## Accessories

### Profile connection cubes
- **black**
  - VE 10 pcs. + fixing material
  - for PU 25
  - 2 × Part no.: 209104 0002
  - 3 × Part no.: 209103 0002

### Profile covers
- **black**
  - PU 25
    - VE 25 pcs.
    - Part no.: 209105 0003
  - PU 50
    - VE 25 pcs.
    - Part no.: 209126 0003
  - PL 40
    - VE 20 pcs.
    - Part no.: 209127 0003
  - PL 80
    - VE 20 pcs.
    - Part no.: 209128 0003
  - PS 50
    - VE 25 pcs.
    - Part no.: 209129 0003
  - PS 80
    - VE 20 pcs.
    - Part no.: 209130 0003
  - PS 140
    - VE 10 pcs.
    - Part no.: 209130 1001

### Plastic equipment bases with rubber plate
- **black**
  - VE 4 pcs. + setting screws
  - for PL 40/PS 50
    - Ø 60
      - M10 × 50 setting screws
      - Part no.: 209032 0003
  - for PL 80/PS 80
    - Ø 80
      - M12 × 50 setting screws
      - Part no.: 209034 0001

### Aluminium corner connectors
- **natural**
  - L 25 × W 25 × H 15 mm
    - VE 10 pcs. + fixing material
    - Part no.: 209114 0101
    - black
      - Part no.: 209114 0111
  - L 40 × W 40 × H 22 mm
    - VE 10 pcs. + fixing material
    - Part no.: 209115 0101
    - black
      - Part no.: 209115 0111

### Guide rollers
- **Rubber-tired guide rollers Ø 75 (M10)**
  - VE 4 pcs.
    - 2 with and 2 without locking device
    - for PL 40/PS 50
      - Part no.: 209043 0011
  - **Aluminium equipment bases**
    - for PL 80/PS 80
      - Ø 120
        - Setting screws M12 × 50
        - Part no.: 209033 0003

### Plastic equipment bases with rubber plate
- **black**
  - for PL 40/PS 50
    - Ø 60
      - M10 × 50 setting screws
      - Part no.: 209032 0003
  - for PL 80/PS 80
    - Ø 80
      - M12 × 50 setting screws
      - Part no.: 209034 0001

### Profile covers
- **black**
  - PU 25
    - VE 25 pcs.
    - Part no.: 209105 0003
  - PU 50
    - VE 25 pcs.
    - Part no.: 209126 0003
  - PL 40
    - VE 20 pcs.
    - Part no.: 209127 0003
  - PL 80
    - VE 20 pcs.
    - Part no.: 209128 0003
  - PS 50
    - VE 25 pcs.
    - Part no.: 209129 0003
  - PS 80
    - VE 20 pcs.
    - Part no.: 209130 0003
  - PS 140
    - VE 10 pcs.
    - Part no.: 209130 1001

### T-groove cover
- **VE 30 m**
  -相似 to RAL 5018
    - black Part no.: 209201 0004
    - turquoise Part no.: 209201 0003
    - light grey Part no.: 209201 0007

We reserve the right to make technical changes.

---

Aluminium profiles | MECHANICS C15
Profile connections

Examples:

**PS 50 with PU 50**

- **Allen screws**
  - M6 × 25 mm
  - VE 10 pcs.
  - Part no.: 209147 0009
  - VE 50 units
  - Part no.: 209147 0010

- **Tapped bushings**
  - M9/M6
  - VE 10 pcs.
  - Part no.: 209147 0001
  - VE 50 units
  - Part no.: 209147 0002

**PS 50 with PP 250**

- **Tapped bushings**
  - M10/M6
  - VE 10 pcs.
  - Part no.: 209147 0124
  - VE 50 pcs
  - Part no.: 209147 0125

**PS 80 with PL 80**

- **Allen key**
  - SW 5
  - DIN 911
  - VE 1 pcs.
  - Part no.: 931152

**Example PL 80**

- Hexagon-Socket Screwdriver
- Grub Screw
- Drilling Template
- Twist Drill
  - Ø 6 mm / Ø 10.4 mm

**Example: Profile quick clamping extension for PS 50**

- Tapped Bush Ø 10.3 x 28 mm
- Grub Screw DIN 914, M8 x 20 mm
- Extension Bolt M10 for PS 50

**Example for PS 50/PL 40 (M10)**

- Locking bush, tapped pin, extension bolts
- Part no.: 209147 0120
- 50 sets
  - Part no.: 209147 0121

**Example for PS 80/PL 80 (M12)**

- Locking bush, tapped pin, extension bolts
  - 10 sets
  - Part no.: 209147 0122
- 50 sets
  - Part no.: 209147 0123

**Matching drill pattern 2**

- Part no.: 290015 0002

**Stepped drill**

- Ø 6/Ø 10.4 mm
  - Part no.: 400090
Profile quick clamping connections

Example:
PL with PS 80

Quick Clamping Connection 0°
e.g. for PL/PS 80

Quick Clamping Connection 90°
e.g. for PP/PU/PS

Example:
PP with PS 50

Quick clamping connection

for PL
• Locking bush, tapped pin and bolts 0°
  • 10 sets:
    Part no.: 209147 0102
  • 50 sets:
    Part no.: 209147 0103

for PL
• Locking bush, tapped pin and bolts 90°
  • 10 sets:
    Part no.: 209147 0112
  • 50 sets:
    Part no.: 209147 0113

for PP/PU
• Locking bush, tapped pin and bolts 0°
  • 10 sets:
    Part no.: 209147 0100
  • 50 sets:
    Part no.: 209147 0101

for PP/PU
• Locking bush, tapped pin and bolts 90°
  • 10 sets:
    Part no.: 209147 0110
  • 50 sets:
    Part no.: 209147 0111

Stepped drill
• Ø 6 mm/Ø 10.4 mm
Part no.: 400090

matching drill pattern 2
Part no.: 290015 0002

Allen key
SW 3
• DIN 911
Part no.: 931150

• Treaded Bush Ø 10.3 x 28 mm
• Grub Screw DIN 914, M6 x 20 mm
• Connection Bolt 0° for PL 40 and PL 80
• Connection Bolt 90° for PL 40 and PL 80

• Treaded Bush Ø 10.3 x 16,5 mm
• Grub Screw DIN 914, M6 x 12 mm
• Connection Bolt 90°

• Treaded Bush Ø 10.3 x 16,5 mm
• Grub Screw DIN 914, M6 x 12 mm
• Connection Bolt 90°

made by isel
# Linear guides

## Overview

<table>
<thead>
<tr>
<th>Linear guides</th>
<th>Slide functional overview</th>
<th>General notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>LFS-8-1</td>
<td>Linear guide rails</td>
<td></td>
</tr>
<tr>
<td>LFS-8-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LFS-8-3</td>
<td>Linear guide rail</td>
<td></td>
</tr>
<tr>
<td>LFS-8-4</td>
<td>Linear guide rail</td>
<td></td>
</tr>
<tr>
<td>LFS-12-1</td>
<td>Linear guide rail</td>
<td></td>
</tr>
<tr>
<td>LFS-12-11</td>
<td>Linear guide rail</td>
<td></td>
</tr>
<tr>
<td>LFS-12-2</td>
<td>Linear guide rail</td>
<td></td>
</tr>
</tbody>
</table>

- **LFS-8-1**: Linear guide rails with LW 6 carriage and WS 1 aluminium slide
- **LFS-8-2**: Linear guide rails with LW 7 carriage and WS 3 aluminium slide
- **LFS-8-3**: Linear guide rail with LW 7 carriage and WS 3 aluminium slide
- **LFS-8-4**: Linear guide rail with LW 7 carriage and WS 3 aluminium slide
- **LFS-12-1**: Linear guide rail with LW 3 carriage, WS 4 aluminium slide, and LS 1 steel slide
- **LFS-12-11**: Linear guide rail with LW 5 carriage and WS 6 aluminium slide
- **LFS-12-2**: Linear guide rail with LW 3 carriage and WS 4 aluminium slide

**CAD data on our website** [www.isel.com](http://www.isel.com)
Linear guides

Overview

- **LFS-12-3** Linear guide rail
  - with LW 2 carriage
  - with LW 8 carriage
  - with WS 7 aluminium slide

- **LFS-12-10** Linear guide rail
  - with LW 4 carriage
  - with WS 8 aluminium slide
  - With dual track set 1+2

- **LFS-16-2** Linear guide rail
  - with L LW 3 carriage
  - with IWS 1 aluminium slide
  - with ILS 1 steel slide

- **LFS-16-120** Linear guide rail
  - with 2 or 4 IWS 1 aluminium slides
  - with 2 or 4 ILS 1 steel slides

- **LFS-16-150** Linear guide rail
  - with ILS1 steel slide
  - with IWS1 aluminium slide

- **LFS-16-250** Linear guide rail
  - with ILS1 steel slide
  - with IWS1 aluminium slide

- **Accessories**

- **Operating loads calculation**

---

CAD data on our website www.isel.com
Linear guide slide function

Aluminium shaft slides
The patented shaft slides are perfectly suited for assembling of complex multiple axis systems for handling and machining.

A wide range of models covers a multitude of applications.

All models can be produced to order with various profile lengths (70, 100, 150 and 200 mm).

1. Both sides greasing option for the recirculating balls.

2. The basic supports for all linear guides are extruded aluminium profiles to DIN EN 12020-2, which are provided with T-key inserts for fastening in the body of the profile or have fixing borings.

3. Precision steel shafts with a hardness of 60 ± 2 HRC are used as guide rails. All LFS-8 versions are optionally available with stainless steel shafts.

4. The recirculating ball steering is reinforced with glass fibre.

5. There are patented recirculating balls in the linear slides. Ball bearings run in each case between two ground steel pins and the guidance shaft.

6. The slide is adjusted with self-locking setting screws. This is how the rows of balls and shafts or pins are used with each other and thus pre-stressed. The slides are preset in the factory to the correct stress. All shaft slides are optionally available stainless.

7. To secure transport loads, slide plates, etc., the shaft slides are provided with T-key inserts or fixing borings.
General notes

Load capacity and working life

Installation position

In principal, the installation position for linear guides can be chosen anywhere. You merely have to consider whether all the forces and moments arising are below the maximum values for the relevant axes.

Temperatures

All linear guides are designed for continuous operation at ambient temperatures of up to 60 °C. In short-term operation, maximum temperatures of 80 °C are permissible.

Linear guides are unsuitable for temperatures below freezing.

Straightness/Warping

The aluminium profiles used are extruded profiles, which exhibit divergences from straightness and may be warped, owing to the manufacturing process. The tolerance of this deviation is set out in DIN EN 12020-2.

In the worst case, the linear guide deviations equal these limits, but typically they are lower.

In order to achieve the desired guidance accuracy, the guide must be aligned using shims or clamped to a bearing service machined to the corresponding accuracy. This achieves tolerances of at least 0.1 mm/1,000 mm.

Load capacity and working life

The dimensioning of a linear guide is based on the load capacity of the individual elements. The load capacity is described by:

- the dynamic load factor \( C \)
- the static load factor \( C_0 \)
- the static torques \( M_{0X}, M_{0Y} \) and \( M_{0Z} \)

The basis of the dynamic load factors according to DIN is a nominal working life of 100,000 m displacement path. Far East suppliers often quote load factors for a nominal working life of 50,000 m displacement path; this produces load factor figures which are approximately 20% higher than those according to DIN.

Dynamic load capacity

The fatigue characteristics of the material determine the dynamic load capacity. The working life - the fatigue period - also depends on:

- the stress on the linear guide
- the speed at which the linear guide moves
- the statistical randomness of the first damage occurring

Useful life

Useful life means the working life actually achieved by a linear guide. The useful life may differ from the computed working life.

The following can lead to premature failure through wear or fatigue:

- Misalignments between guide rails or guidance elements
- Contamination of the guide rails
- Insufficient lubrication
- Oscillating motion with very small lifts (formation of grooves)
- Vibrations at rest (formation of grooves)

Owing to the multiplicity of installation and operating relationships, it is impossible to determine the useful life of a linear guide exactly in advance. The safest way to make an accurate estimate of the useful life is, as before, a comparison with similar installations.
Linear guides

**LFS-8-1**

- **Features**
  - W 30 x H 20 mm (LFS-8-1)
  - W 30 x H 32.5 mm (LFS-8-2)
  - 2 precision steel shafts Ø 8
  - Anti-twist lock
  - Aluminium shaft housing profile, naturally anodised
  - Fixing from below with M6 tapped rails in T-key insert
  - Conditionally self-supporting
  - Special lengths to order
  - Weights: appr. 1.6 kg/m (LFS-8-1)
  - appr. 2.0 kg/m (LFS-8-2)

- **Options**
  - stainless design
  - drilled for M6 (LFS-8-1 only)

**Ordering key**

235 00X XXXX

- LFS-8-1/standard = 0
- LFS-8-1/stainless = 1
- LFS-8-2/standard = 2
- LFS-8-2/stainless = 3

Length in mm (in 100 mm raster)

- e.g. 0029 = Length 298
- 0299 = Length 2998

Steel shaft length: Total length L - 3 mm

Profile up to 6,000 mm available without impact connection, steel shafts divided.

**Load data**

<table>
<thead>
<tr>
<th>Shaft slide WS 1/70</th>
<th>Shaft slide WS 1</th>
<th>Carriage LW 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>3114 N</td>
<td>2160 N</td>
</tr>
<tr>
<td>C</td>
<td>1846 N</td>
<td>4000 N</td>
</tr>
<tr>
<td>F1 stat.</td>
<td>2659 N</td>
<td>F1 stat.</td>
</tr>
<tr>
<td>F1 dyn.</td>
<td>1576 N</td>
<td>F1 dyn.</td>
</tr>
<tr>
<td>F2 stat.</td>
<td>3114 N</td>
<td>F2 stat.</td>
</tr>
<tr>
<td>F2 dyn.</td>
<td>1846 N</td>
<td>F2 dyn.</td>
</tr>
<tr>
<td>M1 stat.</td>
<td>37.3 Nm</td>
<td>M1 stat.</td>
</tr>
<tr>
<td>M1 dyn.</td>
<td>60.5 Nm</td>
<td>M1 dyn.</td>
</tr>
<tr>
<td>M2 stat.</td>
<td>117.6 Nm</td>
<td>M2 stat.</td>
</tr>
<tr>
<td>M2 dyn.</td>
<td>22.1 Nm</td>
<td>M2 dyn.</td>
</tr>
<tr>
<td>M3 dyn.</td>
<td>39.5 Nm</td>
<td>M3 dyn.</td>
</tr>
<tr>
<td>M4 dyn.</td>
<td>69.7 Nm</td>
<td>M4 dyn.</td>
</tr>
</tbody>
</table>

\[
\begin{align*}
F_1 (\alpha) &= \frac{F_2 \cos \alpha}{\sin \theta} \\
F_1 (\alpha) &= \frac{F_1}{\sin \theta}
\end{align*}
\]

**Aluminium slide**

- With recirculating ball guide
- Clamping surface plane milled
- M6 T-key inserts
- Central lubrication option
- Adjustable for no play
- Option: stainless design

L 96 x W 72 x H 28.5 mm (WS 1/70)
(Weight: appr. 0.4 kg)
Part no.: 223100 0070
Stainless steel: 223101 0070

L 126 x W 72 x H 28.5 mm (WS 1)
(Weight: appr. 0.5 kg)
Part no.: 223100
Stainless steel: 223101

**Carriage LW 6**

- L 125 x W 90 x H 7.7 mm
- ground steel plate
- 4 rollers Ø 31, sealed for life
- adjustable for no play
- Weight: appr. 1 kg
Part no.: 223011
Linear guide rails

**Bending**

- **Load config. 1**
- **Load config. 2**

<table>
<thead>
<tr>
<th>Load config</th>
<th>Length [mm]</th>
<th>Bending [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>500</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1000</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>1500</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>2000</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>2500</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>3000</td>
<td>6</td>
</tr>
</tbody>
</table>

**Dimensioned drawings**

- **LFS-8-1 LFS-8-2**
- **LFS-8-1**
- **LFS-8-2**

**Profile length 298 ... 2998 mm in steps of 100 mm**

- **LFS-8-1 or LFS-8-2 with aluminium slide WS 1/70 or WS 1**
- **LFS-8-1 or LFS-8-2 with carriage LW6**

**Profile length 298 ... 2998 mm in steps of 100 mm**

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Linear guide rail LFS-8-3

Features

- W 115 × H 25.5 mm
- 2 precision steel shafts Ø 8
- Particularly resistant to twisting
- Aluminium shaft housing profile, naturally anodised
- Fixing from above through M6 drillings in the raster 100 mm
- Conditionally self-supporting
- Special lengths to order
- Weight: appr. 3.2 kg/m
- Option: stainless design

Ordering key

235 00X XXXX

Standard = 4
Stainless = 5

Length in mm (in 100 mm raster)

- e.g. 0029 = Length 296
- 0299 = Length 2996

Steel shaft length: Length overall L - 1 mm

Profile up to 6000 mm available without impact link, steel shafts divided.

Load data

<table>
<thead>
<tr>
<th>Shaft slide WS 3/70</th>
<th>Shaft slide WS 3</th>
<th>Carriage LW 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>C&lt;sub&gt;max&lt;/sub&gt;</td>
<td>6945 N</td>
<td>C&lt;sub&gt;max&lt;/sub&gt;</td>
</tr>
<tr>
<td>C&lt;sub&gt;static&lt;/sub&gt;</td>
<td>3190 N</td>
<td>C&lt;sub&gt;static&lt;/sub&gt;</td>
</tr>
<tr>
<td>F&lt;sub&gt;1&lt;/sub&gt;&lt;sub&gt;dynamic&lt;/sub&gt;</td>
<td>1604 N</td>
<td>F&lt;sub&gt;1&lt;/sub&gt;&lt;sub&gt;dynamic&lt;/sub&gt;</td>
</tr>
<tr>
<td>F&lt;sub&gt;1&lt;/sub&gt;&lt;sub&gt;static&lt;/sub&gt;</td>
<td>6945 N</td>
<td>F&lt;sub&gt;1&lt;/sub&gt;&lt;sub&gt;static&lt;/sub&gt;</td>
</tr>
<tr>
<td>F&lt;sub&gt;1&lt;/sub&gt;&lt;sub&gt;dynamic&lt;/sub&gt;</td>
<td>1979 N</td>
<td>F&lt;sub&gt;1&lt;/sub&gt;&lt;sub&gt;dynamic&lt;/sub&gt;</td>
</tr>
<tr>
<td>M&lt;sub&gt;x&lt;/sub&gt;&lt;sub&gt;static&lt;/sub&gt;</td>
<td>1157 Nm</td>
<td>M&lt;sub&gt;x&lt;/sub&gt;&lt;sub&gt;static&lt;/sub&gt;</td>
</tr>
<tr>
<td>M&lt;sub&gt;x&lt;/sub&gt;&lt;sub&gt;dynamic&lt;/sub&gt;</td>
<td>692 Nm</td>
<td>M&lt;sub&gt;x&lt;/sub&gt;&lt;sub&gt;dynamic&lt;/sub&gt;</td>
</tr>
<tr>
<td>M&lt;sub&gt;y&lt;/sub&gt;&lt;sub&gt;static&lt;/sub&gt;</td>
<td>629 Nm</td>
<td>M&lt;sub&gt;y&lt;/sub&gt;&lt;sub&gt;static&lt;/sub&gt;</td>
</tr>
<tr>
<td>M&lt;sub&gt;y&lt;/sub&gt;&lt;sub&gt;dynamic&lt;/sub&gt;</td>
<td>73.7 Nm</td>
<td>M&lt;sub&gt;y&lt;/sub&gt;&lt;sub&gt;dynamic&lt;/sub&gt;</td>
</tr>
</tbody>
</table>

Aluminium slide

- With recirculating ball guide
- Clamping surface plane milled
- M6 T-key inserts
- Central lubrication option
- Adjustable for no play
- Option: stainless design

Profile up to 6000 mm available without impact link, steel shafts divided.

Carriage LW 7

- L 175 × W 150 × H 7.5 mm
- Ground steel plate
- 4 rollers Ø 31, sealed for life
- Adjustable for no play
- Weight: appr. 2 kg

Part no.: 223012
Linear guide rail

**Bending**

- **Load config. 1**
- **Load config. 2**

**Dimensioned drawings**

- **LFS-8-3 with aluminium slides WS 3/70 or WS 3**
  - Profile length 296 ... 2996 mm in steps of 100 mm

- **LFS-8-3 with carriage LW7**
  - Profile length 296 ... 2996 mm in steps of 100 mm
Linear guide rail

Features
• W 80 × H 80 mm
• 2 precision steel shafts Ø 8
• anti-twist
• Aluminium shaft housing profiles, naturally anodised
• Fixing from below with M6 tapped rails in the T-key inserts or in the head side through M8 drillings
• side T-key inserts for limit switch securing
• conditionally self-supporting
• Special lengths to order
• Weight: appr. 7.2 kg/m
• Options: stainless design
  2 extra steel shafts
  2 slides or carriage

Ordering key

235 00X XXXX

Standard = 6 Length in mm (in 100 mm raster)
Stainless = 7 e.g. 0029 = Length 298
0299 = Length 2998

Steel shaft length: Length overall L - 3 mm
Profile up to 6000 mm available without impact link, steel shafts divided.

Load data

<table>
<thead>
<tr>
<th>Shaft slide WS 3/70</th>
<th>Shaft slide WS 3</th>
<th>Laufwagen LW 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>3141 N</td>
<td>C</td>
</tr>
<tr>
<td>C</td>
<td>1879 N</td>
<td>C</td>
</tr>
<tr>
<td>F1 stat.</td>
<td>2682 N</td>
<td>F1 stat.</td>
</tr>
<tr>
<td>F1 dyn.</td>
<td>1904 N</td>
<td>F1 dyn.</td>
</tr>
<tr>
<td>F2 stat.</td>
<td>3141 N</td>
<td>F2 stat.</td>
</tr>
<tr>
<td>F2 dyn.</td>
<td>1879 N</td>
<td>F2 dyn.</td>
</tr>
<tr>
<td>M1 stat.</td>
<td>115.7 Nm</td>
<td>M1 stat.</td>
</tr>
<tr>
<td>M1 dyn.</td>
<td>105.3 Nm</td>
<td>M1 dyn.</td>
</tr>
<tr>
<td>M2 stat.</td>
<td>145.3 Nm</td>
<td>M2 stat.</td>
</tr>
<tr>
<td>M2 dyn.</td>
<td>129.2 Nm</td>
<td>M2 dyn.</td>
</tr>
<tr>
<td>M3 stat.</td>
<td>62.9 Nm</td>
<td>M3 stat.</td>
</tr>
<tr>
<td>M3 dyn.</td>
<td>73.7 Nm</td>
<td>M3 dyn.</td>
</tr>
<tr>
<td>Fr (α) = F2 / 100 α</td>
<td>Fr (α) = F1 / 100 α</td>
<td></td>
</tr>
</tbody>
</table>

Aluminium slide
• Clamping surface plane milled
• M6 T-key inserts
• Central lubrication option
• adjustable for no play
• Option: stainless steel version

L 96 × W 130 × H 32 mm (WS 3/70)
(Weight: appr. 0.5 kg)
Part no.: 223103 0070
Stainless steel: 223103 1070

L 176 × W 130 × H 32 mm (WS 3)
(Weight: appr. 0.9 kg)
Part no.: 223103
Stainless steel: 223103 1000

Carriage LW 7
• L 175 × W 150 × H 7.5 mm
• ground steel plate
• 4 rollers Ø 31, sealed for life
• adjustable for no play
• Weight: appr. 2 kg
Part no.: 223012
Linear guide rail

LFS-8-4

Bending

Dimensioned drawings
Linear guide rail

Features
- W 40 × H 27 mm
- 2 precision steel shafts Ø 12
- anti-twist
- Aluminium shaft housing blocks
- Securing from above or below with M6 drillings in the housing blocks
- Guide any length up to 3m
- Special lengths to order
- Weight: appr. 1.9 kg/m

Ordering key
227 312 XXXX

Length in mm (in 100 mm raster)
e.g. 0298 = Length 298
2998 = Length 2998

Special lengths to order

N.B.!
The part no. refers to one steel shaft only

Load data

<table>
<thead>
<tr>
<th>Shaft slide WS 4</th>
<th>Shaft slide WS 4</th>
<th>Shaft slide WS 4</th>
<th>Shaft slide WS 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>2900 N</td>
<td>C</td>
<td>2426 N</td>
</tr>
<tr>
<td>F1, stat.</td>
<td>2821 N</td>
<td>F1, stat.</td>
<td>4517 N</td>
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<td>Mx, dyn.</td>
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<td>My, stat.</td>
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</tbody>
</table>

Aluminium slides
- Clamping surface plane milled
- Weight: appr. 0.3 kg
- Option: stainless design

L 94 x W 62 x H 31.5 mm (WS 4/70)
Part no.: 223104 0070
stainless steel: 223104 1070
L 124 x W 62 x H 31.5 mm (WS 4)
Part no.: 223104
Stainless: 223104 1000

Steel slide LS 1
L 91 × W 60 × H 32 mm
- Clamping surface ground
- Weight: appr. 0.8 kg
Part no.: 223006

Carriage LW 3
L 125 × W 85 × H 7.7 mm
- ground steel plate
- Weight: appr. 0.9 kg
Part no.: 223008

Shaft housing blocks
- Ø 40 mm, hole spacing 28 mm
- Cast zinc, VE 10 units
Part no.: 221501
Linear guide rail

LFS-12-1

Dimensioned drawings

LFS-12-1 with Carriage LW 3

LFS-12-1 with shaft slide WS 4/70 or WS 4

LFS-12-1 with steel slide LS 1

Shaft housing block
Linear guides

Linear guide rail

LFS-12-11

Features

- W 20 × H 31 mm
- Precision steel shaft Ø 12
- Aluminium shaft housing profile, naturally anodised
- Securing from below with M6 tapped rails in T-groove insert on flat surface
- Special lengths to order
- Weight: appr. 1.3 kg/m

Ordering key

220 002 XXXX

Ordering code: Length in mm

- e.g. 0298 = Length 298
- 0998 = Length 998

Profile length = Length overall L - 2 mm

Loading data

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<td>Mx, dyn.</td>
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<td>My, dyn.</td>
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<tr>
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<td>Mz, stat.</td>
</tr>
<tr>
<td>Mz, dyn.</td>
<td>181.7 Nm</td>
<td>Mz, dyn.</td>
</tr>
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<td>M1, stat.</td>
<td>-</td>
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<tr>
<td>M1, dyn.</td>
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<td>M1, dyn.</td>
</tr>
<tr>
<td>M2, dyn.</td>
<td>90.5 Nm</td>
<td>M2, dyn.</td>
</tr>
</tbody>
</table>

Aluminium slide

- With recirculating ball guide
- M6 T-groove inserts
- Central lubrication system option
- Adjustable for no play
- Option: stainless steel design

L 96 × W 50 × H 31.5 mm (WS 6/70)
(Weight: appr. 0.3 kg)
Part no.: 223106 0070
Stainless steel: 223106 1070

L 126 × W 50 × H 31.5 mm (WS 6)
(Weight: appr. 0.5 kg)
Part no.: 223106
Stainless steel: 223106 1000

Carriage LW 5

- L 110 × W 75 × H 7.7 mm
- Ground steel plate
- 4 rollers Ø 31, sealed for life
- Adjustable for no play
- Weight: 0.81 kg
Part no.: 223010

Made by isel®

Length in mm

e.g. 0298 = Length 298
0998 = Length 998
Profile length = Length overall L - 2 mm
Linear guide rail

LFS-12-11

Bending

- Load config. 1
- Load config. 2

Dimensioned drawings

LFS-12-11 with aluminium slide WS 6/70 or WS 6

LFS-12-11 with Carriage LW5

Steel shaft: Length 298 to 2998 mm in steps of 100 mm

made by isel

Linear guides | MECHANICS C31
Linear guide rail

**LFS-12-2**

**Features**

- **W 62 × H 31 mm**
- 2 precision steel shafts Ø 12
- Anti-twist lock
- Aluminium shaft housing profile, naturally anodised
- High parallelism through patented shaft housing outline
- High guidance accuracy
- Securing from above or below using drillings Ø 6.5 in 100 mm raster on flat surface
- Lengths in 100 mm raster
- Max. length up to 2998 mm
- Special lengths to order
- Weight: appr. 3.3 kg/m

**Ordering key**

235 200 XXXX

Length in mm
- e.g. 0298 = Length 298
- 0998 = Length 998

Profile length = Length overall L - 2 mm

**Loading data**

<table>
<thead>
<tr>
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<td>( M_2 ) stat.</td>
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<td>( M_2 ) stat.</td>
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<tr>
<td>( M_2 ) dyn.</td>
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<td>( M_2 ) dyn.</td>
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**Shaft slide WS 4**

| \( F_1 \) stat. | 4860 N | \( F_1 \) stat. | 3400 N |
| \( F_1 \) dyn. | 2426 N | \( F_1 \) dyn. | 2071 N |
| \( F_2 \) stat. | 4888 N | \( F_2 \) stat. | 4537 N |
| \( F_2 \) dyn. | 2426 N | \( F_2 \) dyn. | 2071 N |
| \( M_1 \) stat. | 42.9 Nm | \( M_1 \) stat. | 1552 Nm |
| \( M_1 \) dyn. | 21.8 Nm | \( M_1 \) dyn. | 181.7 Nm |
| \( M_2 \) stat. | 59.7 Nm | \( M_2 \) stat. | 77.3 Nm |
| \( M_2 \) dyn. | 99.9 Nm | \( M_2 \) dyn. | 90.5 Nm |

**Carriage LW 3**

| \( F_1 \) stat. | 2160 N | \( F_1 \) stat. | 1519 N |
| \( F_1 \) dyn. | 1873 N | \( F_1 \) dyn. | 181.7 Nm |
| \( M_1 \) stat. | 4357 N | \( M_1 \) stat. | 181.7 Nm |
| \( M_1 \) dyn. | 1944 Nm | \( M_1 \) dyn. | 181.7 Nm |
| \( M_2 \) stat. | 105.3 Nm | \( M_2 \) stat. | 105.3 Nm |
| \( M_2 \) dyn. | 59.7 Nm | \( M_2 \) dyn. | 59.7 Nm |
| \( M_3 \) stat. | 123.3 Nm | \( M_3 \) stat. | 123.3 Nm |
| \( M_3 \) dyn. | 69.9 Nm | \( M_3 \) dyn. | 69.9 Nm |

**Aluminium slide**

- With recirculating ball guide
- Clamping surface plane milled
- Option: stainless steel design

L 94 × W 62 × H 31.5 mm (WS 4/70)

(Weight: appr. 0.33 kg)

Part no.: 223104 0070

Stainless steel: 223104 1070

L 124 × W 62 × H 31.5 mm (WS 4)

(Weight: appr. 0.46 kg)

Part no.: 223104

Stainless steel: 223104 1000

**Carriage LW 3**

- \( L 125 \times W 85 \times H 7.7 \) mm
- ground steel plate
- Weight: 0.93 kg

Part no.: 223008
Linear guide rail

Bending

- Load config. 1
- Load config. 2

Dimensioned drawings

LFS-12-2 with aluminium slide WS 4/70 or WS 4

Steel shaft: Length 298 to 2998 mm in steps of 100 mm

LFS-12-2 with Carriage LW3

made by isel®
Linear guide rail

LFS-12-3

Features
- W 90 × H 31 mm
- 2 precision steel shafts Ø 12
- anti-twist
- Aluminium shaft housing profile, naturally anodised
- increased shaft spacing allows higher torques to be absorbed
- Securing from above or below with M6 drillings in 100 mm raster
- Any guide length
- Weight: appr. 3.9 kg/m

Ordering key
235 300 XXXX

Length in mm (in 100 mm raster)
e.g. 0029 = Length 298
0299 = Length 2998
Profile length = Length overall L - 2 mm
Special lengths over 3000 mm with rod linkage to order.

Loading data

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<td>46.4 N</td>
<td>46.4 N</td>
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<td>69.9 N</td>
<td>69.9 N</td>
<td>69.9 N</td>
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</table>

Carriage LW 8
- L 150 × W 125 × H 7.5 mm
- ground steel plate
- 4 rollers Ø 31, sealed for life
- adjustable for no play
- Weight: 1.31 kg
Part no.: 223013

Carriage LW 2
- L 150 × W 125 × H 34.5 mm
- Aluminium T-groove plate
- 4 rollers Ø 31,
  sealed for life
- adjustable for no play
- Weight: 0.97 kg
Part no.: 223005

made by isel®
Linear guide rail

LFS-12-3

Bending

- Load config. 1
- Load config. 2

Dimensioned drawings

LFS-12-3 with aluminium slide WS 7

Steel shaft: Length 298 to 2998 mm in steps of 100 mm

LFS-12-3 with Carriage LW 8

LFS-12-3 with Carriage LW 2

made by isel®
**Linear guide rail**

**LFS-12-10**

**Features**
- W 36 × H 24.5 mm
- 2 precision steel shafts Ø 12
- anti-twist
- Aluminium shaft housing profile, naturally anodised
- Fixing from below with M6 tapped rails in T-groove insert and from above M6 drillings in 50 mm raster
- conditionally freeloading
- Special lengths to order
- Weight: appr. 2.9 kg/m

**Ordering key**

220 001 XXXX

Length in mm (in 100 mm raster)
E.g. 0300 = Length 296
3000 = Length 2996
Profile length = Length overall L -1 mm

Special lengths over 3000 with rod linkage to order.

**Loading data**

<table>
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<th>Carriage LW 4</th>
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<th>Dual Track set 2</th>
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<td>Mₓ, stat.</td>
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<td>Mᵧ, stat.</td>
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<td>Mz, dyn.</td>
<td>90.5 Nm</td>
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</tbody>
</table>

For steel shafts Ø 12 mm

**Dual track set 1**
- L75 x W75 x H30.2 mm
- with 2 SMALL linear ball bearings

Part no.: 223001

**Dual track set 2**
- L125 x W75 x H30.2 mm
- with 2 LARGE linear ball bearings

Part no.: 223002
Linear guide rail

**Bending**

- Load config. 1
  ![Bending Diagram 1](image1)
- Load config. 2
  ![Bending Diagram 2](image2)

**Dimensioned drawings**

**LFS-12-10 with slide WS 8**

- ![Dimensioned Drawing 1](image3)
  - Profile length 296 to 2996 mm in steps of 100 mm

**LFS-12-10 with Carriage LW 4**

- ![Dimensioned Drawing 2](image4)

**LFS-12-10 with dual track set**

- ![Dimensioned Drawing 3](image5)
  - Profile length 296 to 2996 mm in steps of 100 mm

*Made by isel*
Linear guide rail

LFS-16-2

Features
• W 25 × H 47.5 mm
• Precision steel shaft Ø 16
• Aluminium shaft housing profile, naturally anodised
• Securing from below on flat surface with M6 tapped rails in T-groove insert
• not self-supporting
• Lengths in 100 mm raster
• max. Length 2998 mm
• Special lengths to order
• Weight: appr. 2.7 kg/m

Ordering key
220 004 XXXX
Length in mm (in 100 mm raster)
e.g. 0029 = Length 298
0299 = Length 2998
Profile length = Length overall L -2 mm
Special lengths to order

Loading data

Carriage ILW 1
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Steel slide ILS 1
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<td>f dyn.</td>
</tr>
<tr>
<td>4900 N</td>
<td>3200 N</td>
<td>1775 N</td>
</tr>
<tr>
<td>194.4 Nm</td>
<td>194.7 Nm</td>
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</tr>
<tr>
<td>180.6 Nm</td>
<td>137.2 Nm</td>
<td>68.1 Nm</td>
</tr>
</tbody>
</table>

Aluminium slide IWS 1
• L 94 × W 55 × H 33.5 mm
• Clamping surface plane milled
• Weight: 0.32 kg
• Option: stainless steel design
Part no.: 223220
Stainless steel: 223220 0001

Steel slide ILS 1
• L 94 × W 58 × H 33.7 mm
• Clamping surface ground
• Weight: 0.72 kg
Part no.: 223210

Carriage ILW 1
• L 125 × W 80 × H 7.7 mm
• ground steel plate
• Weight: 0.87 kg
Part no.: 223230
Linear guide rail

LFS-16-2

Dimensioned drawings

LFS-16-2 with aluminium slide IWS 1

Steel shaft: Length 298 to 2996 mm in steps of 100 mm

LFS-16-2 with aluminium slide ILS 1

LFS-16-2 with Carriage ILW 1

made by isel®
Linear guide rail

LFS-16-120

Features

• W 190 × H 61 mm
• 2 precision steel shafts Ø 16
• anti-twist
• Aluminium shaft housing profile
  naturally anodised
• Securing from below with
  M6 tapped rails in T-groove profile
• conditionally not self-supporting
• Any guide length
• Weight: 10.2 kg/m

Ordering key

220 008 XXXX

Length in mm (in 100 mm raster)
  e.g. 0029 = Length 298
  0299 = Length 2998

Profile length = Length overall L - 2 mm

Special lengths to order

Loading data

\[
\begin{align*}
F_{1x} &= F_2 \cos \theta \\
F_{1y} &= F_2 \sin \theta
\end{align*}
\]

Bending

Load config. 1

Load config. 2

Length in mm (in 100 mm raster)

- e.g. 0029 = Length 298
- 0299 = Length 2998

Profile length = Length overall L - 2 mm

Special lengths to order
Linear guide rail

LFS-16-120

**Slide unit with 2 × steel slide ILS 1 (kit)**
- L 84 × W 178 × H 8 mm
- ground steel plate
- 2 x ILS 1, central lubrication option
- adjustable for no play
- Total weight: 2.30 kg

Part no.: 223240 0009

**Slide unit with 2 × aluminium slide IWS 1 (kit)**
- L 84 × W 178 × H 8 mm
- ground steel plate
- 2 × IWS 1, central lubrication option
- adjustable for no play
- Total weight: 1.50 kg

Part no.: 223240 0007

**Slide unit with 4 × steel slide ILS 1 (kit)**
- L 180 × W 178 × H 8 mm
- ground steel plate
- 4 x ILS 1, central lubrication option
- adjustable for no play
- Total weight: 1.50 kg

Part no.: 223240 0008

**Slide unit with 4 × aluminium slide IWS 1 (kit)**
- L 180 × W 178 × H 8 mm
- ground steel plate
- 4 x IWS 1, central lubrication option
- adjustable for no play

Part no.: 223240 0010

---

**Dimensioned drawings**

Aluminium slide IWS 1

Steel slide ILS 1
**Linear guide**

**LFS-16-150**

**Linear guide rail LS-16-150**

- 2 precision steel shafts Ø 16 mm
- Aluminium profile rail with T-groove inserts, raster 25 mm, anodised
- exact, shaft housing outline milled in a clamping fixture
- Conditionally freeloading
- Standard length 3 m, any number of segments
- Weight: 13.9 kg/m

Part no.: 220030 0099 (Length 1 m)  
220030 0199 (Length 2 m)  
220030 0299 (Length 3 m)

Option:
- Other lengths (longer or shorter)

**Steel slide ILS 1**

- Steel slide L 94 × W 58 × H 33.7 mm
- 4 recirculating balls, adjustable for no play
- Grease nipple on front
- Weight: 0.7 kg

Part no.: 223210

**Aluminium slide IWS 1**

- L 94 × W 55 × H 33.5 mm
- Clamping surface plane milled
- Weight: 0.32 kg
- Option: stainless steel design

Part no.: 223220
Stainless steel: 223220 0001

**Aluminium slide IWS 1 with slot plate**

- 2 or 4 linear guide slides
- Slot plate (ground steel)
- Adjustable for no play
- Weight: 2.5 kg or 5.1 kg

Part no.: 223240 0036 (2 slides)  
223240 0037 (4 slides)

---

**Loading data**

<table>
<thead>
<tr>
<th>Linear guide LFS-16-150</th>
<th>Linear guide LFS-16-150</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 steel slide</td>
<td>4 steel slide</td>
</tr>
<tr>
<td>Fr (cz) = F2 / cos cz</td>
<td>Fr (cz) = F1 / sin cz</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Linear guide LFS-16-150</th>
<th>Linear guide LFS-16-150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cc</td>
<td>7598 N</td>
</tr>
<tr>
<td>C</td>
<td>4857 N</td>
</tr>
<tr>
<td>F1, stat.</td>
<td>6488 N</td>
</tr>
<tr>
<td>F1, dyn.</td>
<td>4148 N</td>
</tr>
<tr>
<td>F2, stat.</td>
<td>7598 N</td>
</tr>
<tr>
<td>F2, dyn.</td>
<td>4857 N</td>
</tr>
<tr>
<td>Mx, stat.</td>
<td>194.6 N</td>
</tr>
<tr>
<td>Mx, dyn.</td>
<td>124.4 N</td>
</tr>
<tr>
<td>My, stat.</td>
<td>64.6 N</td>
</tr>
<tr>
<td>My, dyn.</td>
<td>41.4 N</td>
</tr>
<tr>
<td>Mz, stat.</td>
<td>145.7 N</td>
</tr>
<tr>
<td>Mz, dyn.</td>
<td>356.2 N</td>
</tr>
<tr>
<td>Cc</td>
<td>10130 N</td>
</tr>
<tr>
<td>C</td>
<td>6476 N</td>
</tr>
<tr>
<td>F1, stat.</td>
<td>6050 N</td>
</tr>
<tr>
<td>F1, dyn.</td>
<td>5530 N</td>
</tr>
<tr>
<td>F2, stat.</td>
<td>10130 N</td>
</tr>
<tr>
<td>F2, dyn.</td>
<td>6476 N</td>
</tr>
<tr>
<td>Mx, stat.</td>
<td>475.8 N</td>
</tr>
<tr>
<td>Mx, dyn.</td>
<td>304.2 N</td>
</tr>
<tr>
<td>My, stat.</td>
<td>227.9 N</td>
</tr>
<tr>
<td>My, dyn.</td>
<td>152.8 N</td>
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<tr>
<td>Mz, stat.</td>
<td>311.1 N</td>
</tr>
<tr>
<td>Mz, dyn.</td>
<td>234.7 N</td>
</tr>
</tbody>
</table>

---

**Dimensioned drawing**

Figure: Linear guide rail and 4 linear guide slide with slot plate

---

**Aluminum slide IWS 1**

- L 94 × W 55 × H 33.5 mm
- Clamping surface plane milled
- Weight: 0.32 kg or 5.1 kg

Part no.: 223220 0001
Stainless steel: 223220 0001
## Linear guides

### Linear guide

![Linear guide rail and 4 linear guide slide with slot plate](image)

**Loading data**

<table>
<thead>
<tr>
<th>Linear guide LFS-16-250 2 steel slide</th>
<th>Linear guide LFS-16-250 4 steel slide</th>
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</thead>
<tbody>
<tr>
<td>$C_x$ 7598 N</td>
<td>$C_x$ 10130 N</td>
</tr>
<tr>
<td>$C$ 4857 N</td>
<td>$C$ 6476 N</td>
</tr>
<tr>
<td>$F_1$ stat. 6688 N</td>
<td>$F_1$ stat. 9050 N</td>
</tr>
<tr>
<td>$F_1$ dyn. 4146 N</td>
<td>$F_1$ dyn. 5550 N</td>
</tr>
<tr>
<td>$F_2$ stat. 7986 N</td>
<td>$F_2$ stat. 10310 N</td>
</tr>
<tr>
<td>$F_2$ dyn. 4857 N</td>
<td>$F_2$ dyn. 6476 N</td>
</tr>
<tr>
<td>$M_x$ stat. 810.9 N</td>
<td>$M_x$ stat. 1081.3 N</td>
</tr>
<tr>
<td>$M_x$ dyn. 194.6 N</td>
<td>$M_x$ dyn. 475.8 N</td>
</tr>
<tr>
<td>$M_y$ stat. 227.9 N</td>
<td>$M_y$ stat. 557.2 N</td>
</tr>
<tr>
<td>$M_y$ dyn. 516.4 N</td>
<td>$M_y$ dyn. 691.3 N</td>
</tr>
<tr>
<td>$M_z$ stat. 124.4 N</td>
<td>$M_z$ stat. 304.2 N</td>
</tr>
<tr>
<td>$M_z$ dyn. 145.7 N</td>
<td>$M_z$ dyn. 356.2 N</td>
</tr>
</tbody>
</table>

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

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

**Option:**
- Other lengths (longer or shorter)

### Steel slide ILS 1

- Steel slide
  - L 94 × W 58 × 33.7 mm
  - 4 recirculating balls, adjustable for no play
  - Grease nipple on front
  - Weight: 0.7 kg

Part no.: 223210

### Aluminium slide IWS 1

- L 94 × W 55 × H 33.5 mm
- Clamping surface plane milled
- Weight: 0.32 kg
- Option: stainless steel design

Part no.: 223220

Stainless steel: 223220 0001

### Aluminium slide IWS 1 with slot plate

- 2 or 4 linear guide slides
- Slot plate (ground steel)
- Adjustable for no play
- Weight: 3.5 kg or 7.0 kg

Part no.: 223240 0040 (2 slides)
  223240 0041 (4 slides)
**Accessories**

### Tapped rails
- **M6 tapped rail**
  - 10 × 4 mm
  - galvanised
  - VE 3 units at 1 m
  - Part no.: 209 011

### Sliding nuts
- **M6 sliding nut** (Figure 1)
  - L 25 × W 10 × H 3.5 mm
  - galvanised
  - VE 100 units
  - all except PT/RE 40, 65
  - Part no.: 209 001 0005

- **2 × M6 sliding nuts** (Figure 2)
  - L 45 × W 10 × H 3.5 mm
  - galvanised
  - VE 50 units
  - all except PT/RE 40, 65
  - Part no.: 209 002 0004

- **Angle sliding nut**
  - 2 × M6 (Figure 3)
  - galvanised
  - VE 25 units
  - all except PT/RE 40, 65
  - Part no.: 209 021 0003

- **Special angle sliding nut**
  - 3 × M6 (Figure 4)
  - galvanised, VE 25 units
  - all except PT/RE 40, 65
  - Part no.: 209 022 0003

### Guide shafts
- **Guide shaft SF 12/SF 16**
  - Precision steel shafts
  - Ø 12 or 16 mm, length 3 m
  - Hardened and ground
  - with M4 blind hole thread (SF12) or M6 (SF16) in 100 mm raster
  - or with stepped bore for M4 (SF 12) or M5 (SF 16) in 100 mm raster
  - Part no.: 220019 0299 (SF12, 3m, blind hole thread for M5)
  - Part no.: 220020 0299 (SF12, 3m, stepped bore for M4)
  - Part no.: 220023 0299 (SF16, 3m, stepped bore for M5)
  - Part no.: 220024 0299 (SF16, 3m, blind hole thread for M6)

### Rollers
- **Roller Ø 20 mm** for SF 12
  - with M4 tapped drilling
  - VE 2 units
  - Part no.: 222 010

- **Roller Ø 30 mm** for SF 16
  - with M6 tapped drilling
  - VE 2 units
  - Part no.: 222 010 0003

### Linear ball bearing
- For steel shafts Ø 12 mm
- **Linear ball bearing, large**
  - L80 × W20 × H19 mm, VE 2 units
  - Part no.: 222 002 0001

- **Linear ball bearing, medium**
  - L60 × W20.5 × H17.8 mm, VE2 units
  - Part no.: 222 000

- **Linear ball bearing, small**
  - L40 × W20 × H19 mm, VE 2 units
  - Part no.: 222 001

### Grease/grease gun
- **Grease**
  - Part no.: 299 032 0002

- **Impact press for grease and oil**
  - Part no.: 299 032 0003
Operating loads calculation

Effective loading calculation

Various factors affect the calculation of the loading of isel guides. This includes the position of the
C of G of the load, tensile and compressive forces, torques, load and acceleration forces.

For a linear bench on 4 bearings, the bearing forces are calculated according to the force
application point for various load directions.

The calculation can also be applied to a slot
configuration with 2 slide.

The dimension $L_4/2$ is used as the dimen-
sion $L$ (see dimensioned drawings for the
relevant guides).

The load factor in this case is $C_0/2$.

Combined load

If the load alignment of an element does
not coincide with one of the main load
directions, then the equivalent load is calcu-
lated:

$$ P = |F_1| + |F_2| $$

If a force $F$ and a torque $M$ load an ele-
ment simultaneously, then the dynamically
equivalent load is:

$$ P = F + M $$

According to DIN, the dynamically equivalent load
should not exceed the value $P = 0.5 \cdot C$.

Equivalent load calculation

Operating conditions

A Incremental change  B Uniform change

$$ P = \frac{1}{3} \left( P_1 \cdot L_1 + P_2 \cdot L_2 + \ldots + P_n \cdot L_n \right) $$

Equivalent load

$$ P = \frac{1}{3} \left( P_{\text{min}} + 2 \cdot P_{\text{max}} \right) $$

Static safety

Operating conditions

$S_0$
Normal motion  1.0 - 3.0
High speed  2.0 - 4.0
With impacts and vibration  3.0 - 5.0

$$ S_0 = \frac{C_0}{P_0} = \frac{M_0}{M} $$

$S_0$  static load safety
$C_0$  static load factor [N]
$P_0$  statically equivalent bearing loading [N]
$M_0$  static equivalent torque [Nm]
$M$  equivalent static torque [Nm]

Nominal working life

The nominal working life is achieved or
exceeded by 90% of an adequately large
quantity of identical bearings, before the
first signs of material fatigue become
apparent.

$$ L = \left( \frac{L}{P} \right)^\gamma $$

$$ L_i = \frac{833}{H \cdot n_{\text{imp}}} \cdot \left( \frac{C}{P} \right)^\gamma $$

$$ L_s = \frac{1666}{V} \cdot \left( \frac{C}{P} \right)^\gamma $$

$L$ [m]  nominal working life in units of 100,000 m
$L_i$ [h]  nominal working life in hours run
$C$ [N]  dynamic load factor
$P$ [N]  dynamically equivalent load
$H$ [m]  single stroke of the oscillating motion
$n_{\text{imp}}$ [min]  Number of double strokes per minute
$v$ [m/min]  average speed of movement
Operating loads calculation

Load vertically on the bench surface

Loading

Dimensioned figure

Load on a Carriage

\[
P_1 = \frac{F}{4} + \frac{F \cdot L_1}{2L} + \frac{F \cdot L_2}{2a}
\]

\[
P_2 = \frac{F}{4} - \frac{F \cdot L_1}{2L} + \frac{F \cdot L_2}{2a}
\]

\[
P_3 = \frac{F}{4} + \frac{F \cdot L_1}{2L} - \frac{F \cdot L_2}{2a}
\]

\[
P_4 = \frac{F}{4} - \frac{F \cdot L_1}{2L} - \frac{F \cdot L_2}{2a}
\]

Load in direction of motion

Loading

Dimensioned figure

Load on a Carriage

\[
P_1 \ldots P_4 = \frac{F \cdot L_1}{2L}
\]

\[
P_5 \ldots P_4 = \frac{F \cdot L_2}{2L}
\]

Load at right angles to the direction of motion

Loading

Dimensioned figure

Load on a Carriage

\[
P_1 \ldots P_4 = \frac{F \cdot L_1}{2a}
\]

\[
P_5 \ldots P_4 = \frac{F}{4} + \frac{F \cdot L_2}{2L}
\]

\[
P_6 \ldots P_4 = \frac{F}{4} - \frac{F \cdot L_2}{2L}
\]
Space for your notes
### Drive elements

#### Function overview

- **Ball screw spindle Ø 16**
- **Ball screw spindle Ø 25**
- **Ball bearing nut 2**
- **Ball bearing nut 3**
- **Clamping blocks for nut version 3**
- **Flange bearing for spindle Ø 16**
- **Flange bearing for spindle Ø 25**
- **Bearing supports**
- **Shaft couplings**

#### Information

The ball screw nuts from isel Germany AG are of high quality, precise and abrasion-resistant (hardened and polished). Together with the ball screw spindles, they convert rotations into linear movements most friction-poorly.

The ball screw nut is inserted in the respective clamping block and fastened with a stud screw. The ball screw nuts have several balls paths with internal ball return.

A setscrew on the clamping block makes a clearance-free adjustment of the ball screw spindle's run possible.

The repeatability is less than 0.01 mm at a length of 300 m. To lubricate the linear drive, a grease nipple is fixed on the clamping block.

The ball screw spindles are produced with modern machines; they are rolled, hardened and polished.

Our linear drives are technically mature and have stood the test in practice for more than 20 years.

---

**Function Overview**

- **Redirection**
- **Balls**
- **Clamping block**
- **Ball screw nut**
Drive elements

Linear Drives

The most commonly used type of drive for a linear unit is a directly or by a tooth belt driven ball screw spindle.
Ball screw spindles Ø 16, 25 mm

Ø 16 features
- Ø16 mm, rolled, hardened and polished
- Material CF 53, inductively hardened (HRC 60 ± 2); (for detailed information see DIN 17212)
- Spindle pitches: 2.5 / 4 / 5 / 10 and 20 mm
- Lengths up to max. 3052 mm available
- End machining to isel standard or to order (see "Available lengths")
- Produced to DIN 69051, Part3, Tolerance class 7

Available lengths
Without end machining
- 452 to 1052 mm
- 1252 mm
- 1752 mm
- 2252 mm
- 3052 mm

Both-sided end machining
- 368 mm to 3068 mm

Special length according to drawing: 211 13X 5999

Options
- End machining to order

Ordering key
2 1 1 3 X X X X
Spindle pitch
2 = 2.5 mm
3 = 4 mm
4 = 5 mm
5 = 10 mm
6 = 20 mm
End machining
0 = not machined
5 = both-sided machining suitable for all feeds (aluminium profile length +78 mm)

Lengths
045 = 452 mm
086 = 868 mm
305 = 3052 mm

See "Available lengths" for permissible Combinations.

Ordering information
Slotted nut
- Self-locking
- M 10 x 0.75 mm
Part no.: 890257 0011

Ø 25 features
- Ø 25 mm, hardened and polished
- Material CF 53, inductively hardened (HRC 60 ± 2); (for detailed information see DIN 17212)
- Spindle pitches: 5/10 and 20 mm
- Lengths up to max. 3052 mm available
- End machining to isel standard or to order (see "Available lengths")
- Produced to DIN 69051, Part 3, Tolerance class 7

Available lengths
Without end machining
- 500 to 3,000 mm

Special length to drawing: 211 14X 0999

Options
- End machining to order

Ordering key
2 1 1 4 X X X X
Spindle pitch
4 = 5 mm
5 = 10 mm
6 = 20 mm
End machining
0 = not machined
2 = both sides

Lengths
050 = 500 mm
100 = 1000 mm
289 = 2895 mm

See "Available lengths" for permitted combinations.
Ball bearing nuts

Version 2-Ø16

Features
- Material 16MnCr5 or 20MnCr5, pressed, hardened, polished
- Versions for recirculating ball spindle Ø16 mm
- Nut pitches: 2.5/4/5/10 mm
- Balls are rerouted internally
- as block housing with base fixing
- Regreasing through grease nipples 90°, 0°

Load factors

<table>
<thead>
<tr>
<th>Pitch (mm)</th>
<th>Nominal Ø (mm)</th>
<th>Dynamic load factor (N)</th>
<th>Static load factor (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5</td>
<td>16</td>
<td>3500</td>
<td>5500</td>
</tr>
<tr>
<td>4.0</td>
<td>16</td>
<td>4600</td>
<td>7200</td>
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<td>5.0</td>
<td>16</td>
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<td>7200</td>
</tr>
<tr>
<td>10.0</td>
<td>16</td>
<td>4200</td>
<td>6500</td>
</tr>
</tbody>
</table>

Ordering information
- only for spindles Ø16

Part no.: 213 003 1003
Part no.: 213 003 1004
Part no.: 213 003 1005
Part no.: 213 003 1010

Matching:
Dirt scraper
- VE 2 pcs. Part no.: 213500 0001

Features
- Material 16MnCr5, ground
- Versions for recirculating ball spindles Ø16 and Ø25 mm
- Nut pitches: 2.5/4/5/10 and 20 mm (Ø 16 mm), 5/10 and 20 mm (Ø25 mm)
- Balls are rerouted internally
- The version with nut pitch 20 mm is supplied with scrapers

Version 3–Ø16 Ø25

Load factors

<table>
<thead>
<tr>
<th>Pitch (mm)</th>
<th>Nominal Ø (mm)</th>
<th>Dynamic load factor (N)</th>
<th>Static load factor (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0</td>
<td>25</td>
<td>5100</td>
<td>12600</td>
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<tr>
<td>10.0</td>
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<td>12600</td>
</tr>
<tr>
<td>20.0</td>
<td>25</td>
<td>3570</td>
<td>8800</td>
</tr>
</tbody>
</table>

Ordering information
- only for spindles Ø 25
- only for spindles Ø 16

Pitch | Part no.
------|--------
5.0 mm | 213 700 0005
10.0 mm | 213 700 0010
20.0 mm | 213 700 0020

Part no.: 213 503
Part no.: 213 514
Part no.: 213 505
Part no.: 213 510
Part no.: 213 520

Matching:
Dirt scraper
- VE 2 pcs. Part no.: 213700 9000

Matching:
Dirt scraper
- VE 2 pcs. Part no.: 213500 0001

*At pitch = 20
Clamping blocks For nut version 3

Features

- Material steel, gunmetal finish
- Versions for recirculating ball spindles Ø 25 and Ø 16 mm
- Nut pitches 5 / 10 and 20 mm (Ø 25 mm)
  2.5 / 4 / 5 / 10 and 20 mm (Ø 16 mm)
- Recirculating ball nuts are adjustable for no play
- Clamping blocks for base and flange securing

Ordering information

<table>
<thead>
<tr>
<th>Clamping block 2 Ø16</th>
<th>Clamping block 1 Ø16</th>
<th>Clamping block 2 Ø25</th>
<th>Clamping block 1 Ø25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pitch</td>
<td>Part no.</td>
<td>Pitch</td>
<td>Part no.</td>
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<tr>
<td>all</td>
<td>213 501</td>
<td>all</td>
<td>213 500</td>
</tr>
<tr>
<td>5 / 10</td>
<td>213 700 9003</td>
<td>20</td>
<td>213 700 9004</td>
</tr>
</tbody>
</table>

Dimensioned drawings – spindle clamping blocks Ø 16

Dimensioned drawings – spindle clamping blocks Ø 25

*) Dimensions at pitch 20
Flange bearing

Features

• Bearing, spindle drive side (fixed bearing side) and the spindle floating bearing side
• Flange bearing, drive side: Bushing with two pressed angular contact ball bearings in an O-configuration
• Flange bearing, floating bearing side (counterbearing): bushing with a pressed needle bearing

Ordering information

Flange bearing, drive side
Part no.: 216 504 0001
Flange bearing, floating bearing side
Part no.: 216 504 0002

Dimensioned drawings

Flange bearing drive side
Flange bearing floating bearing side

for spindle Ø 16 mm

for spindle Ø 25 mm

Features

• Bearing, spindle drive side (fixed bearing side) and the spindle floating bearing side
• Flange bearing, drive side: Bushing with two pressed angular contact ball bearings in an O-configuration
• Flange bearing, floating bearing side (counterbearing): bushing with a pressed needle bearing

Ordering information

Flange bearing, drive side
Part no.: 216 504 0006
Flange bearing, floating bearing side
Part no.: 216 504 0005

Dimensioned drawings

Flange bearing drive side
Flange bearing floating bearing side

made by isel
Bearing supports

Bearing support 1

- Aluminium profile to DIN EN 12020-2
- As a parallel connection of flange bearing and motor flange
- Flat milled securing surfaces
- Version for recirculating ball spindle Ø 16 mm
- Universal securing options

Part no.: 216504 0007

Bearing support 2

- Aluminium profile to DIN EN 12020-2
- As a parallel linkage of flange bearing and motor flange
- Version for recirculating ball spindle Ø 25 mm
- Universal securing options

Part no.: 216504 0008
Shaft couplings

<table>
<thead>
<tr>
<th>Connection options</th>
<th>LES 4</th>
<th>LES 6</th>
<th>LES 5</th>
<th>Angular transmission Securing 0°</th>
<th>Angular transmission Securing 90°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct drive</td>
<td></td>
<td></td>
<td></td>
<td>Connection via clutch housing 1</td>
<td>Clutch housing 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>short bushing with corresponding shaft coupling</td>
<td>long bushing</td>
</tr>
<tr>
<td>MS 135 HT - 2</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>MS 200 HT - 2</td>
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<td>DC 100</td>
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<td>MS 600 HT</td>
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<td>DC 300</td>
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</tr>
<tr>
<td>EC 86</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Angular transmission Securing 0°</td>
<td></td>
<td></td>
<td></td>
<td>split clutch housing</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>short bushing with corresponding shaft coupling</td>
<td></td>
</tr>
<tr>
<td>Angular transmission Securing 90°</td>
<td></td>
<td></td>
<td></td>
<td>split clutch housing</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>long bushing with corresponding shaft coupling</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Connection via Transmission shaft set</td>
<td></td>
</tr>
</tbody>
</table>

Shaft couplings

PUR sprockets

Deliverables: 2 aluminium blocks, 3 PUR sprockets (86°, 92° and 98° Shore) and matching adjusting screws

For part no. see table

<table>
<thead>
<tr>
<th>Clutch</th>
<th>Part no. 1</th>
<th>d 1</th>
<th>d 2</th>
<th>Part no. 2</th>
<th>d 3</th>
<th>d 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>20/30</td>
<td>218001 5060</td>
<td>5.0</td>
<td>6.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>218001 9999</td>
<td></td>
<td></td>
<td>from 4 to 7 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30/40</td>
<td>218002 6380</td>
<td>6.35</td>
<td>8.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>218002 8080</td>
<td>8.0</td>
<td>8.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>218002 9999</td>
<td></td>
<td></td>
<td>from 4 to 13 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40/60</td>
<td>218003 9580</td>
<td>9.52</td>
<td>8.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>218003 9999</td>
<td></td>
<td></td>
<td>from 4 to 18 mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

for WK 20/30
for WK 30/40
for WK 40/60

Part no.: 217 011 00**
Part no.: 217 012 00**
Part no.: 217 013 00**

for ** use the Shore hardness

Other clutches to order.

Clutch housing 1 + 2

short bushing
Part no.: 218 100 0001
long bushing
Part no.: 218 100 0002

short bushing
Part no.: 218 100 1001
long bushing
Part no.: 218 100 1002

split clutch housing

short bushing
Part-no.: 218 100 2001
long bushing
Part-no.: 218 100 2002
## Linear units

<table>
<thead>
<tr>
<th>Overview</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>LES functional overview</td>
<td>C 58</td>
</tr>
<tr>
<td>LES 4</td>
<td>C 60</td>
</tr>
<tr>
<td>LES 6</td>
<td>C 62</td>
</tr>
<tr>
<td>LES 5</td>
<td>C 64</td>
</tr>
<tr>
<td>LES 16-150</td>
<td>C 66</td>
</tr>
<tr>
<td>LES 16-250</td>
<td>C 67</td>
</tr>
<tr>
<td>Calculations</td>
<td>C 68</td>
</tr>
<tr>
<td>Combination examples</td>
<td>C 70</td>
</tr>
<tr>
<td>Motor modules</td>
<td>C 72</td>
</tr>
<tr>
<td>Installation kit</td>
<td>C 76</td>
</tr>
<tr>
<td>Slot/crossbench plates</td>
<td>C 78</td>
</tr>
<tr>
<td>T-key slot plates</td>
<td>C 81</td>
</tr>
<tr>
<td>Angle bracket</td>
<td>C 82</td>
</tr>
<tr>
<td>Accessories</td>
<td>C 85</td>
</tr>
<tr>
<td>Cross bench 10/20</td>
<td>C 86</td>
</tr>
</tbody>
</table>
Linear units

Overview

- LEZ functional overview C88
- LEZ 1 with toothed belt drive C90
- LEZ 2 with toothed belt drive C92
- LEZ 3 with toothed belt drive C94
- LEZ 9 with toothed belt drive C96
- Accessories C98
- Examples in use C99
- iLD with direct drive C100

CAD data on our website www.isel-germany.de
**Functional overview**

- End position buffering both sides with soft PVC parabolic springs
- Counter-bearing with 2 needle bushings
- Spindle support from a profile length of 1500 mm without limiting the travel
- Recirculating ball in patented aluminium linear slots
- Glass fibre reinforced loop components with scrapers
Functional overview at example LES 5

- Friction-resistant lip seals to protect the guide elements
- Motor incorporated in the profile

- Preset play-free recirculating ball nut with scrapers
- Central lubrication system for recirculating ball nut and circulations
- Integrated overrun limit switch
- Spindle bearing with angular contact bearings
- Axially free from play by means of self-locking special nuts
- Belt return and connecting electronics covered completely by protective cap
**Linear units with spindle drive**

**LES 4**

**Features**
- Aluminium shaft housing profile W75 × H75 mm, naturally anodised
- Clamping area and profile underside milled flat
- With 2 precision steel shafts Ø 12 h6, material CF53, Hardness 60 ± 2 HRC
- Aluminium shaft slots WS 5/70, 2 x WS 5/70 (70 mm long), adjustable for no play, central lubrication system
- Recirculating ball transmission with 2.5/4/5/10 and 20 mm pitches
- Profile sealing with friction-resistant lip seals
- Cast aluminium end plates
- With 2 limit or reference switches, Repeatability ± 0.02 mm
- Sealed angular contact bearings in drive - steel flange

**Options:**
- Black powder-coated aluminium profile
- Electromagnetic brake
- Steel slots LS2 (Part no. 223007)
- Limit switch attachment kit (see accessories)

**Technical specification**

**Aluminium profile LES 4**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moment of inertia $I_x$</td>
<td>107.711 cm$^4$</td>
</tr>
<tr>
<td>Moment of inertia $I_y$</td>
<td>125.843 cm$^4$</td>
</tr>
<tr>
<td>Centre of gravity</td>
<td>33.23 mm</td>
</tr>
<tr>
<td>Cross-sectional area</td>
<td>18.81 cm$^2$</td>
</tr>
<tr>
<td>Material</td>
<td>AlMgSiO, 5F22</td>
</tr>
<tr>
<td>Anodising</td>
<td>E6/EV1</td>
</tr>
<tr>
<td>Weight with steel shafts</td>
<td>6.2 kg/m</td>
</tr>
<tr>
<td>Weight with steel shafts and spindles</td>
<td>7.6 kg/m</td>
</tr>
</tbody>
</table>

**No load running torques**

<table>
<thead>
<tr>
<th>Speed (rpm)</th>
<th>2.5</th>
<th>4</th>
<th>5</th>
<th>10</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torque</td>
<td>15</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
</tr>
<tr>
<td>Spindle pitch</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>Torque</td>
<td>23</td>
<td>24</td>
<td>24</td>
<td>25</td>
<td>26</td>
</tr>
</tbody>
</table>

**Ordering key**

2 3 4 XXX 0 XXX

- Drive
  - 0 = Preparation
  - 1 = Preparation Belt drive module
- Shaft slots
  - 0 = 1 shaft slots 70 mm
  - 2 = 2 shaft slots 70 mm
- Recirculating ball drive
  - 0 = none
  - 1 = Pitch 2.5 mm
  - 2 = Pitch 4.0 mm
  - 3 = Pitch 5.0 mm
  - 4 = Pitch 10 mm
  - 5 = Pitch 20 mm

**Profile length (L1)**

- e.g. 029 = 290 mm (min.)
- 299 = 2990 mm (max.)

(rounded to the last digit)

Standard profile lengths in 100 mm raster - to order

**Drive modules**

see page 72 et seq. of the catalogue
Linear units
with spindle drive

Bending
Load config. 1
Load config. 2

Load factors

Les 4 with one WS 5/70

\[
C_r = 2576.65 \text{ N} \\
C_z = 1461.14 \text{ N} \\
F_r, \text{ stat} = 1247.93 \text{ N} \\
F_z, \text{ stat} = 2576.65 \text{ N} \\
F_r, \text{ dyn} = 1461.14 \text{ N} \\
M_r \text{ stat} = 36.45 \text{ Nm} \\
M_z \text{ stat} = 82.16 \text{ Nm} \\
M_r \text{ dyn} = 20.67 \text{ Nm} \\
M_z \text{ dyn} = 46.59 \text{ Nm} \\
M_r, \text{ dyn} = 54.55 \text{ Nm} \\
\]

Les 4 with two WS 5/70

\[
C_r = 4954.5 \text{ N} \\
C_z = 2809.5 \text{ N} \\
F_r, \text{ stat} = 4231.5 \text{ N} \\
F_z, \text{ stat} = 4954.5 \text{ N} \\
F_r, \text{ dyn} = 2809.5 \text{ N} \\
M_r \text{ stat} = 44.7 \text{ Nm} \\
M_z \text{ stat} = 126.945 \text{ Nm} \\
M_r \text{ dyn} = 25.2 \text{ Nm} \\
M_z \text{ dyn} = 77.953 \text{ Nm} \\
M_r, \text{ dyn} = 84.285 \text{ Nm} \\
\]

permissible spindle speeds

Les 4 / 5 / 6

<table>
<thead>
<tr>
<th>Profile length L [mm]</th>
<th>Spindle pitch p [mm]</th>
<th>max. permissible spindle speed n [rpm]</th>
<th>max. permissible feed speed v permissible [mm/min]</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>4000</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>1000</td>
<td>1700</td>
<td>220</td>
<td>220</td>
</tr>
<tr>
<td>2000</td>
<td>3300</td>
<td>220</td>
<td>220</td>
</tr>
<tr>
<td>3000</td>
<td>4000</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>500 *</td>
<td>3000</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>1500</td>
<td>1250</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>2500</td>
<td>1750</td>
<td>125</td>
<td>125</td>
</tr>
<tr>
<td>3000</td>
<td>2000</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>500 *</td>
<td>125</td>
<td>35</td>
<td>35</td>
</tr>
</tbody>
</table>

* with spindle support

Dimensioned drawing

Process travel
at 1xWS 5/70 = L1 - 150 mm
at 2xWS 5/70 = L1 - 280 mm

External limit switches see page C85

Dimensioned drawing
Aluminium profile

made by isel
### Linear units

**Features**
- Aluminium shaft housing profile W150 × H75 mm, naturally anodised
- Clamping area and profile underside milled flat
- With 4 precision steel shafts Ø 12 h6, material CF53, Hardness 60 ± 2 HRC
- Aluminium shaft slots WS 5/70, 2 x WS 5/70 (70 mm long), adjustable for no play, central lubrication system
- Recirculating ball transmission with 2.5/4/5/10 and 20 mm pitches
- Profile sealing with friction-resistant lip seals
- Cast aluminium end plates
- With 2 limit or reference switches, Repeatability ± 0.02 mm
- Sealed angular contact bearings in drive - steel flange

**Options:**
- Black powder-coated aluminium profile
- Electromagnetic brake
- Steel slots LS2 (Part no. 223007)
- Limit switch attachment kit (see accessories)

### Technical Specification

#### Aluminium profile LES 6

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moment of inertia Iₓ</td>
<td>707.100 cm⁴</td>
</tr>
<tr>
<td>Moment of inertia Iᵧ</td>
<td>212.200 cm⁴</td>
</tr>
<tr>
<td>Centre of gravity</td>
<td>32.78 mm</td>
</tr>
<tr>
<td>Cross-sectional area</td>
<td>30.07 cm²</td>
</tr>
<tr>
<td>Material</td>
<td>AlMgSiO, SF22</td>
</tr>
<tr>
<td>Anodising</td>
<td>E6/EV1</td>
</tr>
<tr>
<td>Weight with steel shafts</td>
<td>11.4 kg/m</td>
</tr>
<tr>
<td>Weight with steel shafts</td>
<td>12.8 kg/m</td>
</tr>
</tbody>
</table>

#### No load running torques

<table>
<thead>
<tr>
<th>Speed (rpm)</th>
<th>2.5</th>
<th>4</th>
<th>5</th>
<th>10</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>17</td>
<td>17</td>
<td>18</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>1500</td>
<td>20</td>
<td>20</td>
<td>22</td>
<td>24</td>
<td>25</td>
</tr>
<tr>
<td>3000</td>
<td>24</td>
<td>25</td>
<td>26</td>
<td>29</td>
<td>30</td>
</tr>
</tbody>
</table>

**Ordering key**

```
234 XXX 0XX
```

- **Drive**
  - 6 = Preparation Direct drive modules
  - 7 = Preparation Belt drive module

- **Shaft slots**
  - 0 = 2 shaft slots 70 mm
  - 2 = 4 shaft slots 70 mm

- **Recirculating ball drive**
  - 0 = none
  - 1 = Pitch 2.5 mm
  - 2 = Pitch 4.0 mm
  - 3 = Pitch 5.0 mm
  - 4 = Pitch 10 mm
  - 5 = Pitch 20 mm

**Profit length (L₁)**

\[ e.g. \text{L₁} = 230 \text{ mm} (\text{min}) \]

\[ 290 = 2390 \text{ mm} (\text{max}) \]

(Rounded to the last digit)

Standard profile length in 100 mm raster – to order

- Direct drive modules
- Belt drive module

**Drive modules**

See page 72 et seq. of the catalogue

---

**Made by isel**
Linear units with spindle drive

Bending

Load config. 1

Load config. 2

Load factors

LES 6 with two WS 5/70

<table>
<thead>
<tr>
<th>L (mm)</th>
<th>C</th>
<th>C, stat.</th>
<th>C, dyn.</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>2,513.0 N</td>
<td>4,091.33 N</td>
<td>1,900.96 N</td>
</tr>
<tr>
<td>1,500</td>
<td>6,606 N</td>
<td>5,642 N</td>
<td>3,746 N</td>
</tr>
</tbody>
</table>

LES 6 with four WS 5/70

<table>
<thead>
<tr>
<th>L (mm)</th>
<th>C</th>
<th>C, stat.</th>
<th>C, dyn.</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>2,513.0 N</td>
<td>4,091.33 N</td>
<td>1,900.96 N</td>
</tr>
<tr>
<td>1,500</td>
<td>6,606 N</td>
<td>5,642 N</td>
<td>3,746 N</td>
</tr>
</tbody>
</table>

permissible spindle speeds

<table>
<thead>
<tr>
<th>L (mm)</th>
<th>max. permissible feed speed (rpm)</th>
<th>max. permissible feed speed (mm/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>4,000</td>
<td>0.25</td>
</tr>
<tr>
<td>1,500</td>
<td>3,000</td>
<td>0.33</td>
</tr>
<tr>
<td>2,500</td>
<td>2,500</td>
<td>0.25</td>
</tr>
<tr>
<td>4,000</td>
<td>2,000</td>
<td>0.125</td>
</tr>
</tbody>
</table>

Dimensioned drawing

process travel

at 2 × WS 5/70 = L1 = 150 mm
at 4 × WS 5/70 = L1 = 280 mm

eexternal limit switches see page C65

Dimensioned drawing

Aluminium profile

made by isel®

Linear units
Linear units

Features

- Aluminium shaft housing profile W225 × H75 mm, naturally anodised
- Clamping area and profile underside milled flat
- With 4 precision steel shafts Ø 12 h6, material CF53, Hardness 60 ± 2 HRC
- Aluminium shaft slots WS 5/70, 2 x WS 5/70 (70 mm long), adjustable for no play, central lubrication system
- Recirculating ball transmission with 2.5/4/5/10 and 20 mm pitches
- Profile sealing with friction-resistant lip seals
- Cast aluminium end plates
- With 2 limit or reference switches, Repeatability± 0.02 mm
- Sealed angular contact bearings in drive - steel flange

Options:

- Black powder-coated aluminium profile
- Electromagnetic brake
- Steel slots LS2 (Part no. 223007)
- Limit switch attachment kit (see accessories)

Ordering key

2 3 4 XXX 0 XXX

Drive
3 = Preparation Direct drive modules
4 = Preparation Belt drive module

Shaft slots
0 = 2 shaft slots 70 mm
2 = 4 shaft slots 70 mm

Recirculating ball drive
0 = none
1 = Pitch 2.5 mm
2 = Pitch 4.0 mm
3 = Pitch 5.0 mm
4 = Pitch 10 mm
5 = Pitch 20 mm

Profile length (L1)

- Example: 029 = 290 mm (min.)
- 299 = 2990 mm (max.)

Standard profile lengths in 100 mm raster - to order

Technical specification

Aluminium profile LES 5

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moment of inertia Ix</td>
<td>2,361.654 cm³</td>
</tr>
<tr>
<td>Moment of inertia Iy</td>
<td>298.925 cm³</td>
</tr>
<tr>
<td>Centre of gravity</td>
<td>33.39 mm</td>
</tr>
<tr>
<td>Cross-sectional area</td>
<td>42.49 cm²</td>
</tr>
<tr>
<td>Material</td>
<td>AlMgSiO, 5F22</td>
</tr>
<tr>
<td>Anodising</td>
<td>E6/EV1</td>
</tr>
<tr>
<td>Weight with steel shafts</td>
<td>13.8 kg/m</td>
</tr>
<tr>
<td>Weight with steel shafts and spindles</td>
<td>15.2 kg/m</td>
</tr>
</tbody>
</table>

No load running torques

<table>
<thead>
<tr>
<th>Speed (rpm)</th>
<th>2.5</th>
<th>4</th>
<th>5</th>
<th>10</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>15</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
</tr>
<tr>
<td>1500</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>3000</td>
<td>23</td>
<td>24</td>
<td>24</td>
<td>25</td>
<td>26</td>
</tr>
</tbody>
</table>

No load running torques (Ncm)

<table>
<thead>
<tr>
<th>Speed (rpm)</th>
<th>2.5</th>
<th>4</th>
<th>5</th>
<th>10</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>15</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
</tr>
<tr>
<td>1500</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>3000</td>
<td>23</td>
<td>24</td>
<td>24</td>
<td>25</td>
<td>26</td>
</tr>
</tbody>
</table>
Linear units

with spindle drive

Bending

Load config. 1

Load config. 2

Load factors

LES 3 with two WS 5/70

LES 4 with four WS 5/70

permissible spindle speeds

Dimensioned drawing

process travel

at 2xWS 5/70 = L1 - 150 mm

at 4xWS 5/70 = L1 - 280 mm

external limit switches see page C85

Dimensioned drawing

Aluminium profile
Linear units

LES 16-150

Features
- Aluminium shaft housing profile
  W 225 × H 65.3 mm
- Length: 0.5/1.0/1.5 m
  Intermediate sizes to order
- 2 precision steel shafts Ø 16 mm
  with exactly milled shaft housings
- 4 aluminium slides IWS 1
- Central lubrication option
- 2 limit or reference switches
- Repeatability ± 0.01 mm
- Recirculating ball drive Ø 16 × 5 mm
- Various drive options

Options:
- Other lengths (longer or shorter)
- Profile cover
- Ball screw drive Ø 16 × 2.5 mm / 10 mm

General
Linear units in the LES series with spindle drive are of modular construction and can be used for a wide variety of applications. They are based on rigid aluminium profiles with precision steel shafts. Recirculating ball drives produce the feed movement, multiphase motors or servomotors are used as motor drives. Linear units in the LES series can be used either horizontally or vertically. Patented shaft slots with recirculating balls are used as guide slots. The load-bearing balls also run between 2 ground steel pins and the guide shaft respectively. The desired dimensions can be delivered up to a length of 3 metres according to customer requirements.

Technical specification

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moment of inertia Iₓ</td>
<td>1899.61 cm⁴</td>
</tr>
<tr>
<td>Moment of inertia Iᵧ</td>
<td>104.94 cm⁴</td>
</tr>
<tr>
<td>Cross-sectional area</td>
<td>39.63 cm²</td>
</tr>
<tr>
<td>Material</td>
<td>AlMgSiO₅F 22</td>
</tr>
<tr>
<td>Anodising</td>
<td>E6/EV1</td>
</tr>
<tr>
<td>Weight with steel shafts</td>
<td>12.43 kg/m</td>
</tr>
</tbody>
</table>

Ordering data

Part-no.: 238053 004907* (Length 0.5 m)
Part-no.: 238053 009907* (Length 1 m)
Part-no.: 238053 014907* (Length 1.5 m)

* including Motor
Linear units with spindle drive

LES 16-250

Features
- Aluminium shaft housing profile W 325 × H 65.3 mm
- Length: 0.5/1.0/1.5 m
- Intermediate sizes to order
- 2 precision steel shafts Ø 16 mm with exactly milled shaft housings
- 4 aluminium slides IWS 1
- Central lubrication option
- 2 limit or reference switches
- Repeatability: ± 0.01 mm
- Recirculating ball drive Ø 16 × 5 mm
- Various drive options

Options:
- Other lengths (longer or shorter)
- Profile cover
- Ball screw drive Ø 16 × 2.5 mm/10 mm

General
Linear units in the LES series with spindle drive are of modular construction and can be used for a wide variety of applications. They are based on rigid aluminium profiles with precision steel shafts. Recirculating ball drives produce the feed movement, multi-phase motors or servomotors are used as motor drives. Linear units in the LES series can be used either horizontally or vertically. Patented shaft slots with recirculating balls are used as guide slots. The load-bearing balls also run between 2 ground steel pins and the guide shaft respectively. The desired dimensions can be delivered up to a length of 3 metres according to customer requirements.

Technical specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moment of inertia _i_x</td>
<td>5637.55 cm^4</td>
</tr>
<tr>
<td>Moment of inertia _i_y</td>
<td>121.37 cm^4</td>
</tr>
<tr>
<td>Cross-sectional area</td>
<td>53.63 cm^2</td>
</tr>
<tr>
<td>Material</td>
<td>AlMgSiO, 5F 22</td>
</tr>
<tr>
<td>Anodising</td>
<td>E6/EV 1</td>
</tr>
<tr>
<td>Weight with steel shafts</td>
<td>14.41 kg/m</td>
</tr>
</tbody>
</table>

Ordering data

Part no.: 238063 004907* (Length 0.5m)
Part no.: 238063 009907* (Length 1m)
Part no.: 238063 014907* (Length 1.5 m)

* including motor

Dimensioned drawing

General specifications:
- Linear units in the LES series with spindle drive are of modular construction and can be used for a wide variety of applications. They are based on rigid aluminium profiles with precision steel shafts. Recirculating ball drives produce the feed movement, multi-phase motors or servomotors are used as motor drives. Linear units in the LES series can be used either horizontally or vertically. Patented shaft slots with recirculating balls are used as guide slots. The load-bearing balls also run between 2 ground steel pins and the guide shaft respectively. The desired dimensions can be delivered up to a length of 3 metres according to customer requirements.
Theoretically critical speed

Critical speed

In most applications, you need to check tapped spindles at their critical speed.

The critical speed is that speed which causes resonance oscillations of this spindle.

This critical speed depends on the core diameter, the free load-bearing length and on the way the tapped spindle is constructed.

Given a general safety factor of 0.8, the maximum permissible speed can be calculated as follows:

\[
n_{\text{perm}} = 392 \cdot \frac{a \cdot d_2}{L^2} \cdot 10^5
\]

Buckling load

The recirculating ball spindle should as far as possible be subjected only to tensile stress. If it is subjected to compressive loads, then the spindle may buckle.

With a safety factor of 3.0 against buckling, the result is

\[
F_{\text{zul}} = \frac{34000 \cdot b \cdot d_2^4}{L_1^2}
\]

Definitions

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n_{\text{perm}})</td>
<td>([\text{min}^{-1}])</td>
<td>maximum permissible speed</td>
</tr>
<tr>
<td>(a)</td>
<td></td>
<td>Installation coefficient</td>
</tr>
<tr>
<td>(d_2)</td>
<td>[mm]</td>
<td>Spindle core diameter</td>
</tr>
<tr>
<td>(L)</td>
<td>[mm]</td>
<td>Spindle length between the spindle bearings and spindle ends</td>
</tr>
<tr>
<td>(F_{\text{perm}})</td>
<td>[N]</td>
<td>permissible compressive loading</td>
</tr>
<tr>
<td>(d_2)</td>
<td>[mm]</td>
<td>Spindle core diameter</td>
</tr>
<tr>
<td>(L_1)</td>
<td>[mm]</td>
<td>free buckling length, i.e. the maximum distance between the central bearing and the centre of the tapped nut</td>
</tr>
<tr>
<td>(b)</td>
<td></td>
<td>Installation coefficient</td>
</tr>
</tbody>
</table>
# Drive dimensioning

## Drive torque calculation

The required drive torque is made up of:
- Load torque $M_{load}$
- Acceleration torques $M_{trans}$ and $M_{rot}$
- No load torque $M_{no\ load}$

$$M_A = M_{load} + M_{trans} + M_{rot} + M_{no\ load}$$

### Definitions

- $M_A$ [Nm] required drive torque
- $M_{leer}$ [Nm] Torque, resulting from the various loads
- $M_{leer}$ [Nm] No load torque
- $M_{rot}$ [Nm] Rotational acceleration torque
- $M_{trans}$ [Nm] translational acceleration torque
- $F_X$ [N] Feed force
- $g$ [m/s$^2$] Acceleration due to gravity
- $v_{max}$ [m/s] maximum process speed
- $m$ [kg] The weight to be conveyed
- $a$ [m/s$^2$] Acceleration
- $p$ [mm] Spindle pitch
- $P$ [kW] Power
- $L$ [mm] Length
- $n_{max}$ [rpm] maximum speed
- $\mu$ coefficient of friction
- $J_{sp}$ [kgm$^2$/m] Inertial torque of inertia of the spindle per meter
- $F_a$ [N] Accelerating force

### Load torque

$$M_{last} = \frac{F_X \cdot p}{2 \cdot \pi \cdot 1000}$$

with feed force $F_X = m \cdot g \cdot \mu$

### Translational Acceleration torque

$$M_{trans} = \frac{F_a \cdot p}{2 \cdot \pi \cdot 1000}$$

with feed force $F_a = m \cdot a$

If used vertically, the mass acceleration $a$ must be added to the acceleration due to gravity $g$ (9.81 m/s$^2$).

### Rotational acceleration torque

$$M_{rot} = \frac{J_{sp} \cdot L \cdot n_{max} \cdot a \cdot 2 \cdot \pi}{v_{max} \cdot 60 \cdot 1000}$$

### Drive power

$$P = \frac{M_A \cdot n_{max}}{9550}$$
Combination examples

**Crossbench**
2 x LES 5
PS 4 with VP 2

**2-axis H-design**
2 x LES 4, LES 5, angular transmission kit,
2 x PS 6, PS 4

**2-axis flatbed configuration**
2 x LES 4, LES 5, angular transmission kit,
2 x PS 2, 2 x WV 2, PS 4

**2-axis lifting configuration**
2 x LES 5, 2 x PS 4
WV 6

**2-axis boom configuration**
2 x LES 5
2 x PS 4
WV 3

**2-axis H-design**
LES 5, 2 x LES 6, 2 x WV 7
Angular transmission kit, 2 x PS 12
PS 4
Combination examples

3-axis boom configuration
2 × LES 5, LES 6, WV 3, 2 × PS 4, PS 7

3-axis raised boom configuration
3 × LES 5, WV 3, 2 × PS 4, VP 2

3-axis portal configuration
2 × LES 5, 2 × LES 6, 2 × WV 7
Angular transmission kit, 2 × PS4, PS 12

3-axis flatbed configuration
2 × LES 4, LES 5, LES 6, 2 × PS 2, 2 × WV 2
Angular transmission kit, PS 4, PS 7

4-axis portal configuration
3 × LES 5, 2 × LES 6, 2 × WV 7
Angular transmission kit
3 × PS 4
2 × PS 12

5-axis flatbed configuration
2 × LES 5 (Z-axes)
LES 5 (2 spindle drives)
2 × LES 4, 2 × PS 2, 2 × WV 2
Angular transmission kit, 2 × PS4 with VP 2