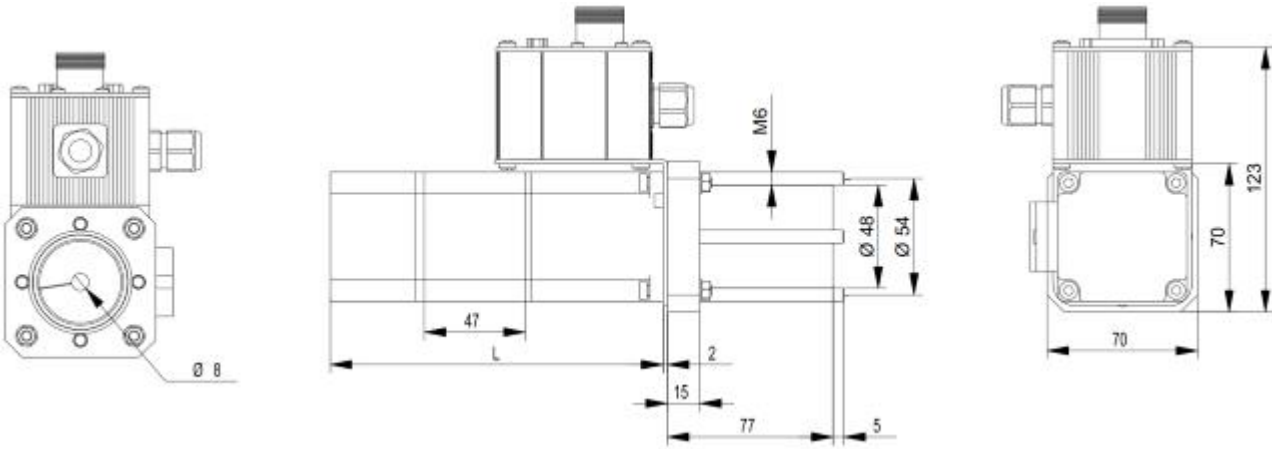
Direct drive modules

Motor module 1



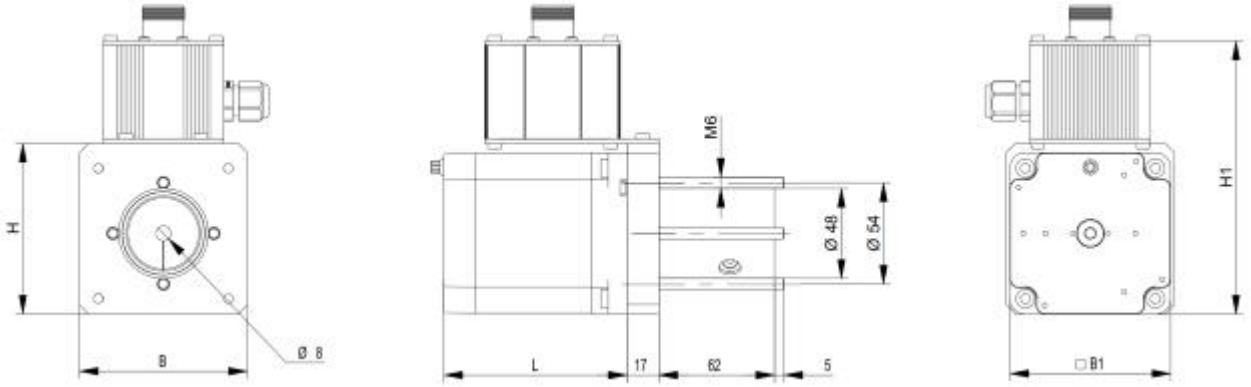
Direct drive LES 4 / 5 / 6	Item-No.
Stepper motor MS 200 HT-2	396058 0060
Stepper motor MS 200 HT-2 with brake	396058 0260

Motor module EC 60



Direct drive LES 4 / 5 / 6	Item-No.	L
EC servo motor EC 60 TM 200W 48V	396421 0060	103.5
EC servo motor EC 60 TM 200W 48V with brake	396421 0260	150.5
EC servo motor EC 60 TM 200W 310V	396421 0070	107.7
EC servo motor EC 60 TM 200W 310V with brake	396421 0270	154.7
EC servo motor EC 60 TM 400W 48V	396440 0080	131.5
EC servo motor EC 60 TM 400W 48V with brake	396440 0280	178.5
EC servo motor EC 60 TM 400W 310V	396440 0070	135.7
EC servo motor EC 60 TM 400W 310V with brake	396440 0270	178.5

Motor module 2



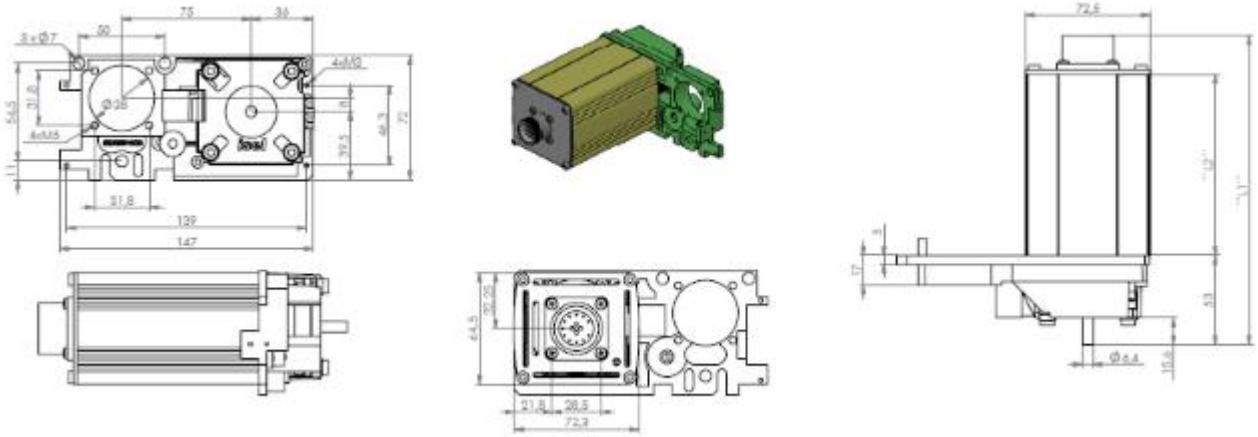
Direct drive LES 4 / 5 / 6	Item-No.	L	H	H1	B	B1
EC servo motor EC 80 TM 750W 310V	396421 0060	143	85	139.5	80	80
EC servo motor EC 80 TM 750W 310V with brake	396421 0260	191	85	139.5	80	80
Stepper motor MS 300 HT	396082 0060	63	91	145.5	90	86
Stepper motor MS 300 HT with brake	396082 0260	101	91	145.5	90	86
Stepper motor MS 600 HT	396085 0060	96	91	145.5	90	86
Stepper motor MS 900 HT	396088 0060	126	91	145.5	90	86

Belt drive modules (integrated)

LES 5 integriert	Item-No.
Stepper motor MS 200 HT-2	396058 1060
Stepper motor MS 200 HT-2 with brake	396058 1260
EC servo motor EC 60 TM 200W 48V	396421 1060
EC servo motor EC 60 TM 200W 48V with brake	396421 1260
EC servo motor EC 60 TM 200W 310V	396421 1070
EC servo motor EC 60 TM 200W 310V with brake	396421 1270
EC servo motor EC 60 TM 400W 48V	396440 1080
EC servo motor EC 60 TM 400W 48V with brake	396440 1280
EC servo motor EC 60 TM 400W 310V	396440 1070
EC servo motor EC 60 TM 400W 310V with brake	396440 1270

Belt drive modules (lateral right)

LES 4 / 6 lateral mounting



LES 4 / 6 lateral mounting (right)	Item-No.	L1 in mm	L2 in mm
Stepper motor MS 200 HT-2	396058 0060	177	105
Stepper motor MS 200 HT-2 wiith brake	396058 0260	227	155
EC servo motor EC 60 TM 200W 48V	396421 2060	200	217
EC servo motor EC 60 TM 200W 48V with brake	396421 2260	200	217
EC servo motor EC 60 TM 200W 310V	396421 2070	200	217
EC servo motor EC 60 TM 200W 310V with brake	396421 2270	200	217
EC servo motor EC 60 TM 400W 48V	396440 2080	200	217
EC servo motor EC 60 TM 400W 48V with brake	396440 2280	200	217
EC servo motor EC 60 TM 400W 310V	396440 2070	200	217
EC servo motor EC 60 TM 400W 310V with brake	396440 2270	200	217

6.2 Sliding plates

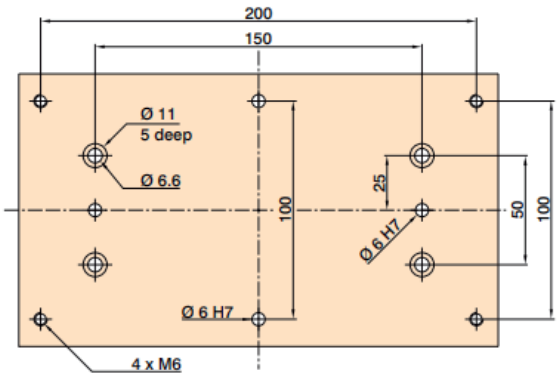
An overview of all our slide/cross table tops with their dimensions, hole patterns and mounting options can be found here

Dimensioned drawing Slide plates for LES 4, 5, 6

Hole diagram, slide plate PS 3

L 220 x W 125 x H 7.5 mm

Mounting on:
LES 5 with 2 x WS 5/70 Part no.: **277003**

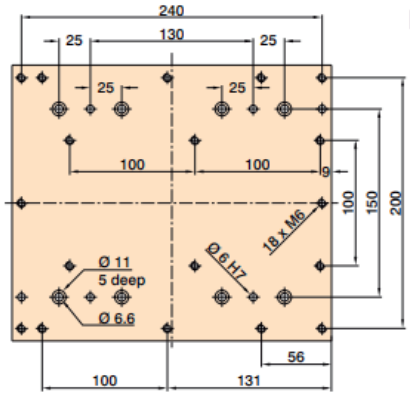


Hole diagram, slide plate PS 4

L 225 x W 220 x H 7.5 mm

Mounting on: LES 5 with 4 x WS 5/70
Mounting on crossbench: LES 5 with LES 5 (in conjunction with VP 2) Fixing option for: Angle bracket WV 3 / WV 6

Part no.: **277004**

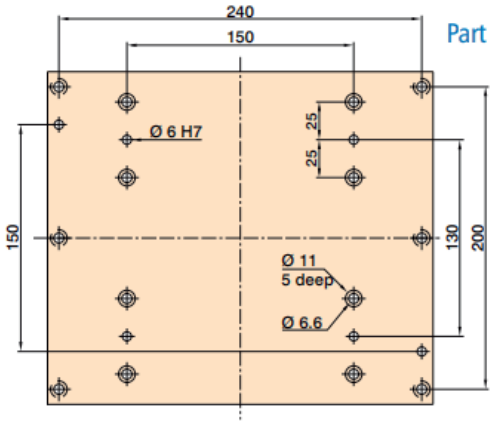


Hole diagram, connection plate VP 2

L 255 × W 220 × H 7.5 mm

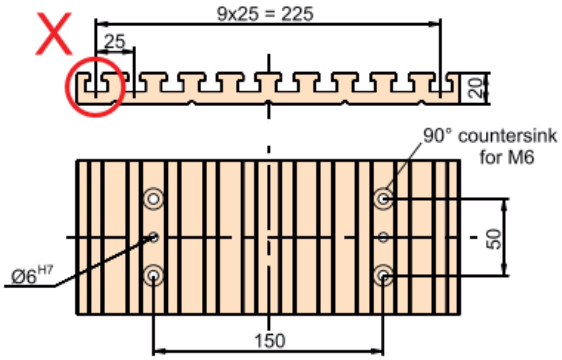
Mounting on: LES 5 with 4 × WS 5/70
Fixing option for: LES 5

Part no.: **277006**

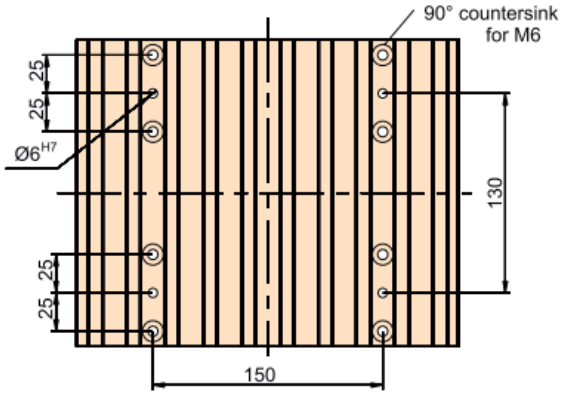


Hole pattern T-slot plate PT 25 × 250 for LES 5

L 100 x W 250 x H 20 mm
Mounting on: LES 5 with 2 x WS 5/70
Part no.: **277030 0005**



L 200 x W 250 x H 20 mm
Mounting on: LES 5 with 4 x WS 5/70
Part no.: **277030 0006**



6.3 Other options

6.3.1 External limit switches

Fig. 23 - external limit switches LES

	Limit switch mounting kit for LES 4	Limit switch mounting kit for LES 5	Limit switch mounting kit for LES 6
Item number	216460 0001	216460 0002	216460 0006

6.3.2 Gas pressure spring

The gas pressure spring is used to balance the weight of vertical linear units. The gas pressure spring mounting kit can be retrofitted as an accessory. The force of the gas spring is constant over its entire stroke. Two sizes with different stroke and spring force are available.

Fig. 24 - LES with gas pressure spring

Information

Observe the maximum permissible speed of the gas spring, as safe guidance cannot be guaranteed if this is exceeded.

Item No.	Length linear unit [mm]	Spring force [N]	Stroke [mm]	v max. [mm/s]
216450 0001	490	170	200	150
216451 0001	690	250	300	150

Mounting a gas spring attachment kit on a LES 5

The following exploded drawing shows the assembly of the gas spring attachment kit to thelinear unitLES 5. Please note that the connecting plate VP2 (4) is already mounted or must be mounted on the guide carriages (accessories - carriage plates).

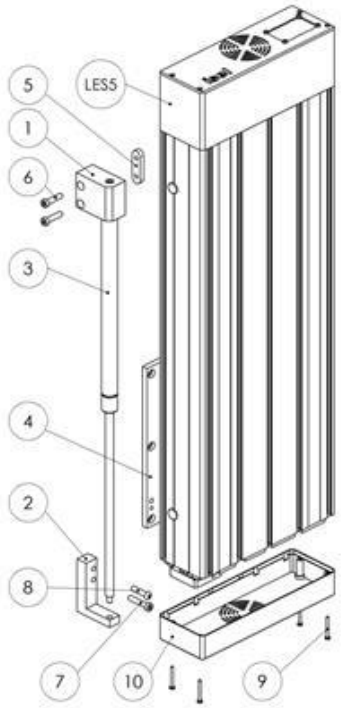


Fig. 25 - Exploded drawing Assembly of the gas spring mounting kit to a LES 5

To mount the gas spring mounting kit on a LES 5

1. Use the pan-head screws (9) to remove the lower cover (10) of the linear unit.
2. Push the mounting block (1) with double slide nut (5) and cap screws M6x25 (6) from below into the lateral groove and fix it only slightly.
3. Move the connecting plate (4) all the way down and fasten the mounting block (2) to it with the M6x22 pan-head screw (8).
   - ➢ The cap screw M6x30 (7) goes through the connection plate (4) and thus allows the entire linear unit to be disassembled without removing the gas spring mounting kit.
4. Insert the gas spring (3) loosely into the upper mounting block (1) and fix the piston rod with the thread on the lower mounting block (2). Please note that the piston rod is only screwed in approx. ½ turn before the fixed stop to avoid tilting.
5. Now lower the upper mounting block (1) onto the gas pressure spring (3) and fasten it with the cylinder screws M6x25 (6).
   - ✓ The gas spring attachment kit is mounted on the LES 5.

6.3.3 Angular transmission

The angular transmission is available in two installation variants for LES4, 5, 6 with direct drive.

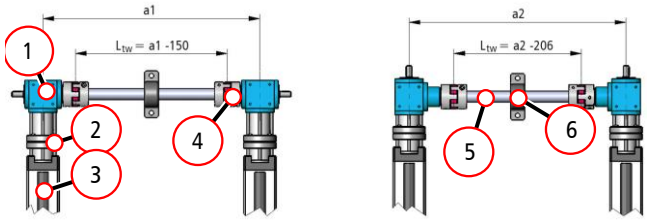


Fig. 26 - Coupling housing set 90° and 0

1 - angular transmission

2 - split coupling housing with shaft coupling WK 40/60

3 - LES4, 5, 6

4 - Coupling for transmission shaft Ø 25 mm

5 - Transmission shaft Ø 25 mm

6 - Pedestal bearing (recommended from a transmission shaft of 1500 mm)

Item No.			Lieferumfang
216150 0001	with H-construction on LES4, 5, 6	Mounting 0°	2x angular transmission, 2x split coupling housing with WK 40/60, 2x coupling for transmission shaft
216451 0001	with H-construction on LES4, 5, 6	Mounting 90°	2x angular transmission, 2x split coupling housing with WK 40/60, 2x coupling for transmission shaft

7 Maintenance, service and cleaning

Regular maintenance and preventive maintenance are prerequisites for the safety of the personnel who are in the machine area. In addition, maintenance contributes to maintaining the value and functionality of the machine.

Carry out the work listed in the maintenance schedule within the specified intervals. Should it become apparent during machine operation that the intervals mentioned are too long or too short, adjust the intervals accordingly.

Information

In the following cases, any claim under guarantee or warranty automatically expires:

- improper maintenance by the operator or third parties,
- Installation of production parts that are not manufactured by isel Germany GmbH

isel Germany GmbH shall not be liable for any personal injury or property damage in this case.

Ensure that safety equipment is regularly maintained and checked for proper functioning.

The linear units work with high precision and reliability. Therefore the maintenance effort is comparatively low. Maintenance of the linear units is limited to their regular cleaning from coarse dirt and impurities as well as regular lubrication.

The ball screws, the ball screw nuts, the guide carriages and the steel shafts of the guide rails must be lubricated.

⚠ NOTE!

Please observe the following instructions before starting any maintenance work.

Non-observance of the safety instructions will result in serious injury or death!

> Only carry out maintenance work when the machine is at a standstill.

> Let heated areas cool down first.

> During repair and maintenance work on the electrical installation, disconnect the power supply (e.g. controller, regulator) from the mains and remove all connecting cables (e.g. motor cables, encoder cables).

> Observe the safety instructions and safety data sheets of the corresponding manufacturer when using oil/lubricants, cleaning agents and spare parts.

7.1 Cleaning

- Clean the surface of the aluminium shaft mounting profile, (flange-mounted) motor modules, sealing lips for profile sealing or guide carriage of the linear unit with a lint-free, dry / slightly damp cloth.
- Do not use harsh cleaning agents or abrasive cleaners.

7.2 Lubrication

General information

- The guide rails and drive shafts are provided with long-term central lubrication ex works. Depending on the load, you should relubricate the guides and drive shafts, but at the latest after the specified maintenance interval of 300 - 700 operating hours. To do this, use the grease gun for central lubrication available as an accessory and the corresponding special grease.
- Do not lubricate too much at once, the shafts and steel rails do not have to float in grease.
- Follow the lubrication instructions for the mechanical components.

⚠ CAREFUL!	
	**Maintenance work** Non-observance can lead to slight to severe injuries. > Maintenance work may only be carried out by authorised and trained specialist personnel (mechanical maintainer).

Basic lubrication

The drive components are lubricated with a special grease ex works. They can be started up immediately. The EC safety data sheet according to Directive 93/112/EEC and ISO 11014-1 can be requested from the manufacturer.

Relubrication

For relubrication of linear bearings with shafts, only the special grease of isel Germany GmbH should be used.

Oil lubrication is possible and reduces heating at higher spindle speeds, but the mounting position must be observed and the lubrication intervals are shortened every 40 to 60 operating hours.

The required grease can be ordered under the following part numbers:

- Item no. 299031 Universal grease
- Part No. 931170 Grease gun

Grease characteristics

- enormous reduction in wear
- significantly less consumption
- miscible with lithium and calcium fats
- water-repellent
- highly resistant to cold, hot and salt water and solvents
- Temperature range: -25°C to 200°C, emergency operation >300°C
- up to 6 times longer service life
- extremely good adhesion to metal surfaces

Classification and labelling according to EU Directives 67/548/EEC and 88/379/EEC - Water hazard class 1.

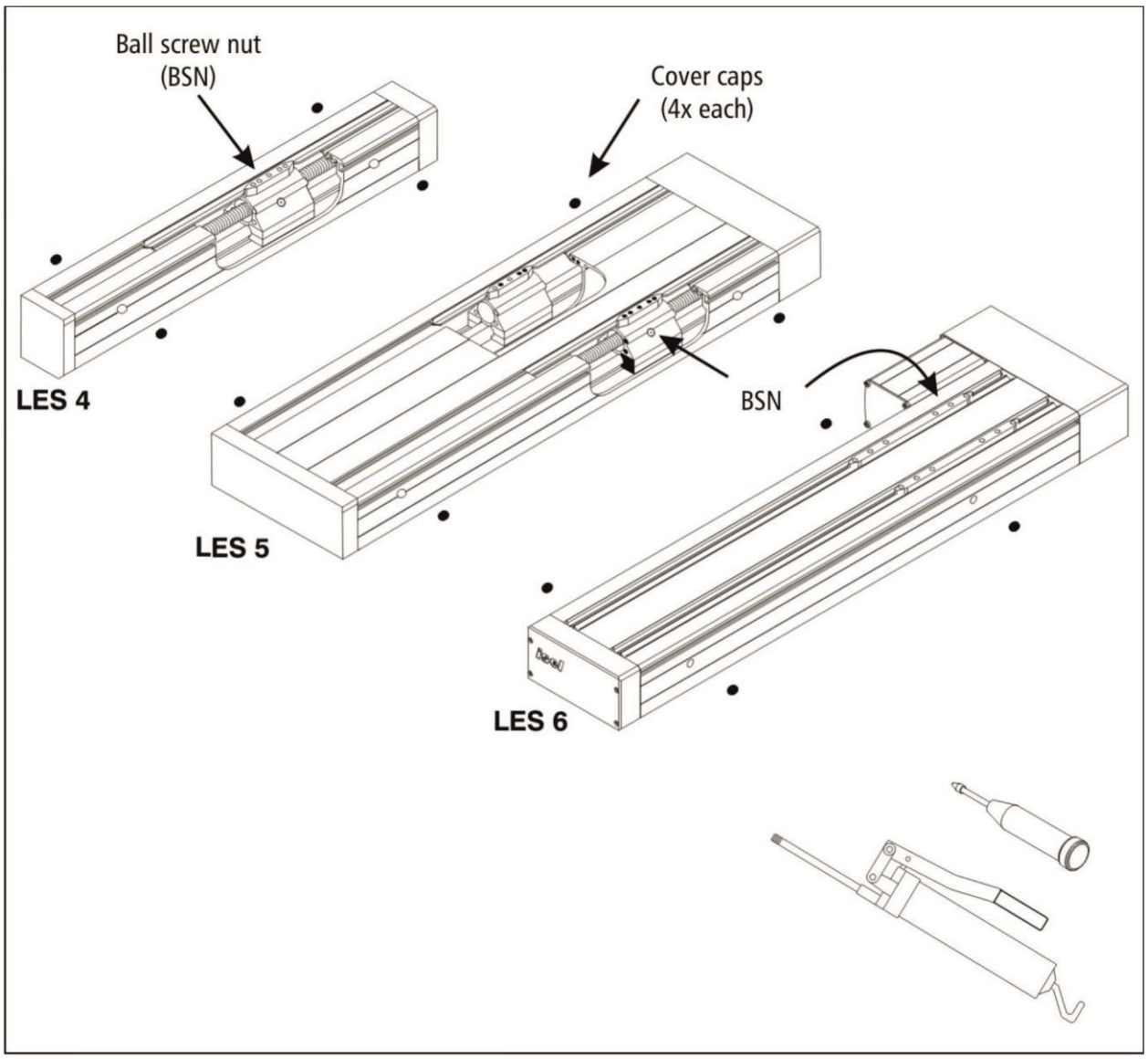


Fig. 27 - Lubrication points of the linear unit LES

Proceed as follows to lubricate the linear unit LES.

1. Remove the cover caps.
2. Position the guide carriage behind a lubrication hole. (see points)
3. Place the grease gun on all accessible grease nipples and lubricate the shaft slides, guide, ball screw nut and ball screw. 2 - 3 strokes are sufficient.
4. Push the cover caps back in.
   ✓ The ball screw nuts of the linear unit are lubricated.

7.3 Maintenance plan

Maintenance interval	Activity to be performed
on request	Cleaning the linear unit
300 - 700 Operating hours	Relubrication guide carriage and ball screw nut with special grease from isel Germany GmbH
monthly	-Visual inspection of linear guide rail - wear -Visual inspection of the toothed belt (tension, abrasion...) -Acoustic check for unusual noise
every two years	-Replacement timing belt -Check backlash-free guide carriage and ball screw

7.4 Troubleshooting

The table below includes some general solutions to potential problems occurring when using the machine; they can be rectified independently by the operator if necessary.

Information

If the problem can not be solved, please get in touch with the maintenance personnel or contact our service/support department. See chapter _RS.

Fault / Problem / Error	Possible cause	Solution	see also chapter ...
Increased running noises	-Pollution -Missing lubricant film	-Cleaning the linear unit -Reduce relubrication interval	
Sluggishness	-Pollution -Bracing	-Cleaning the linear unit -Ausrichtung, Justage	
Increased wear (abrasion)	-Too high load -Missing lubricant film	-Reduce load -Reduce maintenance interval	
Increased play on guide carriage, spindle drive	-Wear -Too high load -Reduction of the preload	-Reduce load -Reduce maintenance interval -Adjusting the preload	_RSe_3199

Table 1 - General faults on the linear unit

8 Dismantling and disposal

After the machine has reached the end of its service life, it must be dismantled and disposed of in an environmentally friendly manner.

8.1 Safety instructions for dismantling and disposal

Safety instructions for dismantling and disposal

Personnel required:

- Specialist staff
- Maintenance staff
- Manufacturer

Protective equipment:

⚠ DANGER!

In the event of improper dismantling and disposal of the machine

Improper dismantling of the machine can result in serious injuries due to angular components, points, corners, sharp edges, vapours, lubricants, liquids, etc.! Observe the safety regulations, accident prevention regulations and safety data sheets!

> Disassembly may only be carried out by specially trained personnel!
> Work on the electrical system may only be carried out by qualified electricians!
> The corresponding warning notices must be visibly displayed in the areas!

⚠ DANGER!

Danger to life due to electric shock!

Touching live parts or damaging insulation poses a risk to life (danger to life and limb) due to electric shock!

> When carrying out maintenance, servicing and cleaning work, always disconnect the machine from the mains first and wait a few minutes before starting work.
> To avoid electric shock, do not insert any objects into the machine, except for the intended replacement of parts in accordance with these operating instructions.

⚠ CAUTION!

Danger to the environment due to improper disposal!

Improper disposal may pose a hazard to the environment! Disposal of materials may only be carried out by qualified personnel and in accordance with legally applicable regulations. When handling hazardous substances, the respective safety data sheet must be observed and, if necessary, personal protective equipment must be used!

> Disposal must be carried out by qualified personnel and in accordance with legally applicable regulations.
> Suitable personal protective equipment must be used!
> When disposing of the hazardous substances, they must be handled in accordance with the instructions on the relevant safety data sheet!

8.2 Disassembly

Disassembly

Important notes before disassembly:

- Make sure you have enough space before starting work!
- Handle open sharp-edged components with care!
- Pay attention to order and cleanliness in the working area. Loose components and tools lying on top of or around each other are sources of accidents!
- Make sure that the components are dismantled properly!
- Please note that some of the components have a high dead weight. If necessary, use lifting gear!
- Secure components against falling down and toppling over!
- Do not breathe in any vapours or dusts!
- Fire, naked lights and smoking are prohibited in the areas!
- Eating and drinking is prohibited in the areas!
- Consult the manufacturer if anything is unclear!

Decommissioning

Before starting disassembly, be sure to follow these steps

1. Switch off the machine (see chapter _RS).
2. Disconnect the machine from all media (power supply network, compressed air supply, cooling water supply, hydraulic supply, etc.).
3. Physically disconnect the entire power supply from the machine and discharge residual energy.
4. Remove all remaining operating and auxiliary materials as well as all processing materials. Dispose of them in an environmentally friendly way according to your local regulations.
5. Then clean and dismantle the components professionally in compliance with the locally applicable occupational health and safety and environmental protection regulations.

   ✓ Machine decommissioned and prepared for dismantling

Information	
	Dismantling may only be started after all work required for decommissioning has been carried out and after approval by an authorised specialist.

Dismantling is defined as the dismantling of the machine for relocation to another installation site or for scrapping.

The electrical and electronic components belonging to the machine as well as the operating materials contained in the machine to make it ready for operation are to be disposed of exclusively in a professional manner, in accordance with the valid jurisdiction of the country of operation. Disposal via household or general commercial waste is strictly prohibited!

8.3 Disposal

Disposal

If no take-back or disposal agreements have been made, recycle the dismantled components.

- Scrap all metals
- Give all glass and plastic elements for recycling
- Sort the remaining components according to their material composition
- Dispose of hazardous substances such as oils, oil-water mixtures, emulsions, greases, fuels, coolants and lubricants properly!

Electronic components	
	Return and collection systems • Users of electrical and electronic equipment are obliged to collect old equipment separately in accordance with the country-specific regulations. Waste electrical and electronic equipment must not be disposed of together with household waste. Separate collection is a prerequisite for recycling and recovery, which helps to conserve resources in the environment. • Separate collection is a prerequisite for recycling and recovery, which conserves resources in the environment. The local waste management companies have created disposal options for this purpose.

9 Spare parts overview

Spare parts LES 4

Quantity	Item-No.	Designation
1	623065 0001	Locking nut for KG nut Ø 16
1	21113x xxxx	Ball screw spindle Ø 16
1	61310x xxxx	Ball screw nut Ø 28
1	623072 0014	Shaft slide WS 5 for ball screw nut
1	623072 0013	Shaft slide WS 5 without ball screw nut
1	623065 6913	Bearing flange counter bearing side, incl. deep groove ball bearing
1	623065 6916	Flange for direct drive
1	613502	Scraper ball screw nut
2	630900	Sealing lip
1	397030 1012	Limit position switch L=400
1	397014 xxxx	Limit position switch L=xxxx
	611999 2000	Spindle support from L=1490 mm

Table 2 - Spare parts LES 4 - Direct drive

Quantity	Item-No.	Designation
1	623065 0001	Locking nut for ball screw nut Ø 16
1	21113x 5xxx	Ball screw spindle Ø 16
1	6131xx 00xx	Ball screw nut Ø 16
1	623072 0014	Shaft slide WS 5 for ball screw nut
1	623072 0013	Shaft slide WS 5 without ball screw nut
1	623065 6913	Bearing flange counter bearing side, incl. deep groove ball bearing
1	623065 0102	Flange for belt drive
1	613502	Wiper ball screw nut
2	630900	Sealing lip
1	397030 1012	Limit position switch L=400
1	3970xx xxxx	Limit position switch L=xxxx
1	616503 0280	Timing belt 16AT5-280
1	616002	Toothed belt wheel Z25 AT5
1	611999 2000	Spindle support from L=1490mm

Table 3 - Spare parts LES 4 - Belt drive

Spare parts LES 5

Quantity	Item-No.	Designation
1	623065 0001	Locking nut for ball screw nut Ø 16
1	21113x xxxx	Ball screw spindle Ø 16
1	61310x xxxx	Ball screw nut Ø 28
1	623072 0014	Shaft slide WS 5 for ball screw nut
1	623072 0013	Shaft slide WS 5 without ball screw nut
1	623065 6913	Bearing flange counter bearing side, incl. deep groove ball bearing
1	623065 6916	Flange for direct drive
1	613502	Wiper ball screw nut
2	630900	Sealing lip
1	397030 1012	Limit position switch L=400
1	397014 xxxx	Limit position switch L=xxxx
	611999 2000	Spindle support from L=1490 mm

Table 4 - Spare parts LES 5 - Direct drive

Quantity	Item-No.	Designation
1	623065 0001	Locking nut for ball screw nut Ø 16
1	21113x 5xxx	Ball screw spindle Ø 16
1	6131xx 00xx	Ball screw nut Ø 16
1	623072 0014	Shaft slide WS 5 for ball screw nut
1	623072 0013	Shaft slide WS 5 without ball screw nut
1	623065 6913	Bearing flange counter bearing side, incl. deep groove ball bearing
1	623065 0102	Flange for belt drive
1	613502	Wiper ball screw nut
2	630900	Sealing lip
1	397030 1012	Limit position switch L=400
1	3970xx xxxx	Limit position switch L=xxxx
1	616503 0280	Timing belt 16AT5-280
1	616002	Toothed belt wheel Z25 AT5
1	611999 2000	Spindle support from L=1490 mm

Table 5 - Spare parts LES 5 - Belt drive

Spare parts LES 6

Quantity	Item-No.	Designation
1	623065 0001	Locking nut for ball screw nut Ø 16
1	21113x 5xxx	Ball screw spindle Ø 16
1	6131xx 0001	Ball screw nut Ø 16
1	623072 0014	Shaft slide WS 5 for ball screw nut
1	623072 0013	Shaft slide WS 5 without ball screw nut
1	623065 6913	Bearing flange counter bearing side, incl. deep groove ball bearing
1	623065 6916	Flange for direct drive
1	613502	Wiper ball screw nut
2	630900	Sealing lip
1	397030 1012	Limit position switch L=400
1	39701x 1012	Limit position switch L=xxxx
	611999 2000	Spindle support from L=1490 mm

Table 6 - Spare parts LES 6 - Direct drive

Quantity	Item-No.	Designation
1	623065 0001	Locking nut for ball screw nut Ø 16
1	21113x 5xxx	Ball screw spindle Ø 16
1	6131xx 0001	Ball screw nut Ø 16
1	623072 0014	Shaft slide WS 5 for ball screw nut
1	623072 0013	Shaft slide WS 5 without ball screw nut
1	623065 6913	Bearing flange counter bearing side, incl. deep groove ball bearing
1	623065 0102	Flange for belt drive
1	613502	Wiper ball screw nut
2	630900	Sealing lip
1	397030 1012	Limit position switch L=400
1	3970xx 1012	Limit position switch L=xxxx
1	616503 0280	Timing belt 16AT5-280
1	616002	Toothed belt wheel Z25 AT5
1	611999 2000	Spindle support from L=1490 mm

Table 7 - Spare parts LES 6 - Belt drive