Vertical Linear Drive with Toothed Belt and Integrated Recirculating Ball Bearing Guide Series OSP-E..BV

Overview ............................................................25-28
Technical Data......................................................29-31
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TOOTHED BELT DRIVE FOR VERTICAL MOVEMENTS IN MULTI-AXIS SYSTEMS

The OSP-E..BV vertical linear drive with toothed belt and integrated recirculating ball bearing guide has been specially developed for lifting movements in the Z-axis. The especially low vibration OSP-E..BV vertical drive in combination with the heavy duty series OSP-E..BHD meets the highest demands in portal and handling applications.

Vertical Linear Drive with Toothed Belt and integrated Recirculating Ball Bearing Guide

Advantages
• Fixed drive head for low moving mass
• Integrated recirculating ball bearing guide for high bending moments
• Magnetic switch set for contactless position sensing
• Easy to install
• Low maintenance

Features
• High acceleration and speed
• Drive Shaft versions with clamp shaft or plain shaft
• Power transmission by toothed belt
• Moving axis profile
• Complete motor and control packages

Toothed belt tensioning end

Precision guide rail made of steel

Carrier with recirculating ball bearing system
To simplify design work, OSP-E system CAD files are available, which are compatible with most common CAD systems.
SERIES OSP-E, VERTICAL LINEAR DRIVE WITH TOOTHED BELT AND INTEGRATED RECIRCULATING BALL BEARING GUIDE

STANDARD VERSION
OSP-E..BV
Pages 29 & 30
Standard drive head with clamp shaft or tenon and integrated recirculating ball bearing guide with two carriers. Choice of side on which gearbox or motor is to be mounted.

DRIVE SHAFT
"CLAMP SHAFT AND PLAIN SHAFT" OR "DOUBLE PLAIN SHAFT" e.g. for parallel operation of two Z-axes with an intermediate drive shaft.

OPTIONS
TANDEM
Pages 32 & 33
Additional drive head and two additional carriers for higher bending moments.

HOLLOW SHAFT WITH KEYWAY
For direct connection of gearbox or motor with keyway.

ACCESSORIES
MOTOR MOUNTINGS
Page 117
For connection of gearbox or motor direct to drive shaft with clamp shaft, or with a motor coupling to drive shaft with plain shaft.

MAGNETIC SWITCHES SET
Page 33
Magnetic switches with connector, mounting rail and magnets for contactless sensing of the end positions. Cable (suitable for cable chain) can be ordered separately in 5 m, 10 m or 15 m length.

MULTI-AXIS SYSTEMS
Page 86
For modular assembly of linear drives up to multi-axis systems.
Vertical Linear Drive with Toothed Belt and Integrated Recirculating Ball Bearing Guide

Series OSP-E..BV
Size 20, 25

**Standard Version:**
- Toothed Belt drive with integrated recirculating ball bearing guide
- Drive shaft with clamp shaft or plain shaft
- Choice of motor mounting side

**Options:**
- Tandem version for higher moments
- Drive shaft with
  - clamp shaft and plain shaft or double plain shaft
  - hollow shaft with keyway
- Special drive shaft versions on request.

### Installation Instructions
Make sure that the OSP-E..BV is always operated with a brake on the drive side. For the mounting of the external mass to be moved there are threaded holes in the end caps. Before mounting, check the correct center of gravity distance from the table on page 31. Mount the external mass on the toothed belt fixed end, so that the belt tension can be checked and adjusted at the toothed belt tensioning end without dismantling.

### Maintenance
Depending on operating conditions, inspection of the linear drive is recommended after 12 months or 3000 km operation. Please refer to the operating instructions supplied with the drive.

**First service start-up**
The maximum values specified in the technical data sheet for the different products must not be exceeded. Before taking the linear drive machine into service, the user must ensure the adherence to the EC Machine Directive 91/368/EEC.
Sizing Performance Overview

Maximum Loadings

Sizing of Linear Drive
The following steps are recommended:

1. Determination of the lever arm length \(l_x\), \(l_y\) and \(l_z\) from \(m_e\) to the center axis of the linear drive.
2. Calculation of the static and dynamic force \(F_A\) which must be transmitted by the toothed belt.
\[ F_A = m_g \cdot g + m_a \cdot a + M_0 \cdot \frac{2\pi}{U_{ZR}} \]

3. Calculation of all static and dynamic moments \(M_x\), \(M_y\) and \(M_z\) which occur in the application.
\[ M = F \cdot l \]

4. Selection of maximum permissible loads via Table T3.

5. Calculation and checking of the combined load, which must not be higher than 1.

6. Checking of the maximum moment that occurs at the drive shaft in Table T2.

7. Checking of the required action force \(F_A\) with the permissible load value from Table T1.

For motor sizing, the effective torque must be determined, taking into account the cycle time.

Legend
\[ l \] = distance of a mass in the \(x\)-, \(y\)- and \(z\)-direction from the guide [m]

\[ m_e \] = external moved mass [kg]

\[ m_{La} \] = moved mass of linear drive [kg]

\[ m_g \] = total moved mass

\[ m_g = m_e + m_{La} \] [kg]

\[ F_A \] = action force [N]

\[ M_0 \] = no-load torque [Nm]

\[ U_{Zn} \] = circumference of the pulley (linear movement per revolution) [m]

\[ g \] = gravity [m/s²]

\[ a_{\text{max}} \] = maximum acceleration [m/s²]

**Important:**
The maximum permissible moment on the drive shaft is the lowest value of the speed- or stroke-dependent moment value.

**Example above:**
OSP-E25BV required speed \(v = 3\) m/s and stroke = 1 m.
Accordingly Table T2 shows permissible moments of 30 Nm for the speed and 36 Nm for the stroke. Therefore the maximum moment at the drive shaft is determined by the speed and must not exceed 30 Nm.

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### Performance Overview

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series</td>
<td></td>
<td>OSP-E20BV</td>
</tr>
<tr>
<td>Max Speed</td>
<td>[m/s]</td>
<td>3.0</td>
</tr>
<tr>
<td>Linear motion</td>
<td>[mm/U]</td>
<td>108</td>
</tr>
<tr>
<td>Toothed Belt</td>
<td></td>
<td>35ATL3</td>
</tr>
<tr>
<td>Max rpm. drive</td>
<td>[min⁻¹]</td>
<td>1700</td>
</tr>
<tr>
<td>Max effective</td>
<td>[N]</td>
<td>650</td>
</tr>
<tr>
<td>action force</td>
<td></td>
<td>1 - 2 m/s</td>
</tr>
<tr>
<td>at speed</td>
<td>[N]</td>
<td>450</td>
</tr>
<tr>
<td>No-load torque</td>
<td>[Nm]</td>
<td>0.6</td>
</tr>
<tr>
<td>Max acceleration</td>
<td>[m/s²]</td>
<td>20</td>
</tr>
<tr>
<td>Repeatability</td>
<td>+/-</td>
<td>0.05</td>
</tr>
<tr>
<td>Max. stroke</td>
<td>[mm]</td>
<td>1000</td>
</tr>
</tbody>
</table>

1) Longer strokes on request and only with profile stiffening
2) As a result of static friction force
3) vertical

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### Max. Permissible Torque on Drive Shaft

<table>
<thead>
<tr>
<th>Speed [m/s]</th>
<th>Torque [Nm]</th>
<th>Stroke [m]</th>
<th>Torque [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>19</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td>2</td>
<td>17</td>
<td>2</td>
<td>10.5</td>
</tr>
<tr>
<td>3</td>
<td>15.5</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>5</td>
<td>22</td>
<td>5</td>
<td>27</td>
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</tbody>
</table>

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### Tightening for Clamp Hub

<table>
<thead>
<tr>
<th>BHD</th>
<th>20</th>
<th>25</th>
<th>32</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>BHDII</td>
<td>4.8</td>
<td>9.5</td>
<td>17</td>
<td>40</td>
</tr>
<tr>
<td>BV</td>
<td>4.8</td>
<td>9.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Combined Loads
If the linear drive is subjected to several forces, loads and moments at the same time, the maximum load is calculated with the equation shown here. The maximum permissible loads must not be exceeded.

The total of the loads must not exceed 1 under any circumstances.

Distance of Center of Gravity of External Mass from Mid-Point of Drive

<table>
<thead>
<tr>
<th>Mass [kg]</th>
<th>Lever arm $l_z$ [mm]</th>
<th>Max. permissible acceleration/deceleration [m/s²]</th>
<th>Lever arm $l_z$ [mm]</th>
<th>Max. permissible acceleration/deceleration [m/s²]</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 3 to 5</td>
<td>0</td>
<td>20</td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>&gt; 5 to 10</td>
<td>0</td>
<td>20</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>&gt; 10 to 15</td>
<td>-</td>
<td>-</td>
<td>35</td>
<td>20</td>
</tr>
<tr>
<td>&gt; 15 to 20</td>
<td>-</td>
<td>-</td>
<td>30</td>
<td>15</td>
</tr>
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</table>
**Vertical Linear Drive with Toothed Belt and integrated Recirculating Ball Bearing – Basic Unit Series OSP-E.. BV**

**Plain shaft**

**Hollow shaft with keyway (Option)**

<table>
<thead>
<tr>
<th>Series</th>
<th>ØKB</th>
<th>KC</th>
<th>KL</th>
<th>KP</th>
<th>ØKR</th>
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<tbody>
<tr>
<td>OSP-E22BV</td>
<td>12h7</td>
<td>13.8</td>
<td>4</td>
<td>28.5</td>
<td>12h7</td>
</tr>
<tr>
<td>OSP-E25BV</td>
<td>16h7</td>
<td>18.3</td>
<td>5</td>
<td>31.5</td>
<td>16h7</td>
</tr>
</tbody>
</table>

* Note:
The mechanical end position must not be used as a mechanical end stop.
Allow an additional safety clearance at both ends equivalent to the linear movement of one revolution of the drive shaft, but at least 100 mm.
Order stroke = required travel + 2 x safety distance.
The use of an AC motor with frequency converter normally requires a larger safety clearance than that required for servo systems.
For further information please contact you local PARKER-ORIGA representative.

**Option – Tandem Series OSP-E.. BV**

**Order stroke **

**Note:**
Order stroke = required travel + KM min + 2 x safety distance.
Contactless Position Sensing with Magnetic Switches

The magnetic switch set, comprising two magnetic switches, a mounting rail and two magnets, is for contactless sensing of the end positions. The mounting rail and magnetic switches are mounted on the drive head and the magnets are mounted in the dovetail slot on the profile. The magnetic switches are the RS-S type (connector version).

For the connecting cable PARKER-ORIGA recommends the use of cable suitable for cable chain.

Order instructions

<table>
<thead>
<tr>
<th>Description</th>
<th>Ident-No.</th>
</tr>
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<tbody>
<tr>
<td>Magnetic switch set, obtaining:</td>
<td>15886</td>
</tr>
<tr>
<td>- 2 magnetic switches</td>
<td></td>
</tr>
<tr>
<td>- KL3087, Typ RS-S</td>
<td></td>
</tr>
<tr>
<td>- 1 mounting rail</td>
<td></td>
</tr>
<tr>
<td>- 2 magnets</td>
<td></td>
</tr>
</tbody>
</table>

Connecting cable, suitable for cable chain

<table>
<thead>
<tr>
<th>Length</th>
<th>Ident-No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 m</td>
<td>KL3186</td>
</tr>
<tr>
<td>10 m</td>
<td>KL3217</td>
</tr>
<tr>
<td>15 m</td>
<td>KL3216</td>
</tr>
</tbody>
</table>